

2008

# Global Climate Change: Water Supply Risks and Water Management Opportunities

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## Recommended Citation

Brian E. Gray, *Global Climate Change: Water Supply Risks and Water Management Opportunities*, 14 *Hastings W.-Nw. J. Envtl. L. & Pol'y* 1453 (2008).

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**Author:** Brian E. Gray  
**Source:** Hastings West–Northwest Journal of Environmental Law & Policy  
**Citation:** 14 Hastings W.–Nw. J. Env'tl. L. & Pol'y 1453 (2008).  
**Title:** *Global Climate Change: Water Supply Risks and Water Management Opportunities*

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## Global Climate Change: Water Supply Risks and Water Management Opportunities

Brian E. Gray\*

In the hierarchy of forces that govern our management and allocation of water resources, water law occupies the fourth position — trailing the natural environment, economics, and geography. Indeed, each of these extralegal forces exerts an independent influence on water rights and water use that dwarfs the law itself.

The hydrologic cycle trumps all other factors — creating short-term water shortages that stress both the economy and the environment and invoke the panoply of laws that govern water allocation and protect *in situ* uses, including water quality and endangered species. In the long-term, hydrologic changes may impel us to reconsider the tenuous compromises we have made to accommodate the competing interests of water supply, population growth and demographic change, protection of existing water rights and reliance interests, and restoration and protection of our rivers and aquatic ecosystems.<sup>1</sup>

Economic forces follow, creating incentives (or disincentives) for conservation, efficient use, changes in demand and type of use, development of new sources of supply, reallocation, and water transfers. The 1991 and 1992 State Water Banks facilitated the short-term transfer of scarce supplies to areas of critical demand during the last drought, and the market will play an even more important role in future droughts.<sup>2</sup> In the

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1. See 1 CALIFORNIA DEPARTMENT OF WATER RESOURCES, CALIFORNIA WATER PLAN UPDATE 2005, CH. 3, 30 (BULLETIN 160-05).

2. See HAROLD O. CARTER, HENRY J. VAUX, JR. & ANN F. SCHEURING, EDs., SHARING SCARCITY: GAINERS AND LOSERS IN WATER MARKETING 230 (Univ. of Cal. 1994); Brian E. Gray, *The Market and the Community: Lessons From California's Drought Water Bank*, 1 HASTINGS W.-NW J. ENVTL. L. & POL'Y 17, 42 (1994).

long-term, the price incentives and opportunity costs presented by the increasing disparity in the value of water between agricultural and municipal uses will induce significant reallocation of developed water supplies within California.<sup>3</sup>

Geography's role is enshrined in the law of riparian and groundwater rights, affording those lands in physical proximity to the waters of the state superior rights.<sup>4</sup> Yet, the influence of geography has an extralegal component as well. Upstream diverters and up-gradient groundwater users have the natural advantage of first access to scarce water supplies, regardless of the strictures of the water rights laws. The ancient property law *caveat* that "possession is nine-tenths of the law" is equally applicable to our water resources system.

I mention this hierarchy of influences — environment, economics, geography, and law — because we are at a moment in our history when these forces have begun to converge in a tangible, and perhaps terrifying, way. Global warming will have profound, and mostly unpleasant, consequences for California's water resources system and for the millions of people, billions of dollars of economic investment and production, and untold numbers of non-human species that are wholly reliant on the state's water supplies and aquatic ecosystems.

In the debate over global warming, those of us who work in the water resources field have one advantage over the scientists and policymakers who must deal with global warming more generally: The debate over the causes of global warming — human production of greenhouse gasses or merely a natural up-cycle in the Earth's temperature — is irrelevant. What we must focus on are the consequences of global warming on California's and the West's water resources.

According to the California Climate Change Center, mean temperatures in California will rise between 3 and 10 degrees Fahrenheit between now and the end of the century.<sup>5</sup> The temperature changes will be most severe in the summer months, causing an increased demand for energy in the cities and suburban areas and an increased demand for water for irrigation of crops and landscaping.<sup>6</sup> Although some models predict a slight increase in average annual precipitation and others predict a 10-percent to 20-percent

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3. See BRENT M. HADDAD, *RIVERS OF GOLD: DESIGNING MARKETS TO ALLOCATE WATER IN CALIFORNIA* xvi (ISLAND PRESS 2000); Brian E. Gray, *The Shape of Transfers to Come: A Model Water Transfer Act for California*, 4 HASTINGS W.-NW. J. ENVTL. L. & POL'Y 23, 45 (1996).

