2016

Water Law Reform in the Face of Climate Change: Learning from Drought in Australia and the Western United States

Barbara Cosens
University of Idaho College of Law, bcosens@uidaho.edu

This article was first published by Thomson Reuters in the Environmental & Planning Law Journal & should be cited as Barbara Cosens, Water Law Reform in the Face of Climate Change: Learning from Drought in Australia and the Western United States, 2016, 33 Envt'l & Plan. L.J. 373. For all subscription inquires, please phone, from Australia: 1300 304 195, from overseas: +61 2 8587 7980 or online at http:legal.thomsonreuters.com.au/search. The official PDF version of this article can also be separately from Thomson Reuters at http://sites.thomsonreuters.com/au/journals/subscribe-or-purchase.

Water law reform in the face of climate change: Learning from drought in Australia and the western United States

Barbara Cosens*

Western societies have developed three approaches to governance of common pool resources such as water: (1) the division of the resource into private property; (2) government regulation; and (3) local self-organisation. This article asserts that all three are needed in varying combinations to rise to the challenge presented by the impact of climate change on water supply and demand. Drought presents a preview of potential future climate scenarios and Australia and the western United States are both responding to its harshness through innovation in water governance. These experiments present an opportunity to compare the approaches of Australia and the western United States to begin to understand the combination of governance approaches that lead to greater adaptive capacity.

INTRODUCTION

A common pool resource is a "resource system that is sufficiently large as to make it costly (but not impossible) to exclude potential beneficiaries from obtaining benefits from its use".[1] Water is a classic common pool resource. In his paper on the inevitable tragedy of human exploitation of common pool resources, Garrett Hardin identified two mechanisms to avoid over-exploitation of a common pool resource: government regulation, and private property rights to the resource.[2] While the division of a common pool resource into private property may have advantages in more directly connecting benefits and costs and allowing adaptation through the development of markets, property use may also have costs that spill over onto neighbouring property (ie externalities). In application to water resources, the fact that water flows means that external consequences of use are the rule rather than the exception. Thus privatisation of the resource alone is a problematic approach to sustainable water governance.[3] In contrast, government regulation as the sole means of governance of a resource with the size and complexity of a water basin would require perfect knowledge and enforcement to be adaptable in the face of change – an unlikely and costly scenario.

Nobel laureate Elinor Ostrom added a third possibility by documenting the self-organisation of local interests to maintain the sustainability of a resource they rely on.[4] Self-organisation, as the third prong of management of common pool resources, may have advantages in being more adaptive than

* Professor, University of Idaho College of Law. The author would like to thank the Goyder Institute for Water Research in South Australia and the Flinders University Visiting Professor in Public Sector Policy and Management Program for the opportunity to participate in the program. That opportunity provided the seed for understanding the response of arid region governments to drought. She would also like to thank the National Socio-Environmental Synthesis Center (SESYNC) under funding from the National Science Foundation DBI-1052875, for their continued support of the Adaptive Water Governance Project. The project provided the foundation for understanding the role of law in adaptive capacity that this work is built on.

[1] E Ostrom, *Governing the Commons: The Evolution of Institutions for Collective Action* (Cambridge University Press, 1990) 30.

[2] G Hardin, "The Tragedy of the Commons" (1968) 162 *Science* 1243.

[3] Ostrom, n 1.

[4] Ostrom, n 1; E Ostrom, "A General Framework for Analyzing Sustainability of Social-Ecological Systems" (2009) 325 *Science* 419.

government regulation while providing a collective means to address the system effects of private property and of market failure. Nevertheless, self-organisation alone may have problems with local capacity and corruption.[5]

Consider as a beginning assumption that the most adaptable legal framework for water governance might include a mix of all three approaches (Figure 1) by providing authority for:

1. clearly defined, marketable, water use rights (the private property prong);
2. government adjustment of water allocation as circumstances change or new information becomes available, and government oversight of markets and facilitation of planning (the government regulation prong); and
3. adaptive water planning through local participatory processes, with capacity built through governmental assistance (the self-organisation prong).

This article asserts that the water laws that provide the highest level of adaptive capacity in the face of change will facilitate aspects of all three with the authority to emphasise one over the other depending on the circumstances.

Climate change is arguably the biggest challenge to equitable and sustainable governance of water resources in our time. The combination of change in supply from historic average, change in timing due to alteration in snowpack and increase in demand corresponding to the response of vegetation to higher temperatures[6] alone would challenge governance approaches adopted under the assumption of stationarity.[7] But the likelihood that the increase in energy in the atmosphere that is precipitating these changes will also result in greater extremes, including flood and drought beyond the historic record,[8] requires a degree of flexibility and adaptability in governance that has yet to be attempted. If these changes were to unfold slowly, society might fail to act. Fortunately (although few would use that word to describe this), with increased variability comes the crisis that will lead to experimentation.[9] The responses to the prolonged Millennium Drought in Australia and the five-year (?)[10] drought in California and parts of the Inland Northwest of the United States are just such experiments. Comparison of the approaches to water law reform in Australia and the western United States in response to extended drought and other causes of scarcity offers a window on the way in which governments are balancing the three approaches to governing the water commons, and a means to improve that balance going forward.

