HOT WATER, DRY STREAMS: A TALE OF TWO TROUT

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INTRODUCTION

Norman Maclean's timeless memoir *A River Runs Through It* begins with the reflection that in his household "there was no clear line between religion and fly fishing."[1] That zeal remains today; nearly 30 million Americans call themselves fishermen.[2] Anglers devoted an aggregate of 517 million user-days pursuing their passion in 2006 and spent billions of dollars to support it.[3] Fishing in the western United States holds a special place in fishing lore the world over and for good reason. From the great trout waters of Montana, to the salmon-laden rivers of the west coast, to the sparkling wilderness of the Colorado Rockies, fishing in the American West is special.

Many native trout and salmon in the West are also on the verge of collapse. Numerous salmonid species are listed under the Endangered Species Act (ESA), signaling that the federal government believes those fish are now threatened with, or in danger of, extinction throughout a significant portion of their range.[4] Other native western salmonids not listed under the ESA have been the subject of losing legal efforts to have them listed.[5] While state and federal agencies have taken positive steps to restore native salmonids,[6] human interference with aquatic ecosystems continues to

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1. NORMAN MACLEAN, A RIVER RUNS THROUGH IT AND OTHER STORIES 1 (Univ. of Chicago Press ed., 25th anniversary ed. 2001).

2. U.S. FISH & WILDLIFE SERV., 2006 NATIONAL SURVEY OF FISHING, HUNTING AND WILDLIFE-ASSOCIATED RECREATION 5 (2007).

3. *Id.* at 11 tbl.1, 5. Trout Unlimited (TU) concluded that recreational angling generates 74.8 billion dollars in annual economic outputs. JACK E. WILLIAMS ET AL., TROUT UNLIMITED, A GUIDE TO NATIVE TROUT RESTORATION: SCIENCE TO PROTECT AND RESTORE COLDWATER FISHES AND THEIR HABITATS 5 (2007) [hereinafter WILLIAMS 2007], *available at* http://www.tu.org/sites/www.tu.org/files/documents/NativeTroutRest_Williams.pdf.

4. Endangered Species Act of 1973, 16 U.S.C. §§ 1531–1544 (2006). A total of 13 species of trout and salmon are listed as threatened or endangered under the ESA. The chart attached as Appendix 1 depicts the listed species. *See infra* pp. 955–56.

5. *See, e.g.*, Am. Wildlands v. Kempthorne, 530 F.3d 991, 1000–02 (D.C. Cir. 2008) (denying petition to list westslope cutthroat trout).

6. For example, Montana established a Bull Trout Restoration Team in response to the species' listing under the ESA. The Restoration Team has developed restoration plans on a watershed level in concert with state and federal agencies and the American Fisheries Society. *See, e.g.*, MONTANA

adversely affect them, pushing some species closer to extinction and preventing the recovery of others.[7] While many human activities such as dams, logging, mining, and urbanization hasten the demise of salmonids, competition for scarce water resources in the West is often at the heart of the problem.[8]

BULL TROUT RESTORATION TEAM, RESTORATION PLAN FOR BULL TROUT IN THE CLARK FORK RIVER BASIN AND KOOTENAI RIVER BASIN, MONTANA (2000), *available at* http://fwpiis.mt.gov/content/getItem.aspx?id=31386 (describing restoration efforts). Utah has undertaken similar efforts to restore Bonneville cutthroat in the critical Bear Lake system, including funding projects for private landowners. Preserving Utah's Bonneville Cutthroat Trout, http://connect2utah.com/content/fulltext/?cid=39193 (last visited February 14, 2010). Utah has also enacted an in-stream flow statute to preserve critical late summer flows for trout. *See* Alan Matheson, Jr., *Utah Law Developments: Let It Flow: Wading Through Utah's Instream Flow Statute*, UTAH BAR J., Nov. 2004, at 18, 21 (applauding and explaining Utah Code § 73-3-3, passed initially in 1986 to "authorize[] . . . the Division of Parks and Recreation to file applications to change existing consumptive uses to instream uses for the propagation of fish, public recreation, or the reasonable preservation or enhancement of the natural stream environment"). Most prior appropriation states in the western United States have enacted similar in-stream flow statutes, though procedural roadblocks and political intimidation of the agencies charged with administering minimum flow statutes have largely prevented meaningful applications of these statutory measures. *See* SCOTT YATES, TROUT UNLIMITED, WYOMING WATER, WYOMING SOLUTIONS: PARTNERING FOR STREAMFLOW RESTORATION FOREWORD (2009) [hereinafter WYOMING WATER, WYOMING SOLUTIONS], *available at* http://www.tu.org/atf/cf/%7BED0023C4-EA23-4396-9371-8509DC5B4953%7D/WYWaterWYSolutions.pdf (explaining that "the 1986 Wyoming Legislature passed a procedurally cumbersome instream flow bill that . . . has yet to 'restore' streamflows anywhere in Wyoming"); Telephone Interview with Tim Hawks, Project Coordinator, Idaho Trout Unlimited (explaining that political backlash has precluded state actions to buy up water rights pursuant to Utah's in-stream flow statute, leading the 2009 legislature to pass a bill that would allow nonprofits like TU to lease water rights to ensure minimum flows); TROUT UNLIMITED, A DRY LEGACY: THE CHALLENGE FOR COLORADO'S RIVERS 6 (2002) [hereinafter A DRY LEGACY], *available at* http://www.tu.org/atf/cf/%7B0D18ECB7-7347-445B-A38E-65B282BBBD8A%7D/Dry%20Legacy%20%28LoRes%29.pdf (describing the passage and historical application of Colorado's 1973 provision of an in-stream flow water right); TROUT UNLIMITED, IDAHO CROSSROADS: THE CHALLENGE FOR IDAHO'S RIVERS AND STREAMS IN THE 21ST CENTURY 5–11 (2010), *available at* http://www.tu.org/atf/cf/%7BED0023C4-EA23-4396-9371-8509DC5B4953%7D/ID_Crossroads_1.pdf (noting Idaho's minimum stream flow statute, describing its efficacy, and outlining opportunities for positive change within Idaho's current statutory rubric). Idaho, Utah, Nevada, and Wyoming, along with numerous federal land managers and the U.S. Fish and Wildlife Service, entered into a formal Conservation Agreement to conserve and restore Bonneville cutthroat across their range. LEO D. LENTSCH ET AL., RANGE-WIDE CONSERVATION AGREEMENT AND STRATEGY FOR BONNEVILLE CUTTHROAT TROUT (*ONCORHYNCHUS CLARKI UTAH*) 2 (2000), *available at* http://wildlife.utah.gov/ pdf/cacs7.pdf.

7. *See, e.g.*, Rock Creek Alliance v. U.S. Fish & Wildlife Serv., 390 F. Supp. 2d 993, 1001–02 (D. Mont. 2005) (holding the Service failed to adequately assess cumulative impacts to ESA-protected bull trout in determining a that proposed new massive copper/silver mine discharging waste water into important fish habitat would not jeopardize the continued existence of the species).

8. *See, e.g.*, Pac. Coast Fed'n of Fisherman's Ass'ns v. U.S. Bureau of Reclamation, 426 F.3d 1082, 1094 (9th Cir. 2005) (holding that the federal government failed to adequately assess impacts of irrigation project in Klamath Basin on coho salmon); Am. Rivers v. NOAA Fisheries, No. CV-04-00061-RE, 2006 U.S. Dist. LEXIS 69442, at *14 (D. Or. Sept. 26, 2006) (enjoining flow augmentation plans on the Snake River based on an inadequate Biological Opinion on several listed salmonids, in violation of the ESA).

The problems that western salmonids face will get worse—far worse—as anthropogenic climate disruption dries and warms the West over the next century.[9] Even conservative projections for temperature increases in much of the West show disastrous effects on fish. More dire scenarios portend collapse and extinction.

This Article will explore potential effects of climate disruption on two species, bull trout and Bonneville cutthroat trout, as emblematic of the larger crisis facing western fisheries. It will highlight why the prior appropriation doctrine, and government subsidization of water use in concert with prior appropriation, have historically been ill-suited to protect aquatic resources. It also discusses why that legal regime is ill-equipped to address the effects of climate disruption. Because warming in the West will occur slowly, we have time to develop adaptive strategies to save native fish species. However, we first must change our 19th century resource management paradigm to fit 21st century realities.

I. HISTORICAL AND CURRENT DISTRIBUTION AND ABUNDANCE OF BULL TROUT AND BONNEVILLE CUTTHROAT TROUT

Bull trout (*salvelinus confluentus*) were once widely distributed throughout the northern Rockies and the Pacific Northwest.[10] Bull trout are not actually trout; rather they are a species of char—cold-water salmonids more prevalent in Arctic climes.[11] Bull trout in the continental United States historically ranged from northern California to Puget Sound, south to northern Nevada, and east to the Continental Divide in Montana.[12] Bull trout occupy main stem rivers like the Columbia and the Snake, and smaller mountain streams and lakes. Bull trout are migratory, ranging up to 250 kilometers.[13] Born and reared in the coldest high mountain streams,

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9. In addition to the studies discussed herein for bull trout and Bonneville cutthroat, scientists have been alerting the public and government agencies to the fisheries crisis in the American West. Dr. Peter Moyle, a nationally renowned fisheries and conservation biology expert, published a study in 2008 where he determined that most of California's native salmon, steelhead, and trout species face extinction by the end of the century without prompt measures to protect their habitat. PETER B. MOYLE ET AL., UC DAVIS CTR. FOR WATERSHED SCIS., SALMON, STEELHEAD, AND TROUT IN CALIFORNIA: STATUS OF AN EMBLEMATIC FAUNA 4 (2008) [hereinafter MOYLE]. Dr. Moyle found the increased pressure posed by climate change to be a new and devastating stressor in addition to the well-known problems by decades of water mismanagement. *Id.*

10. Determination of Threatened Status for the Klamath River and Columbia River Distinct Population Segments of Bull Trout, 63 Fed. Reg. 31647, 31647 (June 10, 1998) (to be codified at 50 C.F.R. pt. 17).