4. See *City of Barstow v. Mojave Water Agency*, 5 P.3d 853, 863 (Cal. 2000); *In re Waters of Long Valley Creek Stream Sys.*, 599 P.2d 656, 660 (Cal. 1979).

5. CALIFORNIA CLIMATE CHANGE CENTER, *OUR CHANGING CLIMATE: ASSESSING RISKS TO CALIFORNIA* 3 (2006), available at <http://www.energy.ca.gov/2006publications/CEC-500-2006-077/CEC-500-2006-077.pdf>.

6. *Id.* at 5.

decrease, in either case the warmer temperatures will cause more of the state's precipitation to fall in the form of rain, and the snowpack of the Sierra Nevada will melt faster and earlier.<sup>7</sup> This means that the precipitation we can capture and use for water supply will diminish over the next decades. Indeed, the average annual snowpack could be reduced by 70 percent to 90 percent; and the Climate Change Center predicts a decline in late spring stream flows of up to 30 percent.<sup>8</sup>

In light of these predictions, the Center's estimate of an aggregate average water supply reduction of 25 percent is surprisingly modest. The authors of the report emphasize that these water shortages would be exacerbated if the predicted one-half to three foot rise in sea levels occurs, however, because even a marginal rise would increase saltwater intrusion into the Delta Estuary during the more extended conditions of low outflow.<sup>9</sup> Increased salinity in the south Delta would put even greater stresses on the state's drinking water supplies, irrigation uses, and the Delta smelt and other species. Higher tides and increased flooding also threaten the Delta levees, breaches of which could render the Delta water supplies interruptible at best and, under a worst case scenario, unsuitable for agricultural and domestic uses for years to come.<sup>10</sup>

In addition, the Colorado River basin — and hence a significant percentage of Southern California's water supply — is likely to suffer similar effects from global warming. As the Intergovernmental Panel on Climate Change concluded in its 2007 report on "Climate Change 2007: Impacts, Adaptation, and Vulnerability:"

Warming, and changes in the form, timing and amount of precipitation, will very likely lead to earlier melting and significant reductions in snowpack in the western mountains by the middle of the 21st century. . . . In projections for mountain snowmelt-dominated watersheds, snowmelt runoff advances, winter and early spring flows increase (raising flooding potential), and summer flows decrease substantially. . . . Over-allocated water systems of the western [United States] . . . that rely on capturing snowmelt runoff, will be especially vulnerable.<sup>11</sup>

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7. *Id.* at 6.

8. *Id.* at 6-7.

9. *Id.* at 7.

10. *Id.* at 12-13.

11. INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE, CLIMATE CHANGE 2007: IMPACTS, ADAPTATION, AND VULNERABILITY, WORKING GROUP II CONTRIBUTION TO THE IPCC 4TH ASSESSMENT REPORT, 627 (2007), available at <http://www.gtp89.dial.pipex.com/14.pdf> (citations omitted) (last visited Oct. 7, 2007).

Indeed, the IPCC confirmed that the diminished water supply reliability would have acute effects for our state: "By the 2020s, 41% of the supply to Southern California is likely to be vulnerable to warming from loss of Sierra Nevada and Colorado River basin snowpack."<sup>12</sup>

In other words, *all* of our most difficult water resources challenges — both of supply and demand — likely will be intensified over the next several decades. We may despair at the prospect of reliving the water wars of the past — seemingly endless political fights and litigation over rights to a dwindling usable resource, exacerbated by the growing demands for water to protect aquatic and terrestrial species threatened by rising water temperatures, increased salinity, and the drying of the land. But we also may look at the changes wrought by global climate change as an opportunity. This is where the second force, economics, comes into play.

Although "doing something" about global warming is now politically and culturally popular, all effective long-term responses will be driven by economic forces. In our field, we may expect increased water conservation in the urban, suburban, and agricultural sectors where demand reduction is less expensive than acquisition of new sources. This will be accompanied by new long- and short-term water transfer agreements to move water from irrigation to municipal and industrial uses, as cities seek reliable water supplies and begin to offer farmers monetary incentives to conserve, fallow, crop-shift, or retire irrigated lands. Moreover, as usable water supplies diminish and the price of water increases, alternatives such as reclamation and reuse of wastewater and desalination will become increasingly cost-effective.