This article begins with a general discussion of how the three approaches to governing the commons manifest in water law. This background sets the stage to explore specific aspects of water law reform in Australia and the western United States in the face of drought, and will separate out as a special case the treatment of over-reliance on groundwater during prolonged scarcity in surface water resources. The article will conclude with a discussion of whether these measures place their societies in a better position to respond to change and increase in variability, and what the western United States and Australia might learn from each other.

---

[5] Ostrom, n 4.

[6] BE Jiménez et al, "Freshwater Resources" in CB Field et al (eds), *Climate Change 2014: Impacts, Adaptation, and Vulnerability. Part A: Global and Sectoral Aspects. Contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change* (Cambridge University Press, 2014) 229.

[7] Robin Kundis Craig, "'Stationarity Is Dead': Long Live Transformation: Five Principles for Climate Change Adaptation Law" (2010) 34 *Harvard Environmental Law Review* 9.

[8] Field et al, n 6.

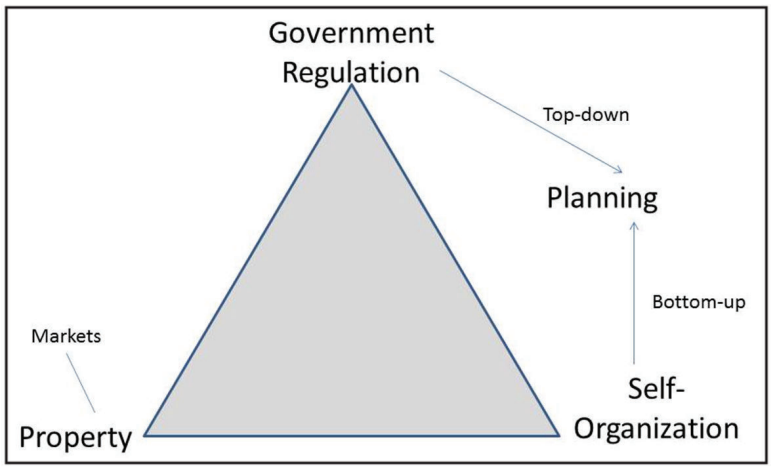
[9] Also referred to as a "window of opportunity" for transformation. P Olsson et al, "Shooting the Rapids: Navigating Transitions to Adaptive Governance of Social-ecological Systems" (2006) 11(1) *Ecology and Society* 18 <http://www.ecologyandsociety.org/vol11/iss1/art18>, citing the work of JW Kingdon, *Agendas, Alternatives, and Public Policies* (Harper Collins, 1995). The authors describe a window of opportunity as a "critical moment in time between the two phases … [characterised by a moment when] three independently operating 'streams', ie, problems, solutions, and politics, come together at critical times": at 4 and 8.

[10] In May of 2016 the California State Water Resources Control Board relaxed some restrictions on urban water use, but with a disappointing El Nino and some State reservoirs only partially full, the State has not lifted the drought declaration.

GOVERNING THE WATER COMMONS

While the three approaches to governance of the commons – marketable private property; government regulation; and local self-organisation – are generally advocated as requiring a choice of one over the others, it is entirely possible for all three to exist in concert, providing an expanded toolbox for the water manager. Before discussing the combination of approaches chosen by Australia and the western United States for water law reform during extended drought and why flexibility to move among them is needed to navigate the drought-flood-sustainability challenge to come, it is necessary to understand the strengths and weaknesses of each approach.

FIGURE 1 Governing common pool resources



Marketable property rights

Property rights as a means to regulate common pool resources are thought to provide incentive for stewardship and reduce the likelihood of over-exploitation by directly linking benefits and burdens.[11] Enforcement and compliance with use allocation is enhanced by clearly defined rights.[12] If alienable separate from the land or thing the rights are used on, adaptation may be rapid.[13] Thus, the severance of water rights from the land, and implementation of water markets with low transaction costs, advances adaptive capacity. Property rights nevertheless have increasing issues with externalities when applied to a fugitive resource like water.[14] Thus both use and transferability require an overlay of regulation.[15]

Government regulation

Restrictions in use of common pool resources have the advantage over property of the ability to plan and adjust allocation prospectively. The prospective approach informs investment and allows a systemic approach to consideration of the secondary impacts of management actions. The inability to contextualise regulation, a problem of both resources and restraints on agencies intended to assure uniform implementation of environmental laws, has led to dissatisfaction with the command and

[11] Hardin, n 2.

[12] Ostrom, n 1.

[13] Coined the "invisible hand" of the market by Adam Smith, *An Inquiry into the Nature and Causes of the Wealth of Nations* (Methuen & Co Ltd, 5th ed, 1904).

[14] Ostrom, n 1.

[15] Joseph W Dellapenna, "The Importance of getting Names Right: The Myth of Markets for Water" (2000) 25 *William and Mary Environmental Law and Policy Review* 317.

control approach to environmental regulation in the United States.[16] Perfect knowledge is essential to perfect implementation of a regulatory approach. Regulation of a resource the size and complexity of a water basin will encounter substantial difficulty without major expenditures in monitoring, forecasting, and enforcement. Even with substantial resources, the uncertainty associated with climate change makes this degree of predictability unlikely. Thus, government regulation without local capacity to act and individual capacity to transfer water is unlikely to meet needs with a changing supply.