11. *Id.*

12. *Id.*

13. *Id.* at 31648.

migratory bull trout move to lakes and large rivers during adulthood and return to mountain headwaters to spawn.[14] Coastal Puget Sound bull trout are thought to be anadromous.[15] Scientists believe that migratory bull trout evolved with stochastic events of the ice ages and that their migratory life history is critical to survival.[16] Resident populations are non-migratory and may be relics, cut off from migration by habitat destruction.[17] Bull trout require the coldest water temperatures of all U.S. salmonids;[18] water temperatures above 59°F are believed to limit their distribution within a watershed.[19]

Bull trout were first listed as Klamath River and Columbia River Distinct Population Segments after a federal district court found the Service's non-listing as "warranted but precluded" violated the ESA.[20] They have been extirpated from over half of their historic range.[21] Remaining populations are in trouble. The U.S. Fish and Wildlife Service (FWS)

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14. According to U.S. Fish and Wildlife Service scientists, bull trout exhibit a number of life-history strategies. Proposed Designation of Critical Habitat for the Klamath River and Columbia River Distinct Population Segments of Bull Trout, 67 Fed. Reg. 71236, 71236 (Nov. 29, 2002). Stream-resident bull trout complete their entire life cycle in the tributary streams where they spawn and rear. *Id.* "Some bull trout are migratory, spawning in tributary streams . . . before migrating to either a larger river (fluvial) or lake (adfluvial) where they spend their adult life, returning to the tributary stream to spawn." *Id.* (citation omitted). "Bull trout in the Coastal-Puget Sound area are believed to include an anadromous form which migrates to saltwater to mature, returning to streams to spawn." *Id.* at 71236–37 (citation omitted). *See generally* Jason Dunham et al., *Influences of Temperature and Environmental Variables on the Distribution of Bull Trout Within Streams at the Southern Margin of Its Range*, 23 N. AM. J. FISHERIES MGMT. 894 (2003), *available at* http://fresc.usgs.gov/products/papers/1406_Dunham.pdf (discussing thermal habitat associations of bull trout).

15. *Id.*

16. *Id.* at 71239.

17. *Id.*; *see also* Determination of Threatened Status of Bull Trout for the Klamath River and Columbia River Distinct Population Segments of Bull Trout, 63 Fed. Reg. 31647, 31670 (June 10, 1998) (to be codified at 50 C.F.R. pt. 17) (discussing the biological problems associated with isolated resident populations of bull trout, cutoff from natural migration by dams, stream dewatering, water diversions, and loss of habitat throughout the listing rule).

18. For example, water temperatures of 1.2 to 5.4°C (34.2 to 41.7°F) have been reported for incubation, with an optimum (best embryo survivorship) temperature reported to be from 2 to 4°C (36 to 39°F). John Fraley & Bradley Shepard, *Life History, Ecology and Population Status of Migratory Bull Trout* (Salvelinus confluentus) *in the Flathead Lake and River System, Montana*, 63 NORTHWEST SCI. 133, 138 (1989). Another scientist, Bruce Rieman, describes the optimal temperatures for bull trout as "substantially lower than those for other salmonids." Bruce E. Rieman et al., *Anticipated Climate Effects on Bull Trout Habitats and Populations Across the Interior Columbia River Basin*, 136 TRANSACTIONS OF THE AM. FISHERIES SOC'Y 1552, 1553 (2007) [herinafter Rieman], *available at* http://www.fs.fed.us/rm/pubs_ other/rmrs_2007_rieman_b001.pdf.

19. Proposed Designation of Critical Habitat for the Klamath River and Columbia River Distinct Population Segments of Bull Trout, 67 Fed. Reg. at 71237 (citations omitted).

20. Friends of the Wild Swan v. U.S. Fish & Wildlife Serv., 945 F. Supp. 1388, 1392 (D. Or. 1995); Determination of Threatened Status for the Klamath River and Columbia River Distinct Population Segments of Bull Trout, 63 Fed. Reg. at 31647.

21. *Friends of the Wild Swan*, 945 F. Supp. at 1392.

concluded that most remaining populations of bull trout have lost the ability to migrate, and most remaining populations are isolated remnants that are highly vulnerable to extinction.[22] Thus, most migratory populations have been lost. Dams, irrigation, mining, logging, introduction of non-native fish, road building, and urbanization caused the decline. According to the U.S. District Court for the District of Oregon, "[v]irtually every bull trout population within the coterminous United States is threatened by a wide variety of land and water management practices."[23]

The Bonneville cutthroat trout (*Oncorhynchus clarkii utah*) is one of 14 subspecies of native cutthroat trout that inhabit the West.[24] So named for the brilliant red slash below their gills, cutthroats inhabit a wide variety of habitat, including high mountain and desert climes of the interior West. Most subspecies of cutthroat remain in mostly small, isolated fragments, and occupy only 10 to 40% of their historic range, primarily in high elevation headwater streams.[25] Remnant populations of cutthroat are especially vulnerable to extinction because of "genetic variability, loss of resilience, demographic and environmental stochasticity, and natural and human-caused catastrophes."[26]

Bonneville cutthroats are native to parts of the Green and upper Colorado River basins in Utah, Nevada, Wyoming, and Idaho—remnants from the "Bonneville Basin," a massive Pleistocene Era lake and river

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22. *Id.* In its 1994 review of the petition to list bull trout under the ESA, FWS found that "[m]ost river systems now contain only isolated, remnant populations of resident fish restricted to the headwater areas of a few remaining suitable tributaries. These remnant populations have lost their migratory life-history forms, exist in isolation, and are likely to be at extreme risk of extinction." *Id.* In overturning the FWS decision not to list the species, the court found that this scientific conclusion undercut the agency's failure to list, and remanded the petition, leading to the bull trout's listing in 1998 as a threatened species under the ESA. *Id.* at 1401–02.

23. *Id.* at 1392 (citation omitted).

24. 12-Month Finding on a Petition To List the Bonneville Cutthroat Trout as Threatened or Endangered, 73 Fed. Reg. 52235, 52235 (Sept. 9, 2008) (to be codified at 50 C.F.R. pt. 17).

25. *See generally* Helen M. Neville et al., *Landscape Attributes and Life History Variability Shape Genetic Structure of Trout Populations in a Stream Network*, 21 LANDSCAPE ECOLOGY 901, 901 (2006) (finding "significant and severe genetic bottlenecks in several populations [of Lahontan cutthroat trout in the Great Basin desert] that were isolated, recently founded, or that inhabit streams that desiccate frequently"); U.S. DEP'T OF AGRIC., FOREST SERV., CONSERVATION ASSESSMENT FOR INLAND CUTTHROAT TROUT 6 (Michael K. Young, tech. ed., 1995), *available at* http://www.fs.fed.us/rm/pubs_rm/rm_gtr256.pdf (noting that "[t]he current distribution and abundance of westslope cutthroat trout appear to be severely restricted compared with historical conditions"). FWS determined that Bonneville cutthroat occupy 35% of their probable occupied historic stream miles. 12-Month Finding on a Petition To List Bonneville Cutthroat Trout as Threatened or Endangered, 73 Fed. Reg. at 52238.

26. Jack E. Williams et al., *Potential Consequences of Climate Change to Persistence of Cutthroat Trout Populations*, 29 N. AM. J. FISHERIES MGMT. 533, 534 (2009) [hereinafter Williams 2009].

system.[27] Like bull trout, Bonneville cutthroats exhibit different life-history strategies depending on whether they are migratory, resident, lake dwelling, or river dwelling.[28] Though FWS determined that Bonneville cutthroat did not qualify for protection under the ESA, FWS found that potentially destructive land use practices "are occurring to some extent in most areas of occupied habitat."[29] Dewatering from agriculture affects 30% of the current habitat.[30]

Bonneville cutthroats are found mostly in Utah; they are nearly extirpated from Wyoming and Idaho, though small remnants remain in both states.[31] Though some subspecies of cutthroat have been listed under the ESA,[32] Bonneville cutthroat are not. In 2008, FWS rejected a petition to list Bonneville trout as a threatened species under the ESA.[33] Despite finding the species not threatened with extinction, FWS found that the species has been extirpated from 65% of its historic habitat.[34] Only five percent of the remaining, fragmented, occupied habitat is considered to be in excellent condition.[35]

While bull trout and Bonneville cutthroats inhabit widely different habitats, the causes of their decline are similar. Human-caused habitat alteration, including stream dewatering, dams, and diversions, is a significant factor.[36] For both species, the loss of migratory life-history forms is critical because migratory fish are larger,[37] have better genetic interchange, and a much greater chance of persisting than isolated remnant populations that have lost their migratory life history.[38]

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27. 12-Month Finding on a Petition To List Bonneville Cutthroat Trout as Threatened or Endangered, 73 Fed. Reg. at 52237.

28. *Id.* at 52236.

29. *Id.* at 52244.

30. *Id.*

31. *Id.* at 52238.

32. Greenback and Paiute Cutthroat are both listed as "Threatened Species" under the ESA. *See infra* Appendix 1.

33. On September 9, 2008, FWS declined to list Bonneville cutthroat under the ESA. 12-Month Finding on a Petition To List Bonneville Cutthroat Trout as Threatened or Endangered, 73 Fed. Reg. at 52235. FWS determined that the existing threats to the species did not warrant listing, finding that populations had increased over the last three decades and that threats to the species including climate change were not significant to warrant listing. *Id.*

34. *Id.* at 52238.

35. *Id.* at 52243.

36. *Id.* at 52243–44.

37. WILLIAMS 2007, *supra* note 3, at 21.

38. Determination of Threatened Status for the Klamath River and Columbia River Distinct Population Segments of Bull Trout, 63 Fed. Reg. at 31670.

II. PRIOR APPROPRIATION: THE RACE TO THE BOTTOM OF THE CREEK

The decline of western salmonids is due to numerous, disparate causes, most of which are beyond the scope of this Article.[39] However, water management is at the heart of many of the causes of decline and is the focus of this Article. Water management includes both diverting water from streams (for irrigation and other uses) and promoting water use by damming streams for water storage, building canals, diversions and other features to foster agriculture, and development. These have been sanctioned, subsidized, and institutionalized by the U.S. government.[40]

Underlying water management in the West is the prior appropriation doctrine. "First in time, first in right" has been settled law in most of the West since the 1860s.[41] While prior appropriation is still the mainstay of western water law, modern permit systems, the role of the federal