Undoubtedly, we will need to develop additional storage and new facilities. As our largest natural reservoirs — the snowfields of the Siskiyou and Sierra Nevada — diminish over the next decades, projects such as Temperance Flat, an expanded Shasta reservoir, and the Sites Reservoir are likely to be inevitable.<sup>13</sup> In addition, as sea levels rise and variations in outflow increase over time, a radical restructuring of the Delta—both as a source of water supply and as a managed ecosystem — will be imperative. Although these projects are controversial and perhaps unjustified at this moment in time, their marginal benefits will begin to exceed their costs — economic and environmental — as usable water supplies decline and demand reduction and reallocation options play their course.<sup>14</sup>

That said, the political challenges of our multifaceted response to global warming will be immense, and resolution of them will require

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12. *Id.* at 633 (citations omitted).

13. See Nancy Vogel, *In a Dry Time, Plans for Water Projects Flow*, L.A. TIMES, July 17, 2007, at A1.

14. See Samantha Young, *In California, Warming Trend Renews Water Debate*, NORTH COUNTY TIMES (San Diego), Apr. 7, 2007, available at [http://www.nctimes.com/articles/2007/04/08/news/state/16\\_23\\_584\\_7\\_07.txt](http://www.nctimes.com/articles/2007/04/08/news/state/16_23_584_7_07.txt).

flexibility and good will on the part of all of the state's water resources constituencies. Urban water managers and suburbanites must acknowledge that there are limits to growth. Farmers and irrigation district managers need to overcome their aversion to the market. Environmentalists will have to put aside the shibboleth of no new dams and get their heads around the idea that we might just need a peripheral canal. The recent Public Policy Institute/U.C. Davis report on the future of the Delta is a first step along this path.<sup>15</sup>

One essential component of our response to global warming will be greater conjunctive use of ground and surface water supplies. Rising temperatures, reduced snowpack, and increased runoff and flooding will render surface storage — both natural and constructed — less efficient and less significant; groundwater storage and conjunctive management will fill the breach. This is where economics and geography converge. Simply put, the predicted consequences of global warming represent an economic bonanza for a lucky group of landowners in California — those who own land overlying usable groundwater basins — and who have the creativity and foresight to exploit their geographic advantages.

I do not underestimate the challenges presented by this scenario, as recent disputes over groundwater banking and conjunctive use have been among our most contentious. The ill-fated Cadiz project in the Mojave Desert,<sup>16</sup> the Conaway Ranch conjunctive use proposal in Yolo County,<sup>17</sup> and Southern Nevada's efforts to pump groundwater from aquifers in the northern part of the state<sup>18</sup> are illustrative of the political and environmental difficulties. These challenges include localism and Balkanization; threats to surface resources and surface water supplies; protection of water quality from imported water; displacement of native recharge and protection of overlying and appropriative rights; privatization and profiteering; and the specter of Owens Valley.<sup>19</sup> Yet, there are a myriad of successful long-term conjunctive management programs from around the state — the adjudicated basins and groundwater management districts of the south coast,<sup>20</sup> the Santa Clara

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15. JAY LUND, ELLEN HANAK, WILLIAM FLEENOR, RICHARD HOWITT, JEFFERY MOUNT & PETER MOYLE, ENVISIONING FUTURES FOR THE SACRAMENTO-SAN JOAQUIN DELTA (Public Policy Institute 2007).

16. See Dale Kasler, *A Water Plan for South State Evaporates: Environmental and Financial Risks Cited in Mojave Pumping*, SACRAMENTO BEE, Oct. 9, 2002 at A3.

17. Mary Lynne Vellinga & Pamela Martineau, *Yolo Backs Off Seizure, Strikes Conaway Deal*, SACRAMENTO BEE, Sep. 8, 2006 at A1.

18. See Bettina Boxall, *Sin City Covets Thy Aquifers*, L.A. TIMES, Mar. 7, 2007 at A1.

19. See BRENT M. HADDAD, *supra* note 4, at xv-xvii; Tom Philip, *Creation of a Reservoir*, SACRAMENTO BEE, May 17, 2007 at E1.

20. See WILLIAM BLOMQUIST, *DIVIDING THE WATERS: GOVERNING GROUNDWATER IN SOUTHERN CALIFORNIA* (ICS Press 1992).

Valley Water District's conjunctive use program,<sup>21</sup> the Kern County Water Bank,<sup>22</sup> and the Semitropic Groundwater Bank<sup>23</sup> foremost among them — that may serve as models for future groundwater recharge, storage, and conjunctive use arrangements. This, of course, is where the law comes into play.