Self-organisation

Self-organisation is described in the observation of many collaborative governance processes variously referred to as new governance, collaborative governance/co-management and adaptive governance, and is thought to be an emergent (ie self-organising) phenomenon.[17] These approaches enhance the use of local knowledge and the legitimacy of restrictions. Recent studies have shown that law may facilitate the emergence of these processes as well as hinder them.[18] Collaborative processes are not timely in the face of crisis such as flood, unless used prospectively to develop scenarios for emergency response. Collaborative processes lacking external pressure, such as the threat of government regulation or the failure of the market, may also encounter difficulty in making tradeoffs in times of scarcity, and they are thought to have a higher risk of corruption.[19] Local collaboration for management of a resource as complex as a water basin facing climate change requires substantial capacity building, and may require access to external governmental resources.[20] Planning, particularly if locally driven, may enhance adaptive capacity by being itself adaptive. According to Professor Craig Anthony Arnold:

> Adaptive planning is an iterative and evolving process of identifying goals and making decisions for further action that are flexible, contemplate uncertainty and multiple possible scenarios, include feedback loops for frequent modification to plans and their implementation, and build planning and management capacity to adapt to change.[21]

In reality, it is the availability of all three approaches used to varying degrees to address the fluctuation in the supply of water that will provide the greatest adaptive capacity. In crisis situations (eg flood), governmental intervention and strong control may be essential, but must also rely on strong local capacity for initial response and recovery. The use of government regulation and planning, in concert with local self-organisation, provides, on the one hand, local buy-in (thus reduced resources needed for enforcement and enhanced legitimacy), and use of local knowledge allowing tailoring; and, on the other hand, a check on local corruption. The timeframe of extended drought represents an intermediate point between a slowly changing climate and the immediate crisis of a flood. It is the assertion of this article that all three approaches are needed during drought and that their development in that context will build capacity to respond to the more long-term effects of climate change.

[16] For a concise summary of the criticisms of command and control environmental regulation in the United States, see, Eric W Orts, "Reflexive Environmental Law" (1995) 89 Nw UL Rev 1227.

[17] T Dietz, E Ostrom and PC Stern, "The Struggle to Govern the Commons" (2003) 302 *Science* 1907. <http://dx.doi.org/10.1126/science.1091015>; RD Brunner et al, *Adaptive Governance: Integrating Science, Policy, and Decision Making* (Columbia University Press, 2005); C Folke, T Hahn, P Olsson and J Norberg, "Adaptive Governance of Social-ecological Systems" (2005) 30 *Annual Review of Environmental Resources* 441 <http://dx.doi.org/10.1146/annurev.energy.30.050504.144511>; LH Gunderson and SS Light, "Adaptive Management and Adaptive Governance in the Everglades Ecosystem" (2006) 39 *Policy Sciences* 323 <http://dx.doi.org/10.1007/s11077-006-9027-2>; see generally, BC Chaffin, H Gosnell and B Cosens, "A Decade of Adaptive Governance Scholarship: Synthesis and Future Directions" (2014) 19(3) *Ecology and Society* 56 <http://dx.doi.org/10.5751/ES-06824-190356>.

[18] B Cosens, G Gunderson and B Chaffin (eds), *Accepted Special Issue in Ecology and Society on Practical Panarchy: Assessing Legal Flexibility, Ecological Resilience and Adaptive Governance in Regional Water Systems Experiencing Climate Change* (2016) articles in preparation.

[19] Ostrom, n 4.

[20] Cosens, Gunderson and Chaffin, n 18.

[21] Craig Anthony (Tony) Arnold, "Adaptive Watershed Planning and Climate Change" (2010) 5 *Environmental and Energy Law and Policy Journal* 417, 440.

WATER LAW REFORM IN AUSTRALIA AND THE WESTERN UNITED STATES

The water laws of both the United States and Australia have their roots in the common law of England which recognised the right to use water as an incident of riparian land ownership.[22] Both Australia and the western United States altered their approach to account for the arid nature of the landscape and the corresponding fact that the desired use may not be riparian to any water source.[23] Interestingly, Australia and the western United States share one of the leading figures in the early 20th century development of water laws that would be distinct from those of England – Elwood Mead. Mead is known in the western United States as the architect of Wyoming's administrative system for allocation of water under the doctrine of prior appropriation, which protects those who invested in the development of water first in times of scarcity,[24] and as the Commissioner of the US Bureau of Reclamation from 1924-1936, a period in which many of the largest federal dams were built on western rivers.[25] But Mead also served as chair of the State Rivers and Water Supply Commission of the Australian State of Victoria from 1907-1915, during which time he oversaw implementation of the *Water Act 1905* (Vic) and amendments in 1909, in which government control over the issuance of licences was adopted, and prior appropriation was not.[26]

Global climate change is likely to result in future droughts of similar severity to Australia's Millennium Drought,[27] and California's drought that began in 2011.[28] A shared understanding of how both regions have responded to this challenge provides an opportunity for both to learn. In keeping with the chronological order of the Millennium and California droughts, the following paragraphs will describe the selected aspects of water law reform related to the three approaches to governance of common pool resources, first in Australia and then in the United States, concluding with a separate section on groundwater.