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39. *See, e.g.*, Friends of the Wild Swan v. U.S. Fish & Wildlife Serv., 945 F. Supp. 1388, 1392 (D. Or. 1995) (summarizing U.S. Fish and Wildlife Service Findings on bull trout). Stream dewatering and water management are not the only factors pushing these fish towards extinction. *See generally* Williams 2009, *supra* note 26, at 533 (listing competition, predation, human degradation of habitat, in-stream barriers, isolation and fragmentation, invasive nonnative plants and animals, wildfires, and flooding as traditionally understood stressors for distinct subspecies of cutthroat trout). In addition to habitat destruction from other human activities like grazing, logging, mining, and urbanization, introduced trout species like brook and brown trout are a significant factor in suppressing native fish by way of both outcompetition and genetic introgression by hybridization. *See id.* (explaining that genetic introgressions by other trout capable of hybridizing as traditionally understood stressors for distinct subspecies of cutthroat trout and concluding that "[s]tress from climate change is likely to compound existing problems associated with habitat degradation and introgression from introduced salmonids"); *see also* Columbia Univ., Invasion Biology Introduced Species Summary Project, Brown Trout (*Salmo trutta*), http://www.columbia.edu/itc/cerc/danoff-burg/invasion_bio/inv_spp_summ/Salmo_trutta.htm (last visited March 18, 2010) [hereinafter Columbia Univ., Brown Trout]. Indeed, introduced species often out-compete native trout, especially in warmer waters. *See, e.g.*, Steven M. Seiler & Ernest R. Keeley, *Morphological and Swimming Stamina Differences Between Yellowstone Cutthroat Trout* (Oncorhynchus Clarkii Bouvieri)*, Rainbow Trout* (Oncorhynchus Mykiss)*, and Their Hybrids*, 64 CAN. J. FISHERIES & AQUATIC SCI. 127, 127 (finding that "introduced rainbow trout and cutthroat–rainbow trout hybrids potentially out-compete native Yellowstone cutthroat trout through higher sustained swimming ability"); *see also* Columbia Univ., Brown Trout (explaining that "[t]he brown trout is able to live and grow in warmer waters than other native trout species, [allowing it] to establish itself in many areas in which brook trout cannot exist or where warmer waters exist . . . [and,] in certain areas . . . [to] outcompete brook trout and other native species"). These problems are the focus of positive restoration efforts. *See, e.g.*, WYOMING WATER, WYOMING SOLUTIONS, *supra* note 6, at 4–7 (describing case studies of successful streamflow restoration projects); TROUT UNLIMITED, BULL TROUT RECOVERY IN THE LITTLE LOST BASIN: PROVING PARTNERSHIPS CAN MAKE THE DIFFERENCE 2–5 (2010), *available at* http://www.tu.org/atf/cf/%7BED0023C4-EA23-4396-9371-8509DC5B4953%7D/Bull_Trout_Recovery_in_the_Little_Lost_Basin_lorez.pdf (outlining long-term conservation plan for bull trout in the Little Lost Basin, Idaho). While habitat improvement and native fish restoration efforts must be commended, those efforts will be in vain if streams are dewatered and temperatures elevated.

40. *See* JOSEPH L. SAX ET AL., LEGAL CONTROL OF WATER RESOURCES: CASES AND MATERIALS 325–90 (4th ed. 2006) (discussing evolution of water law in the West).

41. *Id.* at 126.

government, water claims of Indian tribes, and intrusion of federal environmental laws complicate attempts to define western water management as simply prior appropriation.

The earliest western settlers viewed water as a common resource. Brigham Young declared, upon arriving in the Salt Lake Valley, that the precious water coming from the Wasatch Canyons "belong[s] to the people: all the people."[42] Such an egalitarian view was short-lived; private control of water resources quickly took hold in the days of the California Gold Rush, and prior appropriation, rather than traditional riparian law, became the rule. This was the greatest change that water law in the United States had undergone until the advent of modern environmental law.[43] Colorado emblazoned prior appropriation as a textual right in its 1876 Constitution[44] and permanently squelched riparianism soon thereafter.[45] The race to the bottom of the creek was on.

The hallmarks of traditional appropriation doctrine include: (1) "first in time, first in right," the notion that the first appropriator has the senior right that is permanently vested to the exclusion of others as long as it is used;[46] (2) that an appropriator can put as much water to beneficial use as his land will allow and will receive a vested right to continued use of that water;[47] and (3) that while waste is not condoned, complete efficiency in water delivery or use is not required.[48] These tenants insured that available surface waters would be quickly appropriated.[49] An irrigator who attempts to conserve water by leaving it in-stream simply makes the water available for appropriation by someone else.[50] In addition, the appropriation doctrine usually demands a diversion of water from a stream,[51] which insures that

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42. *Id.* at 328 (quoting ROBERT DUNBAR, FORGING NEW RIGHTS IN WESTERN WATERS 13 (1983)). Professor Sax notes that both Native Americans and the early Spanish settlers in the American Southwest also developed an egalitarian view of water resources. *Id.* at 328.

43. *Id.* at 325.

44. COLO. CONST. art. XVI § 6 ("The right to divert the unappropriated waters of any natural stream to beneficial uses shall *never* be denied. Priority of appropriation shall give the better right as between those using the water for the same purpose[s] . . . .") (emphasis added).

45. Coffin v. Left Hand Ditch Co., 6 Colo. 443, 447 (1882).

46. SAX ET AL., *supra* note 40, at 125–26.

47. *Id.* at 125.

48. *Id.*

49. *See generally id.* at 139–43 (describing the prior appropriation system and how appropriative rights are acquired).

50. *See* Se. Colo. Water Conservancy Dist. v. Shelton Farms, Inc., 529 P.2d 1321, 1327 (Colo. 1974) (noting that irrigator's efforts to conserve water by cutting down non-native, highly water-consumptive trees, simply made the salvaged water available for senior appropriators).

51. *See generally In re* Adjudication of the Existing Rights to the Use of All the Water, 2002 MT 216, ¶ 20, 311 Mont. 327, ¶ 20, 55 P.3d 396, ¶ 20. Montana irrigators argued that because prior appropriation requires a diversion, in-stream flow rights to protect fisheries were *per se* illegal. *Id.* ¶ 18.

streams are both riddled with fish-obstructing diversion structures and that water is removed from the stream and put to a beneficial (i.e. consumptive) use somewhere else.[52]

That prior appropriation can be an inefficient, wasteful water management regime[53] is a topic that cannot be seriously debated.[54] The inevitable result is that thousands of miles of western streams are either seriously impacted or completely dewatered each year. Fish do not thrive in dry creek beds.

The federal government has compounded the problems created by prior appropriation by encouraging and subsidizing the over-use and waste of water in the American West. As the authors of an extensive study on western water marketing concluded, the

> federal government's agricultural marketing loan and price support programs subsidize the production of crops and encourage the use of water for marginal crops that would not be grown but for the subsidies. We think that the same thing might be said about subsidies for water infrastructure, low-cost hydroelectric energy, and federal crop insurance.[55]

Because the appropriation doctrine encourages the complete consumptive use of surface waters, it is not surprising that many streams today are "fully appropriated"—meaning all of the flow is allocated to water users, whether they are private farmers, municipalities, or government agencies.[56] The result of fully appropriated streams is that they are often

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Fortunately, the Montana Supreme Court held to the contrary, thus opening the door for the Department of Fish, Wildlife and Parks to begin claiming in-stream flow rights for fish, a century after many streams had been fully appropriated. *Id.* ¶¶ 30–32.

52. This discussion doesn't add anything that hasn't been said before about prior appropriation. The problems that prior appropriation has caused for fisheries, recreation, aquatic ecosystems, and other non-consumptive water uses has been the subject of scientific and academic discussion for many years, and this author draws upon those works. *See, e.g.*, Reed D. Benson, *Rivers to Live By: Can Western Water Law Help Communities Embrace Their Streams?*, 27 J. LAND RESOURCES & ENVTL. L. 1 (2007).

53. The author has had the privilege of representing many irrigators in state and federal court and carries the greatest respect for those who work the land. These farmers and ranchers are often true conservationists, both in terms of water and the landscape. The criticism herein is directed at the legal regime, not those who depend on water for a living.

54. *See generally* SAX ET AL., *supra* note 40, at 247–56 (describing abandonment and forfeiture of appropriative rights). For example, in the Imperial Valley in southern California, the irrigation district allows one million acre feet to spill into the Salton Sea, a vast body of water created by wasteful irrigation practices. *Id.*

55. Jedidiah Brewer et al., *Transferring Water in the American West: 1987–2005*, 40 U. MICH. J.L. REFORM 1021, 1032 (2007).

56. Emblematic of the complete appropriation of western rivers is the Colorado. One of the greatest rivers in the world, the Colorado often carries no water to its mouth in the Gulf of California,

sucked dry (dewatered, in agency parlance) during the summer irrigation season. Bear in mind that, unlike eastern climes, much of the West is devoid of rainfall during the summer.[57] Western rivers are largely dependent on mountain snowmelt; their natural hydrographs peak in late spring and early summer and steadily decline to baseflow in late summer, when flows may be only ten percent of early summer peaks. Irrigation typically begins in late spring and lasts until the fall.[58] The result of these practices is that many western rivers have been historically dewatered by mid- or late summer. Prior appropriation fosters complete appropriation of all flows; water is abundant during peak flow but scarce by mid-summer. The "use it or lose it" requirement of the legal regime demands that irrigators take their appropriation. The fact that a host of western fish is either threatened with or in danger of extinction is hardly surprising since fish need water.

The impact of prior appropriation on stream dewatering is hard to catalog[59] because of the absence of readily available data on the problem. But the problem is evident where agencies have looked. The Montana Department of Fish, Wildlife and Parks catalogs 4,000 miles of streams that are either chronically or periodically dewatered.[60] Fabled blue-ribbon trout streams like the Big Hole and Bitterroot Rivers can be nothing but a series of puddles in sections during late summer in drought years.[61] In Colorado,

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though by treaty the United States must ensure a small fraction of the river's flow reaches the border. The rest of the flow of the Colorado River is 100% appropriated, divided among competing states, with a few reserved rights to Indian Tribes and federal lands thrown in for good measure. This arrangement, known as "The Law of The River," comes with the blessing of the United States Supreme Court. *See generally* Arizona v. California, 373 U.S. 546, 602 (1963) (describing the water appropriation scheme for the Colorado River); SAX ET AL., *supra* note 40, at 799–835 (describing the Colorado River as a shared and regional resource). States formally recognize the fact that many of their streams are fully appropriated. California publishes a list of fully appropriated streams that includes many of the major drainages in the state. State Water Res. Control Bd., Water Rights, http://www.swrcb.ca.gov/waterrights/water_issues/ programs/fully_appropriated_streams/ (last visited March 18, 2010). Montana has provided a petition process to close entire basins that are determined to be over-appropriated. MONT. CODE ANN. § 85-2-319 (2009).

57. A sample of average August precipitation across the West reveals just how dry this region is during the summer: Grand Junction, Colorado, 0.81 inches; Stockton, California, 0.07 inches; Pocatello, Idaho, 0.67 inches. Univ. of Utah Weather Center, http://www.met.utah.edu/jhorel/html/ (last visited Feb. 11, 2010) (follow "Utah and National Climate Data" hyperlink; then follow "Normal Monthly Rainfall" hyperlink).

58. Williams 2009, *supra* note 26, at 533–48.

59. The author and his research assistant have spent hours trying to find data about stream dewatering. With the exception of Montana, no western state keeps readily available data on the extent of stream dewatering. Given the vested interest in maintaining prior appropriation, it is perhaps not surprising that states are unwilling to catalog the extent of the problem.

60. Mont. Fish, Wildlife & Parks, Dewatered Streams of Montana, http://www.montanariver action.org/water-instream-map.html (last visited March 18, 2010).

61. This author believes that Montana has been a leader among western states in addressing the

stream dewatering for appropriated uses seriously affects 571 different streams, with rivers such as the Cache de la Poudre, San Miguel, La Plata, and South Arkansas going nearly dry during the summer.[62] The mighty Rio Grande—the "Big River"—is but a trickle through Albuquerque.