I do not expect the Legislature to enact a comprehensive state groundwater code, let alone to integrate ground and surface water rights law, anytime soon. Indeed, such legislative actions are probably not necessary responses to the water supply problems caused by global climate change. Rather, I would anticipate legislative action along two lines. First, the Legislature should authorize the creation of regional surface and ground water management agencies with authority to regulate water banking and conjunctive use programs to protect local and regional interests. This authority would include the power to regulate individual pumping; to levy taxes and surcharges to equalize the cost of surface and groundwater and to eliminate economic incentives to overdraft; and authority over importation of surface water, storage, withdrawal, and exportation.

Second, because integrated surface and groundwater storage will be an essential component of California's global warming response, state legislation will be needed to ensure that the diverse local groundwater management plans, county ordinances, water agency policies, and other local regulations are consistent with the statewide interest in achieving the maximum use of our available aquifer storage. I am especially concerned that local legislation may unduly burden the importation of surface water and the exportation of combined surface and groundwater resources. Such a result is likely if local legislation favors parochial interests over the state's broader interest in capturing and storing the increased winter and spring surface runoff for distribution to water-short areas of the state during the longer dry months of the year.

None of this is particularly novel. Numerous precedents exist for each of these water management powers and conjunctive use strategies — including the Orange County Water District Management Act,<sup>24</sup> AB 3030,<sup>25</sup> the California water transfer statutes,<sup>26</sup> the *City of Barstow/Mojave Water Agency*

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21. See SANTA CLARA VALLEY WATER DISTRICT, GROUNDWATER MANAGEMENT PLAN 5 (1961), available at <http://www.valleywater.org/media/pdf/Groundwater%20Management%20Plan.pdf>.

22. See Russel Kletzing, *Imported Groundwater Banking: The Kern Water Bank*, 19 PAC. L.J. 1225 (1988).

23. See SEMITROPIC WATER STORAGE DISTRICT: GROUNDWATER BANKING, <http://www.semitropic.com/GroundwaterBanking.htm> (last visited March 30, 2008).

24. Orange County Water District Act, CAL. WATER CODE App., Ch. 40 (West 2007).

25. Cal. Water Code §§ 10750-10756 (West 2007).

26. See, e.g., *id.* §§ 1700-1745.11; see generally HADDAD, *supra* note 3, at 19-32.



settlement,<sup>27</sup> and many others. Indeed, I believe that our existing water laws are generally adequate to the task ahead.

Nonetheless, I offer one modest proposal to shape our water laws in response to the environmental, economic, and geographic forces that climate change will bring to California. While these extralegal forces prevail in the long run, we live of course (to borrow from John Maynard Keynes) in a shorter time horizon. To address the consequences of global warming, therefore, we must begin to act now — in advance of the decline in average snowfall, the drying of the land, the steepening amplitude of the hydrograph, and the rise in sea levels. And this may require a nudge from our most powerful water law: Article X, section 2 of the California Constitution.<sup>28</sup>

To make full use of our developed water supplies in the face of these changing hydrologic conditions, it will be necessary to have a supervening legal power to put pressure on counties, regional water agencies, and overlying landowners to use their surface and ground water resources — as well as available aquifer storage — for both their private advantage and the broader public welfare. The reasonable use doctrine addresses this subject in two ways. First, it declares that all uses of water must be reasonable — both for the water right holder's own needs and in light of the competing public uses of the resource. Second, the California courts have held that the

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27. *City of Barstow v. Mojave Water Agency*, 5 P.3d 853 (Cal. 2000); see Vince Lovato, *Lawsuit Settled, Water Rationing Plan Preserved: Desert Cities Welcome Decision*, SAN BERNARDINO COUNTY SUN, July 25, 2002.

28. Article X, section 2 provides in relevant part:

It is hereby declared that because of the conditions prevailing in this State the general welfare requires that the water resources of the State be put to beneficial use to the fullest extent of which they are capable, and that the waste or unreasonable use or unreasonable method of use of water be prevented, and that the conservation of such waters is to be exercised with a view to the reasonable and beneficial use thereof in the interest of the people and for the public welfare. The right to water or to the use or flow of water in or from any natural stream or water course in this State is and shall be limited to such water as shall be reasonably required for the beneficial use to be served, and such right does not and shall not extend to the waste or unreasonable use or unreasonable method of use or unreasonable method of diversion of water.