The Millennium Drought and water reform in Australia

Rights to the use of water are a matter of State law in Australia and, despite the origin in English common law, all Australian States and Territories have adopted statutory schemes for the management and allocation of water.[29] As an example of State water allocation prior to the water reform during the Millennium Drought, South Australia's initial statutory scheme, reflected in the *Water Resources Act 1990* (SA), allocated water under licences to landowners and shortage was shared. A government-

[22] *Gartner v Kidman* (1962) 108 CLR 12; *Tyler v Wilkinson* 24 Fed Cas 472 (Cir Ct DRI, 1827).

[23] *Gartner v Kidman* (1962) 108 CLR 12, 23; Sarah Avey and Darryl Harvey, "How Water Scientists and Lawyers can Work Together: A 'Down Under' Solution to a Water Resource Management Problem" (2014) 24 *Journal of Water Law* 45.

[24] Anne MacKinnon, "Order Out of Chaos: Elwood Mead and Wyoming's Water Law", *WyoHistory.org* <http://www.wyohistory.org/essays/order-out-chaos-elwood-mead-and-wyoming%E2%80%99s-water-law>.

[25] US Bureau of Reclamation, "Elwood Mead, Commissioner, Bureau of Reclamation, 1924-1936", *Reclamation History* <http://www.usbr.gov/history/CommissBios/mead.html>.

[26] Ryan S Bezerra, "No Magic Wands: Lessons for California from Australia's Water Law Changes" (2011) 14(1) *ABA Water Resources Committee Newsletter* 22; JM Powell, *Elwood Mead (1858-1936)* (Australian Dictionary of Biography, MUP, 1986) Vol 10 <http://adb.anu.edu.au/biography/mead-elwood-7543>. (The *Water Act 1905* (Vic) did not adopt the doctrine of prior appropriation which allocates water in order of seniority of water development during drought. Then, as today, Australian States followed the approach of shared shortage present in the British common law.)

[27] The Millennium Drought lasted from 1997-2009, and was the longest drought on record in south-east Australia. AIJM Van Dijk et al, "The Millennium Drought in Southeast Australia (2001-2009): Natural and Human Causes and Implications for Water Resources, Ecosystems, Economy, and Society" (2013) 49(2) *Water Resources Research* 1040 <http://onlinelibrary.wiley.com/doi/10.1002/wrcr.20123/full>.

[28] AP Williams et al, "Contribution of Anthropogenic Warming to California Drought during 2012-2014" (2013) 42(16) *Geophysical Research Letters* 6819 <http://onlinelibrary.wiley.com/doi/10.1002/2015GL064924/full>.

[29] K Stoeckel, R Webb, L Woodward and A Hankinson, *Australian Water Law* (Thomson Reuters, 2012) 2. The *Australian Constitution* s 51 listing the powers of the Commonwealth, omits water resources and s 100 specifically states that "[t]he Commonwealth shall not, by any law or regulation of trade or commerce, abridge the right of a State or of the residents therein to the reasonable use of the waters of rivers for conservation or irrigation".

issued licence is an interest for a specific use that may be cancelled by the government, thus the State was viewed as the owner of the water itself.[30] The water licence attached to the land and the licence expired on transfer of the land.[31]

As the Millennium Drought unfolded, the Commonwealth began to play an increasing role in water through its power over interstate commerce[32] and spending.[33] In addition, the Council of Australian Governments, with membership including the Prime Minister, State and Territory Premiers and Chief Ministers, and the President of the Australian Local Government Association,[34] developed the *Intergovernmental Agreement on a National Water Initiative* (NWI) in 2004, with the governments of New South Wales, Victoria, South Australia, Queensland, the Northern Territory, and the Australian Capital Territory signing in 2004, Tasmania signing in 2005, and Western Australia signing in 2006.[35]

The NWI recognises water management as a national issue,[36] while leaving implementation to the States and Territories.[37] The NWI calls for planning to identify a consumptive pool and a non-consumptive level of environmental flows,[38] and an accounting of the consumptive use portion of individual water entitlements to assure they remain within that consumptive pool.[39]

Using South Australian law as an example of implementation, South Australia defines a water entitlement as the right to a share of the "consumptive pool" designated in the plan for a particular water source, and a water allocation is the amount available for that share in a given year.[40] Shortage is generally shared among water entitlements in South Australia;[41] nevertheless, on some systems certain water rights are classified with higher rank and assigned less risk of shortage in dry years.[42] The Minister of the Department of Environment, Water and Natural Resources may vary the licence (ie the entitlement) at any time, consistent with the water plan for the source.[43]

In addition to separating environmental flows from the water available for consumptive use, the NWI sought to remove barriers to water trading.[44] Essential to facilitation of water transfers is the clear definition of the water right and the public availability of that information. The NWI calls for a registration of all water entitlements and trades,[45] development of uniform pricing, and for States and Territories to reduce transaction costs.[46] Water rights are to be quantified both as a permanent paper right expressed as a share in a designated consumptive use pool (generally referred to as either the water entitlement or licence depending on the jurisdiction), and the water allocation or amount of water available to a given water entitlement, in proportion to the entitlement share based on water

[30] *ICM Agriculture Pty Ltd v Commonwealth* (2009) 240 CLR 140; 84 ALJR 87; 170 LGERA 373; [2009] HCA 51, 55.

[31] Avey and Harvey, n 23, 48.

[32] *Australian Constitution* s 51.

[33] *Australian Constitution* s 96. See generally, Stoeckel, Webb, Woodward and Hankinson, n 29, 5.

