

WESTERN WATER ASSESSMENT REPORT

**Climate Change and the Functioning of Water
Rights: A Search of the Literature**

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**CLIMATE CHANGE AND THE FUNCTIONING OF WATER RIGHTS:
A SEARCH OF THE LITERATURE**

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This memo presents the results of a literature search conducted in May-June 2007 as a preliminary step toward the study of how climate change-induced variations in the hydrograph (i.e. earlier snowmelt and peak flows) may impact the temporal elements of water rights. This memo does not review the large body of scientific literature that documents and forecasts the onset of earlier snowmelt and reduced snowpacks in the western United States. Rather, the focus here is upon the relatively smaller body of policy, law, and management papers that link the science of climate change with issues of water rights in this region.

The literature search was conducted using a variety of online databases including Westlaw, Lexis Nexis, LegalTrak, SSRN (Social Science Research Network), JSTOR, and Google Scholar. The search also included a journal-by-journal review of all online journals accessible through the University of Colorado library system that contain the words “water” or “climate” in their titles. Search terms included “climate,” “climate change,” “global warming,” “snow,” “snowmelt,” “early snowmelt,” “runoff,” “early runoff,” “water,” “water rights,” “water law,” and combinations of these terms. Papers were also identified through personal references as well as references from academic papers. Finally, the search included a Lexis Nexis search of major western U.S. newspapers for recent articles (2002 to present) that focused upon relationships between early snowmelt and water resources.

The literature search produced no papers that expressly address the issue of the timing of snowmelt/runoff and the timing of water rights. However, several papers touch upon the broader relationships between climate change, water resources, and policy/law/social sciences in the western United States. These papers include law review and other journal articles, book chapters, conference and symposium proceedings, reports and assessments from government agencies and NGOs, and newspaper articles.

Other researchers have also noted the lack of research considering the nexus of snowmelt timing and the operation of water rights. For example, in a survey of academic literature on climate change and California water resources, Kiparsky and Gleick (2003) note, “Few analyses have tried to evaluate how climate change impacts may affect, and be affected by, water laws and regulatory structures.” In a similar, more recent literature review of climate change impacts on California’s water, Dracup and Vicuna (2007) note that most studies are hydrological: “the authors believe that there has been a dearth of studies on the impact associated with changes in reliability (and therefore economic costs) among different water users (with different water rights and water sources) in the California system.” Typical of this trend is a study by Brekke et al (2004) that models the impacts of climate change and hydrologic change on reservoir storage levels in the San Joaquin River Basin, but does not expand upon management alternatives or issues of rights.

In a rare example of a non-hydrological empirical study, Baldwin et al (2000) surveyed western water managers to identify the degree of concern over potential impacts of climate change on water management. They found that “systematic changes in timing of runoff could have the most significant impact” of any climate change-induced water management issue. Furthermore, one survey respondent from Nevada noted that “water right holders would likely have difficulty obtaining their decreed water rights,” and that these rights assume a consistent period of runoff.

A variety of papers and reports connect scientific trends with suggestions for management strategies, but few emphasize issues in water law and water rights. Much of the

literature (i.e. Riebsame, 1988; Stakhiv, 1998; Frederick and Gleick, 1999; Gleick, 2000; Hancock, 2004; D'Antonio, 2006; and WGA, 2006) emphasizes management options including water markets and transfers, “no regrets policies of water efficiency,” adaptive management, demand management, sustainable development, reoperation of infrastructure, and development of new infrastructure. In some instances (e.g., Miller, 1997; Gleick, 2000; USBR, 2005; D'Antonio, 2006; and WGA, 2006), papers and reports assert the need for institutional reform, the clarification of rights, and the removal of legal barriers, but do not elaborate on these concepts.

Several recent papers address climate change and water law, but do not necessarily focus on issues of prior appropriation and water rights. Osofsky (2007) explores supranational institutions and their role in arbitrating conflicts over melting snow and ice in regions such as California’s Sierra Nevada Range. Salzman and Hunter (2007) examine the role of duty and care (tort law) in climate change cases, including in *California v. General Motors*, in which California argues that greenhouse gas emissions have caused reduction in the Sierra Nevada snowpack and changes in water availability. Zinn (2007) discusses the adaptability of environmental law to climate change; a brief section of the paper discusses hydrology in the West but, overall, the paper emphasizes environmental regulations and impacts.