This legacy of prior appropriation—dewatered streams and the disappearance of native fisheries—is apparent in the demise of bull trout and Bonneville cutthroat trout. Though bull trout are spread across five western states, including the relatively wet Pacific Northwest, stream dewatering has been a major cause of their decline and habitat fragmentation.[63] Dams and water diversion are a principal cause in FWS's decision to list bull trout under the ESA.[64] Even when irrigation does not dewater streams, irrigation ditches trap and kill bull trout and other fish.[65] Moreover, it is axiomatic that streams depleted but not dewatered will still incur elevated temperatures.

FWS is less candid about the role of water management in the decline of Bonneville cutthroat. FWS decided not to list the species under the ESA and, in so doing, had to find that the existing regulatory scheme, including water management under prior appropriation, was adequate.[66] Yet the fact

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problems that stream dewatering poses for fish. However, Montana still issues stream closures nearly every summer because of low flows and elevated temperatures. U.S. Fish & Wildlife Serv., Critical Habitat for Bull Trout (*Salvelinus confluentus*), http://www.fws.gov/pacific/bulltrout/crithab/mtnv/31%20Lower%20Clark%20Fork%20River.pdf (last visited March 18, 2010).

62. A DRY LEGACY, *supra* note 6, at 2.

63. In Montana, for example, many of the dewatered streams (like the Clark Fork River basin) are important bull trout habitat. In the Pacific Northwest "in the 1990s, nearly every stream in Washington had Chinook, steelhead, or bull trout listed as threatened or endangered under the Endangered Species Act—primarily attributed to low stream flows." Brandon Scarborough, *Buy That Fish a Drink*, PERC REPORTS, Summer 2007, at 5, 8.

64. Determination of Threatened Status for Bull Trout in the Coterminous United States, 64 Fed. Reg. 58910, 58912 (Nov. 1, 1999).

65. For example, in *Idaho Watersheds Project v. Jones*, No. 00-0730-E-BLW, 2002 U.S. Dist. LEXIS 27589, at *2 (D. Idaho Nov. 14, 2002) *remanded by* 127 F. App'x 976 (9th Cir. 2005), conservationists sued irrigators under Section 9 of the Endangered Species Act for failing to use a fish screen and a headgate on an irrigation ditch because of bull trout. In the court's words, "the Joneses should be enjoined to use a fish screen and a head gate in their diversion if there is a reasonably certain imminent threat that the lack of a fish screen or a head gate will kill or injure bull trout or will modify habitat in a way that kills and injures bull trout . . . ." *Idaho Watersheds Project*, 127 F. App'x at 977 (internal citation omitted). Traditional irrigation ditches lack fish screens. Researchers have demonstrated that using fish screens on irrigation ditches can diminish mortality. Ryan Alexander Harnish, Fish Screen Efficiency and Effects of Screened and Unscreened Irrigation Canals on the Downstream Movement of Westslope Cutthroat Trout Juveniles in Skalkaho Creek, Montana (Oct. 2007) (unpublished Masters thesis, Montana State University), *available at* http://etd.lib.montana.edu/etd/2007/harnish/HarnishR1207.pdf.

66. 12-Month Finding on a Petition To List Bonneville Cutthroat Trout as Threatened or Endangered, 73 Fed. Reg. at 52256. Rather than address the fact that the species has lost approximately 70% of its historic range, FWS instead lauded the fact that both Utah and Wyoming had recently passed in-stream flow laws. *Id.* at 52247. As discussed in Section V, the existence of laws that allow for in-

remains that of the 10,876 kilometers of historic habitat only 3,830 kilometers is currently occupied.[67] Of that limited remaining habitat, FWS estimated that 30% of the streams in important conservation areas are affected by dewatering.[68] Moreover, FWS found that only five percent of the remaining habitat was in "excellent" condition, meaning that optimal stream temperatures were maintained.[69] In the heavily irrigation-dependent states of Utah, Idaho, and Wyoming, where the most of the species' former habitat is vacant, it is reasonable to assume that habitat degradation caused by stream dewatering is responsible for a large part of the decline. The other "usual suspects" of mining, grazing, logging, road construction, and urbanization are also undoubtedly factors.

The effects of increased diversion and dewatering have been more acutely felt due to the increasingly common decadal drought conditions that have characterized the Rocky Mountain West during the past 30 years. The vast Missouri River Basin is subject to the country's highest rate of withdrawal for irrigation and experienced dangerous and prolonged periods of low flows and high water temperatures during the perennial drought periods of the mid- to late 1980s and 2001 to 2008.[70] The effects of these critical conditions were further amplified during years in which Pacific Ocean cycles generated climate variability leading to annual fluctuations in precipitation of 60 to 70%, further increasing temperatures and lowering levels of flow.[71] Increasing with the incidence of these natural phenomena are the ever-present tensions between upstream and downstream users, who quarrel over water rights within the system of prior appropriation.[72] The disconnect between legal entitlement and environmental realities becomes most evident during these times of reduced flow, and the system of prior appropriation is only equipped to reconcile the former.

Today, the deadly effects of dewatering extend beyond the traditional notion of hot water in downstream stretches of large rivers during low summer levels. Indeed, today even candidate endangered species sequestered in the cold upper reaches of tributaries are feeling the heat of drought conditions and over-appropriation.[73] Recent studies confirm the

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stream flow protection does not mean that adequate water is actually left in place for fish.

67. *Id.* at 52238.

68. *Id.* at 52243.

69. *Id.*

70. Vikram M. Mehta & Norman J. Rosenberg, , *Introduction to the Missouri River Basin*, 1 MO. BASIN CLIMATEER (Ctr. for Res. on the Changing Earth Sys.), Jan. 2009, at 2, *available at* http://drought.unl.edu/news/workshopkansascity09/Missouri-Basin_Climateer.pdf.

71. *Id.*

72. *Id.*

73. *See, e.g.*, DAMON PELLICORI & MIKE ROBERTS, MONT. DEP'T OF NATURAL RES. &

long-feared notion that increased temperatures lessen overall snowpack, cause early runoff, and exacerbate the effects of global warming on drought,[74] eventuating in greater variability and less habitable late-summer conditions for trout survival. Recent studies in Idaho and Montana also suggest that these warming trends are subject to increase rapidly due to Pacific Ocean phenomena which amplify the negative affects of drought by further contributing to early runoff and decreased winter precipitation.[75] More alarming still are studies projecting that future daily temperature increases will cause snowmelt timing at high elevations (which currently varies by more than four weeks year-to-year) to occur three weeks earlier in the late 21st century.[76]

Prior appropriation remains at the heart of irrigated agriculture to this day, a social and economic mainstay of the West. Irrigated agriculture consumes an overwhelming share of water in the West.[77] Irrigated agriculture remains a driving force in the western economy and a significant contributor to our nation's food sources.[78] It is not surprising that the appropriation doctrine remains firmly entrenched in the legal regime governing water allocation and use, despite its consequences to western fisheries.

While government agencies and private organizations laud recent changes to prior appropriation that make the system more fish-friendly, the regime is still firmly entrenched as the dominant paradigm in western water law. For example, in Idaho, prior appropriation doctrine remains the law of the land, albeit in a form augmented by modern permitting schemes and

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CONSERVATION – WATER MGMT. BUREAU, FUNDING PROPOSAL FOR WATER MEASUREMENT DEVICES THROUGH US BUREAU OF RECLAMATION, DROUGHT RELIEF ASSISTANCE ACT (2006) (describing effects of dewatering on increased stress for Arctic grayling in the Big Hole Valley).

74. Johnnie N. Moore et al., *Significance of Trends Toward Earlier Snowmelt Runoff, Columbia and Missouri Headwaters, Western United States*, 34 GEOPHYSICAL RES. LETTERS L16402, 4 (2007) (concluding that runoff is occurring earlier now than 55 years ago and suggesting reasons for this trend).

75. *See generally* Brian Harshburger et al., *Observational Evidence of the Influence of Pacific SSTs on Winter Precipitation and Spring Stream Discharge in Idaho*, 264 J. HYDROLOGY 157, 167 (2002) (describing a study performed in Idaho); Bonnie J. Gillan et al., *Timing of Present and Future Snowmelt from High Elevations in Northwest Montana*, 46 WATER RESOURCES RES. W01507, 1 (2010) (describing a study performed in Montana).

76. Gillan et al., *supra* note 75, at 2.

77. In Nevada—the most arid state in the country—domestic water use amounted to 9.8 million gallons a day in 1993. By contrast, agriculture used 2.8 billion gallons of water per day. W. B. SOLLEY ET AL., ESTIMATED USE OF WATER IN THE UNITED STATES IN 1990, USGS CIRCULAR 1081, 37 tbl.16 (1993).

78. Irrigation is critical to agriculture in the United States: nearly half of the value of all crops sold comes from the 16% of harvested cropland that is irrigated. In the process, agriculture accounts for more than 80% of all water used for consumptive purposes. Econ. Res. Serv., USDA, Western Irrigated Agriculture, http://www.ers.usda.gov/Data/WesternIrrigation (last visited March 18, 2010).

statutory overlays.[79] State courts and administrators continue to validate the baseline concepts of "first in time, first in right" limited only by beneficial and reasonable (for irrigators) use.[80] Recent Idaho Supreme Court decisions evidence continued operation under the assumption that this background water law principle is controlling,[81] and the federal district court recently held that dewatering under the current scheme has functioned to inexcusably preclude both the survival and recovery of the Snake River Basin steelhead.[82] Similarly, the Idaho Department of Water Resources (IDWR) relies upon the notion of prior appropriation in its perpetually ongoing efforts to procure completion of the Snake River Basin Adjudication (SRBA) by quantifying the nature and extent of all validly executed water rights.[83] Some of the most alarming, and often irreversible,

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79. IDAHO CONST. art. XV, § 3 ("Priority of appropriations shall give the better right as between those using the water" of the state.); IDAHO CODE ANN. § 42-106 (2009) ("As between appropriators, the first in time is first in right."); IDAHO CODE ANN. § 42-226 (2009) ("[W]hile the doctrine of 'first in time is first in right' is recognized, a reasonable exercise of this right shall not block full economic development of underground water resources."). In *American Falls Reservoir District No. 2 v. Idaho Department of Water Resources*, 154 P.3d 433, 444 (Idaho 2007), the court stated:

> [Conjunctive Management of Surface and Ground Water Resources] Rule 20.02 provides that: '[T]hese rules acknowledge all elements of the ***prior appropriation doctrine*** as established by Idaho law.' 'Idaho law' . . . means '[T]he constitution, statutes, administrative rules and case law of Idaho.' Thus, the Rules incorporate Idaho law by reference . . . to the extent the Constitution, statutes and case law have identified the proper presumptions, burdens of proof, evidentiary standards and time parameters . . . .

(emphasis added).