[34] Council of Australian Governments, "About COAG" <https://www.coag.gov.au/about_coag>.

[35] Stoeckel, Webb, Woodward and Hankinson, n 29, 8.

[36] *Intergovernmental Agreement on a National Water Initiative* (NWI) (COAG, 2004) cl 3 <http://nwc.gov.au/__data/assets/pdf_file/0008/24749/Intergovernmental-Agreement-on-a-national-water-initiative.pdf>.

[37] NWI, n 36, cl 20.

[38] NWI, n 36, cl 23.

[39] NWI, n 36, cl 28.

[40] South Australia, *2009 Water for Good Plan* (2012) <http://www.environment.sa.gov.au/about-us/our-plans>.

[41] See *Natural Resources Management Act 2004* (SA) Pt 3 for an example of the water licence and allocation scheme.

[42] See, eg Mike Young, *The Role of the Unbundling Water Rights in Australia's Southern Connected Murray Darling Basin, Evaluating Economic Instruments for Sustainable Water Management in Europe* (IBE Review Report No D6.1, 19 December 2011) <http://www.feem-project.net/epiwater/docs/d32-d6-1/CS23_Australia.pdf>.

[43] *Natural Resources Management Act 2004* (SA) Pt 3, s 149.

[44] NWI, n 36, cl 23.

[45] NWI, n 36, cl 59.

[46] NWI, n 36, cll 58 and 60.

availability in a specific season. The property nature of a water entitlement allows it to be mortgaged independently of land and to be traded separate from land.[47] The NWI contemplates both permanent trades of water entitlements/licences, and temporary trades of the seasonal water allocation.[48] The NWI sets forth the principles the State parties should use to establish consistent approaches to water transfers, maintain consistency with water plans and avoid impact on environmental and cultural values when considering transfers.[49]

As an example of implementation of the NWI, the Water Registry for South Australia is available to the public online and information on registered water licences include water source, quantity, type of use, and duration.[50] South Australian law provides for the temporary and permanent transfer of all or part of a water entitlement,[51] and of a seasonal water allocation.[52] Approval of a transfer by the Minister requires consistency with the water plan and that the transfer is in the public interest, and allows the Minister to alter the water entitlement or allocation to achieve consistency.[53]

One of the impediments to water transfers under any system of governance is the fact that water, even when diverted and used, is part of a system physically shared with others. Thus, water users who share diversion structures or who are located downstream from the return flow or wastewater outlet of another user are dependent on aspects of the use of other water users. The requirement as illustrated above in South Australia water law that a transfer need only comply with the plan, may go too far in reducing transaction costs at the expense of local impacts. Much of the commentary on Australia's new water markets has focused on the concern with transfers that remove water from a local area, because in doing so the transfer may impact environmental and cultural values as well as local economies.[54] A study done following implementation of marketable water rights in the Murray-Darling Basin suggests that it has substantially increased the ease of water transfers and thus eased the economic impact of drought.[55] The study also noted that third parties and communities harmed by a transfer that is nevertheless consistent with the water plan, have no recourse,[56] and that increases in efficiency to facilitate transfer of saved water has reduced return flow and increased over-allocation of the system.[57] The study attributes this failure to lack of robust accounting that is consistent with the hydrologic system in question.[58]

While response to drought appears to have increased the definition and marketability of rights to water in Australia, it may have decreased self-organisation. Again, South Australia provides an example of how this played out. With the *Water Resources Act 1997* (SA), South Australia implemented a planning approach, with catchment boards that allowed local representation to lead the effort.[59] This approach can be characterised as government assisted self-organisation. In 2004, South Australia revised its water resources management with passage of the *Natural Resources Management Act 2004* (SA) (NRM Act), reflecting a goal of landscape-scale integrated natural resources

[47] NWI, n 36, cl 31. See also, Australian Government, "Water Rights", *Water Market Information* <http://www.nationalwatermarket.gov.au/about/rights.html>.

[48] NWI, n 36, Sch G.

[49] NWI, n 36, Sch G.

[50] South Australia, "Water Permit and Licence Register", *Water Connect* <https://www.waterconnect.sa.gov.au/Systems/WLPR/Pages/default.aspx>.

[51] *Natural Resources Management Act 2004* (SA) Pt 3, s 150.

[52] *Natural Resources Management Act 2004* (SA) Pt 3, s 157.

[53] *Natural Resources Management Act 2004* (SA) Pt 3, ss 150, 157.

[54] See, eg J McKay, "Water Markets and Trading" in Chris Davis and Bob Swinton (eds), *Securing Australia's Water Future* (Focus Publishing, 2011).

[55] Young, n 42.

[56] Young, n 42.

[57] Young, n 42.

[58] Young, n 42.

[59] Avey and Harvey, n 23, 48.

management.[60] Development of the NRM Act occurred in parallel with the multi-State/federal effort to develop the National Water Initiative, and thus the NRM Act also reflects the goals of the NWI.[61] Implementation of the NRM Act has at least been perceived to replace the prior bottom-up planning reflected in the catchment boards with a top-down approach.[62] Studies of the perceived effectiveness of the change in South Australia to integrated management suggest that some legitimacy was lost in the process by eliminating longstanding community relations with board representatives from the prior governance entities.[63] Over time, it is possible that the top-down approach will decrease local capacity to respond to a water crisis. In the short term, the loss of legitimacy may be a factor in some of the backlash to regulation since the end of the Millennium Drought.