Most relevant to the purposes of the proposed study are those papers that meaningfully engage with questions of climate change and water rights, often focused on the limits/constraints associated with prior appropriation. However, as noted above, none of these papers specifically address issues of timing of water rights. Trelease (1977) provides an in-depth analysis of how prior appropriation rights may be adaptable to climate change-induced drought. The analysis does not consider changes in the timing of snowmelt and streamflow, but is applicable in its thoughtful approach to the functioning of water rights in general under climate change scenarios. Tarlock (1991) explores the adaptability to climate change of prior appropriation and USBR regulations, arguing (in Tarlock, 2000) that property rights in western water law provide a good model for international adaptation to climate change, an argument that runs counter to much of Dellapenna’s (1999) analysis calling for the treatment of water as a public resource. Miller et al (1997) discuss capacity for institutional adaptation of the prior appropriation and riparian systems and highlight the need for clarification of consumptive versus nonconsumptive rights and the limits upon these rights. Carter and Morehouse (2001) examine the legal and policy frameworks of water management in Arizona and discuss problems of inflexibility within the state’s prior appropriation system. Getches (2003) discusses the constraints of water law and policy on water management under conditions of climate change. Slaughter and Wiener (2007) explore the adaptability of prior appropriation rights in the Pacific Northwest. They discuss the changes in the hydrograph, but their focus is upon how property rights influence the ability to resolve water shortage conflicts.

The newspaper article search produced many articles that link climate change with melting snowpacks, but only a handful that link these trends with water management issues. Articles reviewed (listed in the bibliography) discuss issues of early snowmelt, late winter flooding, decreased summer water availability, reservoir management, proposals for new reservoirs, rural-to-urban water reallocation, and water conflicts. An article from *The Oregonian* (“Report: Global warming costs coming soon,” 13 Jan 2007) quotes a Washington official as noting that “Disputes over water rights and other water issues already are highly controversial, and it’s not going to get any better if you have smaller snowpacks and warmer summer temperatures.” No articles explicitly addressed in detail water rights issues associated with climate change.

In summary, this literature search produced no papers that directly analyze relationships between temporally-delineated water rights and temporal shifts in the hydrograph. Compared to the body of literature addressing climate science and hydrologic modeling, the body of literature addressing climate change implications for water management, policy, and law in general is relatively small. The literature that does exist tends to emphasize adaptation and institutional reform. Papers that emphasize water rights do not examine temporal issues. Thus, further research and analysis is needed to identify and address issues related to temporal water rights and climate change.

Bibliography / Literature Reviewed

Baldwin, C.K., Lall, U., Wagner, F.H. 2000. Climate change impacts on water-resource operations in the Rocky Mountain/ Great Basin region. In *Watershed Management and Operation Management 2000*. Proceedings from a conference held June 20-24, 2000 in Fort Collins, CO. American Society of Engineers, ed. Flug, M., Frevert, D., and Watkins, D.W. Jr.

Brekke, L.D., Miller, N.M., Bashford, K.E., Quinn, N.W.T., Dracup, J.A. 2004. Climate change impacts uncertainty for water resources in the San Joaquin River Basin, California. *Journal of the American Water Resources Association* 40, 149-164.

Carter, R. and Morehouse, B. 2001. An examination of Arizona water law and policy from the perspective of climate impacts. University of Arizona: The Climate Assessment Project for the Southwest (CLIMAS).

D'Antonio, J.R. 2006. The impact of climate change on New Mexico's water supply and ability to manage water resources. Report by the New Mexico Office of the State Engineer/Interstate Stream Commission.

Deason, J.P., Schad, T.M., and Sherk, G.W. 2001. Water policy in the United States: a perspective. *Water Policy* 3:175-192.

Dellapenna, J.W. 1999. Adapting the law of water management to global climate change and other hydropolitical stresses. *The Journal of the American Water Resources Association*. 35(6): 1301-1326.

Dinar, A., Rosegrant, M.W., and Meinzen-Dick, R. 1997. Water allocation mechanisms – principles and examples. World Bank: Policy Research Working Paper 1779. Washington, D.C.