CAL. CONST., art. X, § 2. In its most recent groundwater rights decision, the California Supreme Court declared that Article X, section 2 "dictates the basic principles defining water rights: that no one can have a protectable interest in the unreasonable use of water, and that holders of water rights must use water reasonably and beneficially." *City of Barstow*, 5 P.3d at 864.

definition of reasonable use is dynamic; and a use of water that once was reasonable may *become* unreasonable as economic, social, and environmental conditions change over time.<sup>29</sup> Although Article X, section 2 has been applied sparingly, it has served as the legal foundation of several monumental changes in contemporary California water policy, including the 1984 Imperial Irrigation District-Metropolitan Water District water transfer; resolution of the Mono Lake case; and protection of water quality and endangered species in the Bay-Delta Estuary.<sup>30</sup>

I believe the reasonable use doctrine may play a similarly constructive role in helping us to maximize our conjunctive use of surface and groundwater supplies in the increasingly stressful circumstances presented by global climate change. As the California Supreme Court confirmed in its *Mojave* decision, Article X, section 2 provides firm constitutional support for pumping limitations and other regulation of groundwater rights as required to protect the sustainable use of the aquifer.<sup>31</sup> It is but a minor leap to conclude that Article X also would authorize local groundwater managers to regulate pumping to facilitate the most efficient administration of the aquifer, both for local water supply and to maximize capture and storage of imported surface water to supply export users.

Article X, section 2 also will be used to pressure counties and regional water management agencies to create water banks and other conjunctive use programs, as well as to give permission to private water banking endeavors. The reasonable use doctrine thus may be asserted to challenge local laws that restrict import-export agreements and conjunctive use arrangements in favor of protecting local interests. Indeed, Article X, section 2 will be an indispensable legal tool if the Legislature fails to enact legislation that better accommodates the local and statewide interests at play.

Finally, the reasonable use doctrine may be used to compel recalcitrant property owners to permit the portion of the aquifer beneath their lands to

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29. See *Environmental Defense Fund v. East Bay Municipal Utility District*, 605 P.2d 1, 6 (Cal. 1980):

The scope and technical complexity of issues concerning water resource management are unequalled by virtually any other type of activity presented to the courts. What constitutes reasonable water use is dependent upon not only the entire circumstances presented but varies as the current situation changes. As this court noted in *Joslin v. Marin Mun. Water Dist.* (1967) [429 P.2d 889], "what is a reasonable use of water depends on the circumstances of each case, such an inquiry cannot be resolved *in vacuo* from statewide considerations of transcendent importance."

30. See Brian E. Gray, *The Uncertain Future of Water Rights in California: Reflections on the Governor's Commission Report*, 36 MCGEORGE L. REV. 43 (2005).

31. *City of Barstow*, 5 P.3d at 864.

be included in water banking and conjunctive use projects. Although overlying landowners have property rights to the groundwater *and* aquifer space beneath their lands, Article X, section 2 requires them to use both in a way that is reasonably efficient, taking into account their own uses and competing public demands on the resource.<sup>32</sup> In a warming environment, the value of this storage may exceed the value of the native groundwater itself. We thus may expect economic forces to induce most property owners to put the aquifer capacity of their lands to use — either by participating in a groundwater management arrangement or by selling or leasing rights to use the storage space to a public or private water bank. But where this does not happen, and there is a demonstrable public need for the available aquifer capacity, Article X, section 2 may be employed to put the landowner to a choice: Do the right thing, and profit from your beneficence, or risk losing your rights. For in a world in which the harvesting and storage of our available water supplies are increasing imperatives, non-use is as unreasonable as profligate use.

The challenges presented by global warming — the water management problems alone — may seem insurmountable. Yet, Californians have always looked to the future with an abiding optimism — confident both in our creativity and in our willingness to put in the years (sometimes decades) of hard work required to achieve constructive solutions to our problems. A couple of years ago, I spoke to a group of western judges and supreme court justices whose dockets include a good share of water cases. I concluded my talk with a quotation from Joan Didion about the source of this native optimism. She believes that it is an optimism born out of necessity. In Didion's words:

California is a place in which a boom mentality and a sense of Chekhovian loss meet in uneasy suspension; in which the mind is troubled by some buried but ineradicable suspicion that things had better work here, because here, beneath that immense bleached sky, is where we run out of continent.<sup>33</sup>

Far above, that immense bleached sky is clouding. We will need to redouble our optimism, creativity, and commitment to see through to the light.

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32. See *Niles Sand and Gravel Co. v. Alameda County Water Dist.*, 112 Cal. Rptr. 846, 853 (1974).

33. JOAN DIDION, *Notes From a Native Daughter*, in *SLOUCHING TOWARDS BETHLEHEM* 172 (FSG 1968).

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