DROUGHT AND WATER LAW REFORM IN THE WESTERN UNITED STATES

Similar to Australia, water allocation is a matter of State law in the United States and most western States have developed either an administrative or judicial system for the issuance of permits for the right to use water.[64] Many States recognise State ownership of the water itself as a public resource,[65] and clearly view the water right owner to hold a use (referred to as usufructry) right.[66] Idaho statutes codify the common law view of the nature of the private property interest in water:

> Nature of property in water. Water being essential to the industrial prosperity of the state … its control shall be in the state … *All the waters of the state, when flowing in their natural channels, including the waters of all natural springs and lakes within the boundaries of the state are declared to be the property of the state*, whose duty it shall be to supervise their appropriation and allotment to those diverting the same therefrom for any beneficial purpose … and the right to the use of any of the public waters which have heretofore been or may hereafter be allotted or beneficially applied, *shall not be considered as being a property right in itself, but such right shall become the complement of, or one of the appurtenances of, the land or other thing to which, through necessity, said water is being applied …*[67]

The combination of clear assertion of State ownership and control, and a mere use right that only rises to a property right in combination with whatever it is used for, would suggest that States have at least as much ability to regulate water allocation to prevent harm as they do with respect to land, and even more likely that they would recognise a degree of State control to alter water allocations similar to that of Australia. At present, this is not the case. Whereas the High Court of Australia found that government has the authority to reduce water-use rights as owner of the water (and thus cannot be found to have "taken" something the government did not already own),[68] the US Federal Circuit Court has found that any government reduction in water use by a water right holder is a physical taking

[60] Avey and Harvey, n 23, 49; see generally Bruce Mitchell, *Evolving Regional, Integrated and Engagement Approaches for Natural Resources Management in South Australia* (Report as part of the ANZSOG-Goyder Institute Visiting Professor in Public Sector Policy and Management Program, 2014) <http://www.goyderinstitute.org/uploads/documents/publications/2014/Bruce%20Mitchell-WEB.pdf>.

[61] Avey and Harvey, n 23, 49.

[62] Mitchell, n 60.

[63] Mitchell, n 60.

[64] See, eg *Idaho Water Use Act* and *Groundwater Act* codified in Title 42, Idaho Statutes, available at <http://legislature.idaho.gov/idstat/Title42/T42CH1.htm>; *California Water Code*, available at <http://www.leginfo.ca.gov/cgi-bin/calawquery?codesection=wat&codebody=&hits=20>.

[65] Frank J Trelease, "Government Ownership and Trusteeship of Water" (1957) 45 Cal L Rev 638 <http://scholarship.law.berkeley.edu/californialawreview/vol45/iss5/4>; see, eg *Idaho Constitution*, Art XV.

[66] A Dan Tarlock, *Law of Water Rights and Resources* (Thomson Reuters Pub, 2014) [3.10] "Usufructory nature of water rights".

[67] *Idaho Water Use Act*, n 64, s 42-101, emphasis added.

[68] *ICM Agriculture Pty Ltd v Commonwealth* (2009) 240 CLR 140; 84 ALJR 87; 170 LGERA 373; [2009] HCA 51, 55; *Arnold v Minister Administering the Water Management Act 2000* (2010) 240 CLR 242; 84 ALJR 203; 172 LGERA 82; [2010] HCA 3. Note that both cases involve licences to groundwater.

requiring compensation.[69] The US court ruling is contrary to the views of Elwood Mead, a leading architect of the prior appropriation doctrine in the United States. Mead viewed the public nature of the water right to be such that it required strong governmental oversight in its use.[70] The confusion between the rights of water users vis á vis the government that owns the water, and the relative rights between water users appears to be one source of the problem,[71] as well as the difficult problem of conceptualising a "use" right.[72] While it seems unlikely that an outcome that gives government in the United States less ability to regulate a resource it owns than it has for regulation of private land is unlikely to persist, this issue has not gone to the highest court in the United States and currently has a chilling effect on the assertion of government regulation.

Despite the federal court ruling finding a government taking when regulating water use, California has exercised greater regulatory authority over water use by declaration of a drought emergency.[73] Exercise of emergency powers in the United States is considered exempt from the Constitutional requirement of compensation for a taking of a property right.[74]

While emergency powers provide an avenue for drought response, it is not clear that such powers would be available during a long-term climate change scenario. In the context of more slowly developing scarcity as a consequence of overdevelopment and relatively mild drought, States have just begun testing the common law concept that the "beneficial use" of the water not only determines the type of use allowed, but the amount. What is beneficial must be reasonable under the circumstances, with scarcity, efficiency, and new technology being factors, among others.[75] While the concept of beneficial use may not upset the priority system, it does provide a tool for government to ensure that no water user faces reduced supplies while a more senior water user wastes water.