80. *Am. Falls Reservoir Dist. No. 2*, 154 P.3d at 438 (quoting the Director's Relief Order) The Director's Relief Order stated that

> [r]esolution of the conjunctive administration issue lies in the application of two well established principles of the *prior appropriation doctrine*: (1) the principle of 'first in time is first in right' and (2) the principle of optimum use of Idaho's water. Both of these principles are subject to the requirement of reasonable use.

Id. (emphasis added).

81. *Id.* at 454.

82. Nez Perce Tribe v. NOAA Fisheries, No. CV-07-247-N-BLW, 2008 U.S. Dist. LEXIS 28107, at *2 (D. Idaho Apr. 7, 2008) (finding minimum flows insufficient to assure the survival and recovery of the steelhead where continued withdrawals degrade critical habitat by reducing flows during spawning season and drying up creek beds during summer months).

83. *See* Idaho Dep't of Water Res., Snake River Basin Adjudication, http://www.idwr.idaho.gov/WaterManagement/AdjudicationBureau/default.htm (last visited Feb. 3, 2010) (providing resources for information about adjudication); Idaho Dep't of Water Res., Water Rights, http://www.idwr.idaho.gov/WaterManagement/WaterRights/default.htm (last visited Feb. 11, 2010).

> When a private right to the use of public waters is established by appropriation, a water right is established that is a real property right much like property rights in land. The constitution and statutes of the state of Idaho protect private property rights, including water rights. The right to divert the public waters of the state of Idaho and put them to a beneficial use, in accordance with one's priority date.

Id.

consequences of the prior appropriation doctrine's inflexibility have come in the form of fisheries mismanagement for endemic and even endangered species. Both bull trout and Bonneville cutthroat have important remnant populations in Idaho, and their future survival rests in part on Idaho's outdated legal regime for water.

Idaho, of course, is not alone in continuing to embrace the prior appropriation doctrine. Utah, home of most remaining Bonneville cutthroat trout, also retains a commensurately vital permutation of the traditional strictures of prior appropriation doctrine in its current water distribution scheme, despite changes under the statutory and regulatory permitting rubric.[84] Utah statutes control distribution based on the underlying premise of "first in time, first in right."[85] Courts in Utah continue to apply the traditional boilerplate principles of prior appropriation doctrine in defining the extent of a user's right.[86] It follows logically that the Utah system is susceptible to the same abuses and potential mismanagement as other states employing the archaic and, in times of low water, draconian law of appropriation. Consistent with outcomes and patterns in other prior appropriation states, Utah has borne its share of shortages, disputes, and dry stream beds due to the doctrine's patent inflexibilities.[87]

Though Montana constitutionally protects all water resources in the public trust,[88] Montana also retains fundamental vestiges of prior appropriation. Pre-1973 water rights are constitutionally protected,[89] and the Water Use Act codifies "first in time, first in right" principles. No limits are placed on new appropriations, though the Legislature has closed a number of major river basins like the Missouri and Clark Fork to new appropriations because they are over-appropriated and state-wide

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84. *See generally* Strawberry Water Users Ass'n v. Bureau of Reclamation, 2006 UT 19, 133 P.3d 410 (discussing appropriations in Utah as part of its determination of jurisdiction).

85. *See* UTAH CODE ANN. § 73-3-17 (2009) (making certificates of appropriation prima facie evidence of the owner's right to the use of the water).

86. *Strawberry Water Users Ass'n*, 2006 UT at ¶ 35 (citing United States v. Dist. Court of Fourth Judicial Dist. in and for Utah County, 121 Utah 1, 238 P.2d 1132, 1134 (Utah 1951)).

87. *See generally* Orderville Irrigation Co. v. Glendale Irrigation Co., 409 P.2d 616 (Utah 1965) (describing a water dispute between two irrigation companies); E. Jordan Irrigation Co. v. Morgan, 860 P.2d 310 (Utah 1993) (denying a shareholder of a water corporation the right to change the point of diversion for his usage); Green River Canal Co. v. Thayn, 2003 UT 50, 84 P.3d 1134 (denying enforcement of a specified water usage); W. Water, L.L.C. v. Olds, 2008 UT 18, 184 P.3d 578 (describing dispute over water rights permitting process).

88. MONT. CONST. art. IX, § 3, cl. 3; *see* Mont. Coal. for Stream Access, Inc. v. Curran, 682 P.2d 163, 168 (Mont. 1984) (finding that "[t]he control of the State for the purposes of the trust can never be lost, except as to such parcels as are used in promoting the interest of the public therein, or can be disposed of without any substantial impairment of the public interest in the lands and waters remaining").

89. MONT. CONST. art. IX, § 3.

adjudication of old and new rights has not occurred. It was not until 2000 that the Montana Supreme Court ruled that in-stream flows for fish could even be a beneficial use; irrigators argued that because no water was diverted from the stream, a water right could not issue to the Department of Fish, Wildlife and Parks for in-stream fishery protection.[90] The Department of Natural Resources and Conservation, the state agency in charge of protecting water resources, refused to recognize the basic principles of ground-surface water inter-connectivity, granting large groundwater withdrawals that threatened flows in the Smith River.[91] The Montana Supreme Court reversed the agency's archaic views;[92] the fact that incorporating long-recognized principles of hydro-geology was fought by the agency entrusted with managing water resources shows that traditional views of water use remain entrenched.

The examples provided by Montana, Idaho, and Utah are repeated throughout much of the West, though with some variation.[93] Nineteen western states embrace significant aspects of the appropriations doctrine, and nine states adopt the "Colorado Doctrine" or pure prior appropriation.[94] As discussed above, the predominance of prior appropriation, even under "modern" permit systems, still governs the use and allocation of water. The heavy toll prior appropriation has taken on bull trout and Bonneville cutthroat won't change any time soon, given the entrenched nature of the system.

Professor J.B. Ruhl, in analyzing how the ESA might fare in the face of climate disruption, described it as a "no analog future."[95] The term is apt for western water law as well: A system with its feet intractably rooted in the 19th century is about to confront 21st century problems of a magnitude our forefathers never envisioned.

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90. *In re* Adjudication of the Existing Rights to the Use of All the Water, 2002 MT 216, ¶ 20, 311 Mont. 327, ¶ 20, 55 P.3d 396, ¶ 20.

91. Mont. Trout Unlimited v. Dep't of Natural Res. & Conservation, 2006 MT 72, ¶ 43, 331 Mont. 483, ¶ 43, 133 P.3d 224, ¶ 43.

92. *Id.* ¶ 44.

93. California, for example, still retains a modified riparian/prior appropriation system. *See generally* California State Water Resources Control Board, Information Pertaining to Water Rights in California – 1990, *available at* http://www.waterboards.ca.gov/waterrights/publications_forms/forms/docs/app_general_info.pdf (describing California water permitting system).

94. This article is not intended to be a walk through of the subtleties of each western state's water management regime. As noted earlier, prior appropriation is modified by permit systems, case law, and other factors. However, the central features still remain. The Colorado Doctrine or "pure appropriation" states include Alaska, Utah, Montana, Idaho, Colorado, Wyoming, New Mexico, Arizona, and Nevada. Five states originally recognized riparian uses but switched to appropriation: Washington, Oregon, North and South Dakota, and Texas.

95. J.B. Ruhl, *Climate Change and the Endangered Species Act: Building Bridges to the No-Analog Future*, 88 B.U. L. REV. 1, 1, 26–31 (2008).

III. CLIMATE DISRUPTION, FISH, AND WATER IN THE AMERICAN WEST

Climate disruption has already affected parts of the West. Ambient air temperatures in the West have increased over the last five decades. These changes coincide with climatological trends throughout the world attributed to increases in greenhouse gases (GHGs) from anthropogenic sources.[96] These changes will continue and accelerate during the 21st century. Because GHGs are slow to deteriorate, even radical reductions in GHGs today will not forestall the disruptive effects of GHGs already "in the pipeline." If our national behavior in terms of reducing GHGs is any indication of future behavior, significant reductions in atmospheric concentrations of GHGs are unlikely.

Climate modeling forecasts for the western United States predict increased air temperature, which correlates directly to increased stream temperature. One study predicts temperature increases from 1.0 to 2.5°C or more by 2050 for the Columbia River Basin in the northwestern United States.[97] Another study estimates a 3.0°C increase as a likely scenario for the western United States in the 21st century.[98]

Increased air temperature from climate disruption will have two consequences for trout. First, because of the correlation between air temperature and water temperature, streams will warm as temperatures rise. Increased water temperature can be lethal for trout. As cold-water species, western trout have water temperature tolerances that limit their abundance and distribution. Bull trout have the most demanding cold water requirements of all American salmonids.[99] Bonneville cutthroat are also sensitive to temperature (albeit less so than bull trout), such that modest increases in temperature will restrict their available habitat.

Increasing temperatures will also affect the hydrological cycle by altering the timing of spring runoff.[100] Think of western mountains as one

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96. The 2007 Intergovernmental Panel on Climate Change Report concluded that global temperatures increased 0.6°C during the 20th century. INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE, CLIMATE CHANGE 2007: SYNTHESIS REPORT 30 (2007) [hereinafter IPCC], *available at* http://www.ipcc.ch/ pdf/assessment-report/ar4/syr/ar4_syr.pdf.

97. L. Ruby Leung et al., *Mid-Century Ensemble Regional Climate Change Scenarios for the Western United States*, 62 CLIMATE CHANGE 75, 75 (2004), *available at* http://climateknowledge.org: 16080/NA_precipitation/Leung_Regional_Water_ClimaticChange_2004.pdf; PHILIP MOTE ET AL., CLIMATE IMPACTS GROUP, SCENARIOS OF FUTURE CLIMATE FOR THE PACIFIC NORTHWEST (2005), *available at* http://cses.washington.edu/db/pdf/kc05scenarios462.pdf.

98. CLIMATE IMPACTS GROUP, OVERVIEW OF CLIMATE CHANGE IMPACTS IN THE U.S. PACIFIC NORTHWEST 1 (2004), *available at* http://cses.washington.edu/db/pdf/cigoverview353.pdf.

99. Rieman, *supra* note 18, at 1553.

100. The basic western hydrological cycle can be described as follows: Winter snow accumulates in the mountains from late fall until mid- or late spring. Spring runoff, where a significant

large reservoir. Annual winter snow fills the reservoir; mountain snowfall accounts for 50 to 80% of all of the precipitation in the West.[101] The mountain "reservoir" stores the water as snow, and then drains slowly during spring and early summer melt, ensuring that valley rivers are nourished during the summer months when little rain falls. The timing of peak spring runoff from snowmelt, a critical factor in western stream hydrology, already occurs from one to four weeks earlier than historic averages.[102] One study suggests future changes in peak spring snowmelt may occur as much as 30 to 40 days earlier.[103] This change is profound. Snow historically lingered well into the summer months, insuring a steady, though gradually decreasing flow. Earlier spring runoff means that river levels will drop much sooner than they did historically. Warmer summer temperatures, coupled with lower summer flows, will further increase water temperature, especially in late summer when irrigators and fish already compete for the low flows that nature provides.