Dracup, J.A. and Vicuna, S. 2007. The evolution of climate change impact studies on hydrology and water resources in California. *Climatic Change* 82:327-350.

Frederick, K.D. and Gleick, P.H. 1999. Water and global climate change: potential impacts on U.S. water resources. Report prepared for the Pew Center on Global Climate Change.

Getches, D.H. 2003. Constraints of law and policy on the management of Western water. In *Water and Climate in the Western United States*. W.M. Lewis, Jr, ed. Boulder: University Press of Colorado, 2003: 183-234.

Gleick, P.H. 2000. Water: The potential consequences of climate variability and change for the water resources of the United States: the report of the Water Sector Assessment Team of the National Assessment of the Potential Consequences of Climate Variability and Change. Pacific Institute, with support from US Department of Interior, US Geological Survey.

Hancock, K., Chung, C., and Mills, W. Climate change and its effects on California resources. World Water Congress 2004.

- Hobbs, G. 2003. The role of climate in shaping Western water institutions. Speech delivered at Water, Climate, and Uncertainty: Implications for Western Water Law, Policy, and Management. Natural Resources Law Center, University of Colorado, 11 Jun 2003.
- Kiparsky, M. and Gleick, P. 2003. Climate change and California water resources: a survey and summary of the literature. Oakland: The Pacific Institute.
- Miller, K.A. 1997. Climate variability, climate change, and Western water. Report to the Western Water Policy Review Advisory Commission.
- Miller, K.A., Rhodes, S.L., and Macdonnell, L.J. 1997. Water allocation in a changing climate: institutions and adaptations. *Climatic Change* 35:157-177.
- Osofsky, Hari M. 2007. A right to frozen water? The institutional spaces for supranational climate change petitions. In *Progress in international institutions: confronting the 21st century*. Rebecca Bratspies, Russell Miller, eds, Martinus Nijhoff, 2007.
- Riebsame, W.E. 1988. Adjusting Water Resources Management to Climate Change. *Climatic Change*, 13(1), 69-97.
- Salzman, James E. and Hunter, David B. 2007. Negligence in the Air: The Duty of Care in Climate Change Litigation. *University of Pennsylvania Law Review* 155: 101.
- Schlenker, W., Hanemann, W.M., and Fisher, A.C. 2005. Water availability, degree days, and the potential impact of climate change on irrigated agriculture in California. *Climatic Change* 81(1):19-38.
- Slaughter, R.A. and Wiener, J.D. 2007. Water, adaptation, and property rights on the Snake and Klamath Rivers. *Journal of the American Water Resources Association*. 43(2): 308-321.
- Smeardon, E.T. 1992. Impact of global change on water resources. *Arizona Journal of International and Comparative Law*. 9(1):155-168.
- Stakhiv, E.Z. 1998. Policy implication of climate change impacts on water resources management. *Water Policy* 1: 159-175.
- Tarlock, A.D. 1991. Western water law, global climate change, and risk allocation. *Managing Water Resources in the West under Conditions of Climate Uncertainty*. Proceedings of a colloquium held 14-16 November 1990 at Scottsdale, Arizona. National Academy Press, Washington, DC. p 239-254.
- Tarlock, A.D. 1991. Western water law, global warming, and growth limitations. *Loyola of Los Angeles Law Review* 24: 979.
- Tarlock, A.D. 2000. How well can international water allocation regimes adapt to global climate change? *Journal of Land Use and Environmental Law* 15: 423.

Teclaf, L.A. 1991. The river basin concept and global climate change. *Pace Environmental Law Review* 8(2): 355-388.

Trelease, F.J. 1977. Climatic change and water law. In *Climate, Climatic Change, and Water Supply*. Washington, D.C.: National Academy of Sciences, 1977: 70-84.

U.S. Department of the Interior. Bureau of Reclamation, August 2005. WATER 2025.

VanRheenen, N.T., Palmer, R.N., Hamlet, A.F., and Lettenmaier, D.P. 2003. Climate change, fish, agriculture, and power: impacts and implications for future Snake River water resources management. *Proceedings from World Water Congress 2003*.

Western Governors' Association (WGA). 2006. *Water needs and strategies for a sustainable future*.

Zinn, M.D. 2007. Adapting to climate change: environmental law in a warmer world. *Ecology Law Quarterly* 34(1): 61-105.