Despite the higher value placed on the "property" nature of the right to water in the western United States, water transfers are heavily regulated, leading to much less robust water markets than developed in Australia's Murray-Darling Basin. Western States in the United States allow the transfer of water rights generally through State-administered processes. The process used by Idaho is illustrative. A water user seeking to change the point of diversion, place, type or period of use, including in the process of marketing the water right, must apply to the Idaho Department of Water Resources.[76] The department must do an inquiry into, among other things, impacts on other rights, the public interest and the conservation of water resources, and any person with an interest may file an objection.[77]

The actual definition of what may be transferred occurs in the change-in-use process, although in recent years it has been facilitated by a centralised recording of water rights through the process of

[69] *Casitas Municipal Water District v United States* 543 F3d 1276 (2008); In determining the amount of compensation, the court did soften the impact of its ruling with a finding that the water district must show loss of beneficial use, not just paper loss, to receive compensation: *Casitas Municipal Water District v United States* 708 F3d 1340 (2013).

[70] Elwood Mead, *Irrigation Institutions: A Discussion of the Economic and Legal Questions Created by the Growth of Irrigated Agriculture in the West* (The MacMillan Co, 1903) 347-348.

[71] See, eg L MacDonnell, "Prior Appropriation: A Reassessment" (2015) 18 U Denv Water L Rev 228.

[72] See, eg *Casitas Municipal Water District v United States* 543 F3d 1276 (2008) finding a taking for any reduction in use, followed by the determination of just compensation to require a showing of harm to beneficial use in *Casitas Municipal Water District v United States* 708 F3d 1340 (2013). Beneficial use is part of the defining elements of the use right to water, thus the court has confused the definition of the right with the finding of harm.

[73] Edmund G Brown Jr (Governor of California), *A Proclamation of a State of Emergency* (17 January 2014) <https://www.gov.ca.gov/news.php?id=18368>. For discussion of regulatory authority in the instance of an emergency, see Robin Kundis Craig, "Adapting Water Law to Public Necessity: Reframing Climate Change Adaptation as Emergency Response and Preparedness" (2010) 11 *Vermont Journal of Environmental Law* 709.

[74] See, eg San Francisco earthquake case: Craig, n 73.

[75] See, eg *American Falls Reservoir District No 2 v Idaho Department of Water Resources* 154 P3d 433 (2007) 446-449.

[76] *Idaho Water Use Act*, n 64, s 42-222.

[77] *Idaho Water Use Act*, n 64, s 42-222(1).

adjudication.[78] The adjudication of a water right is analogous to the determination of an entitlement in South Australia in that it determines a maximum right to water that will nevertheless vary according to water availability and beneficial use in any given year.[79] Thus, adjudication should reduce the time involved, but does not eliminate the need for a particularised inquiry into the specific change.

Although the individualised process for determining change in use avoids some of the secondary impacts of concern in Australia's process, it is also criticised for greatly increasing transaction costs and the timeframe required for a transfer.[80] The interdependency of irrigation regions due to shared conveyance facilities, return flow, and ecosystems that have grown dependent on the inefficiency of agricultural water application,[81] have stood as barriers to numerous attempted transfers.[82] A number of States, including Idaho, have turned to water banks to reduce transaction costs.[83] Water banking reduces transaction costs by eliminating the need for a perfect match between buyer and seller. In essence, it provides a central paper repository for banked water that others may then withdraw from, similar to a financial bank. Water "banked" is not subject to the rules requiring forfeiture of unused rights,[84] thus water may be banked before the need to withdraw is identified. Additional means of reducing transaction costs while avoiding secondary impacts that the western United States should consider include redefining irrigation water rights to identify (unbundle) the portion of the right diverted that is actually consumed.[85]

Water planning in the western United States is much less developed than Australia and is generally a State level rather than a watershed-based process, with watershed focused efforts developing on an ad hoc basis when conflict arises.[86] In the face of recent drought, California has taken a major step forward in the development and implementation of a State water action plan that seeks both integration and flexibility in water management, stating:

> There is broad agreement that the state's water management system is currently unable to satisfactorily meet both ecological and human needs, too exposed to wet and dry climate cycles and natural disasters, and inadequate to handle the additional pressures of future population growth and climate change …

The California Water Action Plan has been developed to meet three broad objectives: more reliable water supplies; the restoration of important species and habitat; and a more resilient, sustainably managed water resources system (water supply, water quality, flood protection, and environment) that can better withstand inevitable and unforeseen pressures in the coming decades.[87] What is lacking in this State-led approach is the step toward devolution of specific watershed-based

[78] See, eg Idaho Water Adjudications <https://www.idwr.idaho.gov/WaterManagement/AdjudicationBureau>; Montana Water Court <http://courts.mt.gov/water>; Wyoming Bighorn Adjudication <http://bhrac.washakiecounty.net>; Arizona General Stream Adjudication <https://www.superiorcourt.maricopa.gov/SuperiorCourt/GeneralStreamAdjudication/Index.asp>.

[79] See, eg *American Falls Reservoir District No 2 v Idaho Department of Water Resources* 154 P3d 433 (2007), 446-449.

[80] BG Colby, "Transaction Costs and Efficiency in Western Water Allocation" [December 1990] *American Journal of Agricultural Economics* 1184; LJ MacDonnell, "The Water Transfer Process as a Management Option for Meeting Changing Water Demands" (USGS Grant Award No 14-08-0001-G1538, University of Colorado, 1990) Vol I.

[81] See, eg Elliot Spagat, "Salton Sea, California's Largest Lake, Threatened by Urban Water Transfer", *89.3KPCC*, 4 June 2015 <http://www.scpr.org/news/2015/06/03/52175/salton-sea-california-s-largest-lake-threatened-by>.