Projected changes in the amount of western precipitation are less certain but may also hurt fish. In general, the Intergovernmental Panel on Climate Change (IPCC) predicts that precipitation events will be of greater intensity, with longer, drier periods in between.[104] Site-specific studies for the western United States are consistent with these overall predictions.[105] Less summer precipitation will add to low flow problems that already exist in dewatered streams. In addition, if increased precipitation in the winter and spring falls as rain in areas traditionally covered by snow, increased winter flooding events will be harmful to fish habitat.[106]

Yet another consequence of these climatological changes is a likely increase in forest fire frequency and intensity. Fire plays an integral, natural role in western forest ecology. However, increased air temperature and earlier snowmelt lead to conditions that make catastrophic wildfire more

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portion of the winter snow melts, occurs in May or June, depending on the region, elevation, spring weather, and many variables. Rivers are "bank full;" fish and irrigators are happy. Rivers naturally decline towards base flow throughout the summer and into the early fall. During these times, July through September, irrigators often dewater streams and compete with one another for a scarce resource. Streams remain at base flow through the fall and winter, when irrigation generally does not occur in the Rocky Mountain West. Iris T. Stewart et al., *Changes in Snowmelt Runoff Timing in Western North America Under a 'Business as Usual' Climate Change Scenario*, 62 CLIMATIC CHANGE 217, 217 (2004), *available at* http://meteora.ucsd.edu/cap/stewart_clch.pdf.

101. *Id.* at 217.

102. *Id.* at 219 fig.2.

103. *Id.* at 217.

104. IPCC, *supra* note 96, at 46.

105. 12-Month Finding on a Petition To List Bonneville Cutthroat Trout as Threatened or Endangered, 73 Fed. Reg. at 52248 (citation omitted).

106. Williams 2009, *supra* note 26, at 537.

likely.[107] Rather than historic, low-intensity wildfire that nourished ecological processes by creating a vegetative mosaic of lightly, moderately, and heavily burned areas, catastrophic wildfire can denude vast acreages, scarify the soil, and make regeneration a slow process.[108] Landslides and erosion are more likely in heavily burned areas. Western forest fires have been demonstrably more severe; since the mid-1980s there has been a 60% increase in large wildfires in the Northern Rockies.[109] Increased catastrophic risk of wildfire is bad for fish for two reasons. First, fires can cause direct mortality. Second, catastrophic wildfire can render habitat unsuitable for years, as riparian vegetation is gone, and steep hillsides are more prone to erosion.[110] Climate change models in the western United States predict longer fire seasons, hotter fires, and larger areas subject to intense burning than in the past.[111]

What do the effects of climate change in the West mean for bull trout and Bonneville cutthroat? Two recent studies predict dire consequences from climate change for these species. A team of mostly government scientists led by Dr. Bruce Rieman of the U.S. Forest Service analyzed extensive temperature data across bull trout habitat and correlated water temperature with occupied bull trout habitat.[112] Various climate change scenarios were modeled. The researchers then quantified the loss of habitat caused by increased temperature. The second study by Dr. Jack Williams and others[113] focused on several subspecies of cutthroat trout. These researchers examined not only water temperature changes, but also the effects of increased wildfire, and the effects of increased winter flooding caused by rain-on-snow events and earlier snowmelt.[114] These studies are discussed below.

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107. A.L. Westerling et al., *Warming and Earlier Spring Increase Western U.S. Forest Wildfire Activity*, 313 SCIENCE 940, 940–43 (2006). This study concludes, "Regardless of past trends, virtually all climate-model projections indicate that warmer springs and summers will occur over the region in coming decades. These trends will reinforce the tendency toward early spring snowmelt and longer fire seasons. This will accentuate conditions favorable to the occurrence of large wildfires, amplifying the vulnerability the region has experienced since the mid-1980s." *Id.* (citations omitted).

108. *See* Jamison Colburn, *The Fire Next Time: Land Use Planning in the Wildland/Urban Interface*, 28 J. LAND RESOURCES & ENVTL. L. 223, 223 (2008). This article explains how government management policy and recent congressional legislation exacerbate the catastrophic effects of wildfire; climate change will amplify the adverse effects of misguided management of federal national forests which dominate the forested landscape of the West.

109. Westerling et al., *supra* note 107, at 941.

110. Williams 2009, *supra* note 26, at 534.

111. *Id.* at 537.

112. Rieman, *supra* note 18.

113. Williams 2009, *supra* note 26, at 533.

114. *Id.*

Because bull trout are so temperature sensitive, relatively small incremental increases in temperature will limit available habitat. In practical terms, bull trout will have to seek higher elevation (colder) waters—they will retreat farther into isolated mountain habitats, diminishing the species' already reduced ability to migrate and connect with other populations. Dr. Rieman estimates the loss of thermally suitable bull trout habitat from 18 to 92%, depending on the extent of temperature increase.[115]

The threat of substantial habitat loss for a species already threatened by extinction may be fatal, notwithstanding millions of dollars spent by state and federal agencies to improve other habitat problems like sedimentation from logging. One might counter that the habitat loss at the low end of the temperature changes, 18%, is not so bad. However, Dr. Rieman found that habitat loss would be more pronounced in the largest and most robust remaining habitat patches.[116] Thus, "[e]ven limited warming may produce dramatic increases in the extirpation of local populations of bull trout in some areas . . . ."[117] Given that the U.S. Fish and Wildlife Service has concluded that most remaining isolated, remnant bull trout populations already face a great risk of extinction,[118] further fragmentation and loss of the most robust remaining patches would be devastating. Even more disturbing is the worst-case scenario projection of the loss of 92% of thermally suitable habitat—bull trout simply won't have anywhere to live.

Rieman's study is based on temperature change. It does not account for changes in stream flow timing and runoff, increased demand for water from new appropriators, or habitat loss and fish mortality from increased wildfire and catastrophic flooding. The combined effects of shrinking patch size and increasing frequency of stream channel disturbance (from increased winter flooding) "could even accelerate the rate of local extinctions beyond that driven by temperature alone."[119]

Bonneville cutthroat will also suffer from climate change. A recent study of climate change and cutthroat trout looked not only at the effects of warmer water, but also attempted to quantify predicted increases in spring

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115. Rieman, *supra* note 18, at 1558–59. Rieman used projected temperature in increases of 0.6, 1.6, and 5.0°C for three model runs, resulting in the range of 18 to 92% of habitat loss, the latter reflecting the 5.0°C increase in temperature, a rise that is at the upper end of many current predictions. *Id.* at 1559.

116. *Id.*

117. *Id.* at 1560.

118. *See* Determination of Threatened Status of Bull Trout in Coterminous United States, 68 Fed. Reg. 58912 (November 1, 1999); *see also* Determination of Threatened Status of Bull Trout for the Klamath River and Columbia River Distinct Population Segments of Bull Trout, 63 Fed. Reg. 31647 (June 10, 1998).

119. Rieman, *supra* note 18, at 1562.

and winter flooding, and more intense wildfire, both of which have strong negative implications for fish. The authors of this study conclude that "[a]lthough Bonneville cutthroat trout include several large, interconnected populations, our analysis suggests they are at a relatively high risk from climate change impacts."[120]

The primary added risk for Bonneville trout from climate change is increased winter flooding, as habitats normally blanketed by snow will warm to increase winter melt and rain on snow events, causing huge floods to which trout cannot adapt. The combination of warmer temperatures, winter flooding, and wildfires resulted in 73% of current habitat being ranked at a high risk from one or more of those factors.[121] Fish in two of four Bonneville trout habitat units "are at high risk of extinction."[122]

While a study of the effects of climate change on fish throughout the West is beyond the scope of this Article, the problems highlighted herein will further compromise fisheries throughout the region. Dr. Peter Moyle at the University of California Davis projects similar problems for many California salmonids.[123]

If the prior appropriation doctrine is ill-suited for today's world, its problems will only intensify as climate change will result in even less water to appropriate. There is a strong consensus that climate change will leave the American West hotter and drier. Earlier runoff and hotter, drier summers (both of which are already occurring) mean that currently dewatered streams will remain that way. More streams will be periodically or chronically dewatered in the future. Earlier runoff means that streams will go dry weeks or months earlier. Irrigators, municipalities, and industry—those with existing water rights—will battle over ever-dwindling supplies. Fish already in danger of extinction from habitat loss will have even fewer places to go. Competition among junior and senior appropriators will intensify, making it even more difficult and expensive to lease water for in-stream flows for fish.

IV. A WAY FORWARD

The tone of this Article is pessimistic, and for good reason. Anthropogenic climate change will affect western weather, which in turn will affect stream flows and water temperature. We don't know the extent of these changes, only that they are highly likely to occur in an accelerated

120. Williams 2009, *supra* note 26, at 539–40.
121. *Id.* at 540.
122. *Id.*
123. MOYLE, *supra* note 9, at 5.

manner over the 21st century. We know that the West will be hotter and drier, snow pack will be diminished, and spring runoff will occur earlier and quicker. We also know (but rarely admit for fear of offending prevailing mores) that the prior appropriation doctrine has been devastating for fish. We know that many salmonids are already threatened with extinction.

However, the most severe human-induced climate changes are decades away, providing an opportunity for adaptive strategies to be implemented. But two hurdles must be overcome. First, the prior appropriation doctrine must be opened to genuine modification. Second, the inevitable effects of climate disruption on water resources must be more than fodder for academic debate and scientific study: they must be understood and appreciated by those with the power and resources in local, state, and federal government agencies to address the problem. If those obstacles can be overcome, then the slow march into the "no analog future" provides opportunities for adaptive management in watersheds where trout have the greatest chance of survival.[124]

Market-based solutions are not the key to saving fish from the double whammy of climate change and prior appropriation. The grip that prior appropriation retains on western water law is so great that states struggle just to pass legislation to allow water to be legally left in a stream.[125] Even where in-stream flow rights are recognized and water leasing programs are sanctioned by the legislature, success is slow. Purchasing water rights is expensive, even assuming willing sellers can be found. Farmers fear any non-use may cause a loss of water rights or a change in priority dates. Moreover, the amount of water actually leased to date specifically for in-stream flows to protect fish appears to be a drop in the bucket.

Water trusts are a much-touted, market-based solution for keeping water in our rivers.[126] While this author supports the hard work being done on the ground by water trusts, the concept has serious limitations that will not solve the underlying problem posed by prior appropriation and government subsidization of agricultural water.

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124. *See id.* at 115 ("There is little reason to be optimistic about long-term trends in the future without major changes in watershed management.").

125. New Mexico has yet to even recognize in-stream uses as beneficial. Wyoming has passed an in-stream law that Trout Unlimited finds nearly unworkable. Utah did not pass in-stream flow legislation until 2008. *See* Instream Flow to Protect Trout Habitat, Ch. 311, 2008 Utah laws 117. Montana finally recognized the right of the State to reserve an in-stream water right for fish in 2002, but only as the result of a Supreme Court decision. *See In re* Adjudication of the Existing Rights to the Use of All the Water, 2002 MT 216, ¶ 40, 311 Mont. 327, ¶ 40, 55 P.3d 396, ¶ 40.

126. For an excellent overview of western water trusts, see Mary Ann King, *Getting Our Feet Wet: An Introduction to Water Trusts*, 28 HARV. ENVTL. L. REV. 495 (2004).

There are several problems with relying on water trusts as a solution to current water problems that will be greatly exacerbated by hydrologic alterations caused by global warming. Unlike land trusts that acquire permanent conservation easements, water trusts most often lease water for a fixed period.[127] Granting a lease for water does not offer the same type of lucrative tax breaks that conservation easements offer. Protecting flows by lease is ephemeral. Water trusts may not actually hold the right to the water; the lease rights obtained by the Oregon and Washington water trusts are held by state agencies, which are subject to the same political pressures that keep prior appropriation and subsidized water programs intact.[128] Bias against in-stream flows remains rooted in Western culture; just getting legislatures to recognize in-stream flow rights is difficult. Though Oregon was the first state to recognize in-stream flows as a legally valid use of water, it was not until 1987 that Oregon allowed water trusts to lease those rights.

The track record for water trusts does not match the magnitude of the problem. One commentator notes that "[i]n 2001, for example, the OWT conserved 93.55 cfs by lease (donated or paid) and only 8.11 cfs by permanent sale or donation."[129] While these efforts are to be lauded, 100 cfs only represents the flow of one small stream. While the FWS pointed to the success of water leasing for in-stream uses as a reason not to protect Bonneville trout under the ESA, the agency could point to only a handful of actual in-stream flow rights that had actually been purchased.[130] In Montana, the same is true: market forces have not moved strongly in the direction of protecting fish.[131] While public agencies (like state fish and game departments) and private organizations (such as water trusts) do work diligently to secure in-stream flows, water leasing alone will not eradicate the dewatering of streams nor will it postpone future tragedy wrought by

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127. *Id.* at 514–15.

128. *Id.* at 515.

129. *Id.* at 514.

130. 12-Month Finding on a Petition To List Bonneville Cutthroat Trout as Threatened or Endangered, 73 Fed. Reg. at 52247. The only statistic that FWS provides to support its conclusion that the existing legal regime for water resources is not a threat to the Bonneville cutthroat is the following: "Wyoming has approved instream flow rights on 17 stream segments encompassing 66 km (41 mi) of BCT [Bonneville cutthroat trout] habitat." *Id.* (citation omitted). No information is provided as to how much water was actually leased in these 41 miles of streams in Wyoming. The 41 miles of streams with leased in-stream water cannot possibly be a significant contributing factor to a species that occupies 2,380 miles of habitat. *See id.* at 72246 tbl.2.

131. Trout Unlimited has been a leader in water leasing for in-stream flows in Montana. While the author congratulates their bold efforts, the results have been limited at best. According to the organization's data from 1995 to 2005, water leases on 20 streams protected a minuscule portion of necessary flows. Remember that in Montana alone there are over 4,000 miles of dewatered streams. TROUT UNLIMITED, PRIVATE WATER LEASING: A MONTANA APPROACH 13 (2005), *available at* http://www.tu.org/atf/cf/%7B0D18ECB7-7347-445B-A38E-65B282BBBD8A%7D/MT_WaterReport.pdf.

climate change. Water leasing will be a proverbial drop in the bucket compared to the amount of in-stream flows that are necessary to save western salmonids.

Water is becoming too valuable of a commodity to expect that market forces will work to protect fish. For example, a comprehensive study on western water leasing found that thirsty cities and developers will pay hundreds of times more than current (admittedly subsidized) rates to purchase water supplies to sustain development.[132] While water leasing based on market rates may help stymie that unconscionable waste of water caused by prior appropriation and government water policies subsidizing irrigated agriculture in the West, it is unlikely that conservation groups can compete with the billion dollar budgets of municipal water agencies when it comes to purchasing water on the open market.[133] While private market-based solutions should remain part of the mix, there is little evidence that such programs, standing alone, can effectively compete with the problems of a legal regime driven by consumptive uses and further stressed by climate change.

The way forward is also not through traditional environmental laws. These laws have been highly successful in protecting fish. Indeed the first ESA blockbuster, *T.V.A. v. Hill*, was a fish protection case, and spurred measures to secure the protection for the snail darter.[134] Throughout the West, ESA-driven court orders have provided substantive protection for fish in the face of recalcitrant bureaucracies and angry farmers.[135]

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132. Brewer et al., *supra* note 55, at 1023–24. The authors of the study demonstrated just how much thirsty cities and developers will pay for water: San Diego offered $258 per acre-foot for water that farmers in the Imperial Irrigation District only paid $15 or $20 for. *Id.* A development near the South Rim of Grand Canyon National Park was prepared to spend $ 20,000 per acre-foot for Colorado River water. *Id.* at 1024.

133. For example, the Southern Nevada Water Authority generates hundreds of millions of dollars in annual revenue. Among its myriad of income sources is a sales tax in Clark County (Las Vegas) that can generate up to $2.3 billion. S. NEV. WATER AUTH., 2008 SNWA ANNUAL REPORT 34 (2008), *available at* http://www.snwa.com/assets/pdf/ar_financial.pdf. By contrast, when the Oregon Water Trust and Oregon Trout merged to form the Freshwater Trust, the combined 2009 budget was $4.5 million. EXLOCO, SEVEN LESSONS FROM THE FIELD: MERGERS AND WESTERN ENVIRONMENTAL ORGANIZATIONS (2009), *available at* http://www.exloco.org/projects/Exloco_Issue_Brief_Mergers.pdf.

134. Tenn. Valley Auth. v. Hill, 437 U.S. 153, 161 (1977). Snail darters remain protected under the ESA. However their population has expanded into three states through re-introduction efforts and continued protection for the few remaining undammed streams in the Southeast. PAM FULLER, NAS – SPECIES FACTSHEET (2004), *available at* http://nas.er.usgs.gov/queries/FactSheet.asp?speciesID=827.

135. *See* Pac. Coast Fed'n of Fisherman's Ass'ns v. Bureau of Reclamation, 426 F.3d 1082, 1090–91 (9th Cir. 2005) (using ESA to hold that a reasonably prudent alternative of 57% of total water needs of threatened species was arbitrary and capricious); Nat'l Wildlife Fed'n v. Nat'l Marine Fisheries Serv., 422 F.2d 782, 793–94 (9th Cir. 2005) (noting that ESA, through Congress, has given endangered species a very high priority).

However, the ESA is not a panacea for the long-term problems posed by an inadequate legal regime on a collision course with a hotter and drier West. The ESA is reviled in many parts of the West.[136] The ESA has been, and remains, a "whipping boy" for western politicians.[137] The law itself seemed headed for extinction in recent years. Representative Pombo, a western politician with ties to water users, led the charge to "reform" the ESA.[138] While unsuccessful, anti-ESA sentiment should be a major concern for those that seek to reform water policy solely through litigation. The ESA backlash is always lurking around the corner of the next court decision.

In addition, a recent Federal Circuit decision found that ESA-driven water allocation for fish constitutes a physical taking of property.[139] Whether the *Casitas* decision comports with established takings jurisprudence is subject to debate. However, the specter of takings litigation when the government acts to protect fish will be a damper on future use of the ESA or other litigation tools to force appropriated water back into streams to benefit fish.

Finally, as Professor Ruhl noted, the ESA is ill-suited to address the complex issues pertaining to climate change.[140] The ESA is a powerful tool to force government and private entities to alter or drop specific projects. It provides a critical safety net to protect trout and salmon.[141] But the ESA alone is not an effective means to address long-term, policy-driven solutions to both reform water law and adapt to climate change.

This author believes that the Public Trust Doctrine is an important legal paradigm well-suited to imbue water management with criteria necessary to protect public values, fish, and aquatic ecosystems. The landmark *Mono*

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136. *See, e.g.*, Tom DeWeese, *The Tyranny of the ESA and the Threat of Kelo 2*, AMERICAN POLICY CENTER: PROPERTY RIGHTS, Sept. 7, 2005, http://www.americanpolicy.org/prop/tyranny.htm ("The Endangered Species Act (ESA) is the worst, most destructive, and most powerful law ever to come out of Congress (with the possible exception of the federal income tax law)."); Montanans for Multiple Use, *Changing the Endangered Species Act*, ESA REFORM, http://www.mtmultipleuse.org/ ENDANGERED/ esareform.htm (last visited Feb. 2, 2010) ("[W]e are . . . stuck with a bloated bureaucracy and distorted legislation that is harmful to America . . . .").

137. *See, e.g.*, James Wynn, *Governor: State Won't Back Down in Wolf Debate*, RIVERTON RANGER, May 28, 2006, *available at* http://govdave.com/new/issues/docs/wolves-riverton.aspx (describing Wyoming Governor Freudenthal's speech at a Wyoming Farm Bureau "wolf seminar").

138. Environmental groups attacked former Representative Pombo's proposed Bill H.R. 3824 because it would delete from the ESA key parts like the requirement for critical habitat. *See* CTR. FOR BIOLOGICAL DIVERSITY ET AL., REPRESENTATIVE RICHARD POMBO'S ANTI-ENDANGERED SPECIES BILL H.R. 3824, *available at* http://www.earthjustice.org/library/references/ TESRA_Factsheet_9-26-05_1.pdf.

139. Casitas Mun. Water Dist. v. United States, 543 F.3d 1276, 1296 (Fed. Cir. 2008).

140. Ruhl, *supra* note 95, at 5.

141. *See* MOYLE, *supra* note 9, at 157, 161 (discussing the ESA's use to rebuild salmon populations).

Lake decision demonstrates that public trust principles are a strong match for vested prior appropriation water rights.[142] However, the doctrine remains a creature of state law and poses considerable problems as a tool for protecting fish resources for two reasons. First, watersheds transcend state boundaries, but the public trust doctrine does not. States adopt different permutations of the public trust, and it is applied unevenly in only a few western states. Second, no state has fully adopted the reasoning in *Mono Lake* to protect aquatic resources. While continued advocacy of public trust principles is vital to recognizing societal interests in common pool resources like water, it is unrealistic to count on state courts to adopt the Public Trust Doctrine on a landscape level to protect fish.

Revamping prior appropriation on a state-by-state basis to give fish their due is a daunting task, with or without public trust principles. The difficulty of enacting fundamental change to western water law is revealed by problems associated with implementing something as simple as recognizing in-stream protection as a beneficial use.[143]

Given the legal and political realities discussed above, a better approach is to utilize the resources of the federal government without bringing along the heavy, often reviled hand of federal regulation and oversight. I propose the creation of a long-term federal fund to make grants available to states and qualified state water trusts to purchase existing water rights for permanent in-stream flow protection. Attributes of the program include:

> (1) No federal ownership of water rights or additional entanglement of the federal government in water management;
> (2) Prioritization of funding based on targeting key watersheds identified by state fish and game departments where trout are most vulnerable to low flows and/or where ESA-listed fish are present;
> (3) A focus on obtaining more senior water rights that will provide water during periods of low flow;
> (4) A preference for obtaining permanent water rights as opposed to leasing water for limited periods;
> (5) A preference for obtaining more senior water rights;
> (6) Federal funding for irrigation infrastructure improvements that conserve water, with savings permanently dedicated to in-stream flows; and

142. Nat'l Audubon Soc'y v. Superior Court, 658 P.2d 709 (1983).

143. *See, e.g.*, Matthew J. McKinney, *Water for Wildlife: Integrating Science and Politics in Wildlife Conservation*, 19 POL'Y STUD. J. 534, 537 (noting that "efforts to formulate instream flow policies in the West have been either sidetracked or significantly delayed because of overwhelming opposition by agriculture and other traditional offstream water users").

> (7) Incremental but substantial funding of the program over a 10 or 20 year period to build up a "Super Fund" for aquatic protection that will provide benefits over a long time horizon.

Australia provides an example of how an irrigation-dependent agricultural system based on prior appropriation is attempting to address environmentally damaging, chronic low flows in the face of climate change.[144] The Australian government is engaged in a major state-federal effort to permanently shore up in-stream flows in the Murray–Darling River system. This river basin suffers the same basic problem as many western U.S. rivers: over-appropriation for consumptive uses leaves little water for riverine ecosystems.[145] Attempted reforms at the state level have been largely procedural, with protection of existing entitlements firmly entrenched.[146] However, the recently passed Federal Water Act establishes sustainable diversion limits.[147] Part of the legislation establishes funding up to $10 billion to modernize irrigation and address over-allocation.[148] Water savings will be committed to protecting in-stream flows. Additionally, direct buy-back of water rights for in-stream flows would help achieve "volumetric environmental entitlements."[149] These buy backs can be compromised when they focus on "low security" flows that are not available in drought or that can be captured by downstream users.[150] Still, the focus on committing water recovered by increased efficiency towards environmental flows is something that can be adapted in the United States. Australia's efforts are driven by problems posed by climate change in an arid land dependent on irrigation—a mirror image of the American West. While a commentator notes problems of over-inflated water savings that evaporate in times of water scarcity,[151] the Australian government's recognition that federal intervention is necessary to counter recalcitrant state government and entrenched water users is an approach that deserves scrutiny. It represents a societal recognition that climate change is going to drastically affect already stressed river systems and that the status quo is doomed to failure.

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144. Anita Foerster, *Progress on Environmental Flows in Southeastern Australia in Light of Climate Change*, 39 ENVTL. L. REP. 10,426, 10,426 (2009).

145. *Id.* at 10,426–27.

146. *Id.* at 10,429.

147. *Id.*

148. *Id.* at 10,430 n.33.

149. *Id.* at 10,431.

150. *Id.* at 10,432.

151. *Id.* at 10,433.

Federal water management legislation mandating in-stream flows for fisheries would be unpopular in the West, to put it mildly. But to leave prior appropriation as a "sacred cow" in light of the future disruptions caused by climate change is irresponsible. The doctrine has already proven nearly worthless in protecting native fish, and it is even less suited for the inevitable warmer and drier future.

The heavy hand of the federal government has already appeared in state water management. ESA-driven court mandates override state water management throughout the West. Witness the Klamath Basin water wars and the serious political conflict result from mandating in-stream flows through court order on an ad hoc basis.[152] ESA listings can only increase as climate disruption leaves more habitat unsuitable and irrigators fight over dwindling water supplies. Does it not make more sense to approach water shortages on a comprehensive watershed-wide basis?

Federal financing of water right purchases for permanent in-stream flow protection is another option that must be considered. A long-term (20 to 30 year) buy-out program based on a watershed approach, with defined goals and objectives, rather than piecemeal attempts under current water leasing and water trust programs, would yield real protection for fish before the worst impacts of warming and drying are felt in the West. Such a program is not without precedent: The joint federal–state California water agency, CALFED, has spent millions of dollars of the public's money to buy water for fish through its Environmental Water Account (EWA). The EWA ironically purchases water at market rates from local water districts that obtain the water at government subsidized rates, thus reaping enormous profits. This is not a model for a long-term solution.[153]

Professor Charles Wilkinson described prior appropriation as one of the "Lords of Yesterday"—19th century resource management schemes ill-suited for the modern West and urged reform for the needs of the 20th century.[154] The realities of climate change drive the need to reform this lord of water management for the 21st century. Bull trout and Bonneville cutthroat trout will not make it without such reform, and neither will the

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152. As one farm-related publication described it, "When farmers, townspeople and the agri-business community slammed down the gauntlet against the federal government, it signaled a new, more highly charged era in the water wars and for the Endangered Species Act." *Klamath Basin Water Wars Changed Engagement Rules*, W. FARM PRESS, Jan. 18, 2003, *available at* http://westernfarm press.com/mag/farming _klamath_basin_water/ (last visited October 19, 2009).

153. For a critical review of CALFED's water purchase program, see ENVIRONMENTAL WORKING GROUP, TAKING FROM THE TAXPAYERS: RESELLING SUBSIDIZED WATER (2005), *available at* http://www.ewg.org/node/19772.

154. CHARLES F. WILKINSON, CROSSING THE NEXT MERIDIAN: LAND, WATER, AND THE FUTURE OF THE WEST 3–27 (1992).

salmon, steelhead, and other trout that are ESA-listed. Until significant reforms in water law doctrine are realized, and funding is available to cure the imbalance in water allocation, native fish species will suffer and the old adage "whiskey is for drinking, water is for fighting" will remain true.

Appendix 1:
Western Salmonids Listed Under the Endangered Species Act

Common Name	Scientific Name	Date Listed	Listing Range	Lead Region	Listing Status
Salmon, Atlantic	*Salmo salar*	11/17/00	Gulf of Maine Atlantic Salmon DPS	Northeast Region	Endangered[155]
Salmon, chinook	*Oncorhynchus tshawytscha*	4/6/90-12/29/99	ID/WA/OR/CA drainages	NMFS	Endangered & Threatened[156]
Salmon, chum	*Oncorhynchus keta*	8/2/99	Columbia R., summer run Hood Canal	NMFS	Threatened[157]
Salmon, coho	*Oncorhynchus kisutch*	11/20/96-6/28/05	OR/CA populations, lower Columbia R.	NMFS	Endangered & Threatened[158]
Salmon, sockeye	*Oncorhynchus nerka*	1/3/92-3/25/99	Snake R., ID; Ozette Lake, WA	NMFS	Endangered & Threatened[159]
Steelhead	*Oncorhynchus mykiss*	6/17/98-9/7/00	ID/WA/OR/CA drainages	NMFS	Endangered & Threatened[160]
Trout, Apache	*Oncorhynchus apache*	3/11/67	Arizona	Southwest Region	Threatened[161]
Trout, bull	*Salvelinus confluentus*	6/10/98	Lower 48 U.S.	Pacific Region	Threatened[162]

155. U.S. Fish and Wildlife Service, Species Profile: Atlantic Salmon, http://ecos.fws.gov/speciesProfile/profile/speciesProfile.action?spcode=E07L (last visited March 3, 2010).

156. U.S. Fish and Wildlife Service, Species Profile: Chinook Salmon, http://ecos.fws.gov/speciesProfile/profile/speciesProfile.action?spcode=E06D (last visited March 3, 2010).

157. U.S. Fish and Wildlife Service, Species Profile: Chum Salmon, http://ecos.fws.gov/speciesProfile/profile/speciesProfile.action?spcode=E09Q (last visited March 3, 2010).

158. U.S. Fish and Wildlife Service, Species Profile: Coho Salmon, http://ecos.fws.gov/speciesProfile/profile/speciesProfile.action?spcode=E08A (last visited March 3, 2010).

159. U.S. Fish and Wildlife Service, Species Profile: Sockeye Salmon, http://ecos.fws.gov/speciesProfile/profile/speciesProfile.action?spcode=E06Y (last visited March 3, 2010).

160. U.S. Fish and Wildlife Service, Species Profile: Steelhead, http://ecos.fws.gov/speciesProfile/profile/speciesProfile.action?spcode=E08D (last visited March 3, 2010).

161. U.S. Fish and Wildlife Service, Species Profile: Apache Trout, http://ecos.fws.gov/speciesProfile/profile/speciesProfile.action?spcode=E00D (last visited March 3, 2010).

162. U.S. Fish and Wildlife Service, Species Profile: Bull Trout, http://ecos.fws.gov/speciesProfile/profile/speciesProfile.action?spcode=E065 (last visited March 3, 2010).

Trout, Gila	*Oncorhynchus gilae*	3/11/67	Arizona, New Mexico	Southwest Region	Threatened[163]
Trout, greenback cutthroat	*Oncorhynchus clarki stomias*	3/11/67	Colorado	Mountain-Prairie Region	Threatened[164]
Trout, Lahontan cutthroat	*Oncorhynchus clarki henshawi*	8/13/70	California, Oregon, Nevada, Utah	California / Nevada Region	Threatened[165]
Trout, Little Kern golden	*Oncorhynchus aguabonita whitei*	3/15/78	California	California / Nevada Region	Threatened[166]
Trout, Paiute cutthroat	*Oncorhynchus clarki seleniris*	3/11/67	California	California / Nevada Region	Threatened[167]

163. U.S. Fish and Wildlife Service, Species Profile: Gila Trout, http://ecos.fws.gov/speciesProfile/profile/speciesProfile.action?spcode=E00E (last visited March 3, 2010).

164. U.S. Fish and Wildlife Service, Species Profile: Greenback Cutthroat Trout, http://ecos.fws.gov/speciesProfile/profile/speciesProfile.action?spcode=E00F (last visited March 3, 2010).

165. U.S. Fish and Wildlife Service, Species Profile: Lahontan Cutthroat Trout, http://ecos.fws.gov/speciesProfile/profile/speciesProfile.action?spcode=E00Y (last visited March 3, 2010).

166. U.S. Fish and Wildlife Service, Species Profile: Little Kern Golden Trout, http://ecos.fws.gov/speciesProfile/profile/speciesProfile.action?spcode=E01Z (last visited March 3, 2010).

167. U.S. Fish and Wildlife Service, Species Profile: Paiute Cutthroat trout, http://ecos.fws.gov/speciesProfile/profile/speciesProfile.action?spcode=E00G (last visited March 3, 2010).