[82] Colby, n 80; MacDonnell, n 80.

[83] See, eg *Idaho Statutes*, s 42-1761; see generally Peggy Clifford, Clay Landry and Andrea Larsen-Hayden, *Analysis of Water Banks in the Western States* (Report for the Washington Department of Ecology, July 2004) <https://fortress.wa.gov/ecy/publications/publications/0411011.pdf>.

[84] See, eg *Idaho Water Use Act*, n 64, s 42-222(2) (regarding forfeiture), s 42-223(5) (regarding exemption from forfeiture while banked).

[85] RN Johnson, M Gisser and M Werner, "The Definition of a Surface Water Right and Transferability" (1981) 24(2) *Journal of Law and Economics* 273.

[86] See, eg Brian C Chaffin, Robin Kundis Craig and Hannah Gosnell, "Resilience, Adaptation, and Transformation in the Klamath River Basin Social-Ecological System" (2014) 51 Idaho L Rev 157.

[87] California Natural Resources Agency, California Environmental Protection Agency and California Department of Food and Agriculture, *California Water Action Plan 2016 Update* (January 2014) <http://resources.ca.gov/docs/california_water_action_plan/Final_California_Water_Action_Plan.pdf>.

planning to the local level.[88] This eliminates the benefits of local capacity building, buy-in, and the opportunity to tailor approaches to specific watersheds.

THE SPECIAL CASE OF GROUNDWATER

Groundwater is singled out here as a special case because reform of the laws related to its use, rather than being a direct consequence of drought, are an indirect consequence of the fact that groundwater becomes the storage that irrigators turn to in the face of drought. The result, if not managed appropriately, is over pumping and, in some cases, irreversible loss of storage due to subsidence.

Groundwater comprises over 90% of the world's readily available freshwater resources and provides drinking water to an estimated 1.5 billion people.[89] Even ignoring the importance of groundwater alone, it is also crucial to the integrity of our surface water supplies. Most surface water features, from rivers to lakes to wetlands, interact with groundwater and, thus, groundwater plays an essential role in both surface water availability and quality.[90] Despite the increased understanding of surface and groundwater connection in the 20th and 21st centuries, water reform efforts in both the United States and Australia have been slow to recognise that connection. As a result, individual adaptation to drought through development of groundwater is having consequences for both the surface water supply and the future viability of the groundwater resource.[91]

Over-drafting of aquifers for agriculture in response to drought has caught water managers by surprise in both countries.[92] Lack of integrated management of surface water and groundwater has resulted in double counting of available water,[93] with consequences for both surface water users[94] and ecological features.[95] Complicating the problem, in both Australia and the United States there are aquifers with very limited recharge,[96] and neither country has developed the policy and legal framework to manage aquifer mining at a level that does not have irreversible consequences. Finally, both countries treat what is variously referred to as the dewatering (US) or interception (Australia) of groundwater as a secondary result of other activities such as mining and forest plantations separately from the regulation of groundwater use.

[88] It should be noted that California has taken a major step in this direction in the context of groundwater discussed below. In addition, watershed organisations are used in many States as part of the implementation of the federal *Clean Water Act* 33 USC 1251 (1972). However, this effort pertains to water quality rather than water allocation.

[89] United Nations Environment Program, *Vital Water Graphics: An Overview of the State of the World's Fresh and Marine Waters* (2nd ed, 2008) <http://www.unep.org/dewa/vitalwater/index.html>.

[90] Thomas C Winter et al, *Ground and Surface Water: A Single Resource* (US Geological Survey Circular 1139, 1998) 1 <http://pubs.usgs.gov/circ/circ1139/pdf/circ1139.pdf>; N Harrington and P Cook, *Groundwater in Australia* (National Centre for Groundwater Research and Training, Australia, 2014) 18 <http://www.groundwater.com.au/media/W1siZiIsIjIwMTQvMDMvMjUvMDFfNTFfMTNfMTMzX0dyb3VuZHdhdGVyX2luX0F1c3RyYWxpYV9GSU5BTF9mb3Jfd2ViLnBkZiJdXQ/Groundwater%20in%20Australia_FINAL%20for%20web.pdf>.

[91] NASA, "NASA Analysis: 11 Trillion Gallons to Replenish California Drought Losses" (Press Release 14-333, 16 December 2014) <https://www.nasa.gov/press/2014/december/nasa-analysis-11-trillion-gallons-to-replenish-california-drought-losses>.

[92] See, eg BR Brodie et al, *An Adaptive Management Framework for Connected Groundwater–Surface Water Resources in Australia* (Bureau of Rural Sciences, 2007); Dennis Dimick, "If You Think the Water Crisis Can't Get Worse, Wait until the Aquifers are Drained", *National Geographic News*, 16 August 2014 <http://news.nationalgeographic.com/news/2014/08/140819-groundwater-california-drought-aquifers-hidden-crisis>.

[93] Brodie et al, n 92; *American Falls Reservoir District No 2 v Idaho Department of Water Resources* 154 P3d 433 (2007).

[94] *American Falls Reservoir District No 2 v Idaho Department of Water Resources* 154 P3d 433 (2007).

[95] Harrington and Cook, n 90.

[96] A Beall, F Fiedler, J Boll and B Cosens, "Sustainable Water Resource Management and Participatory Systems Dynamics, Case Study: Developing the Palouse Basin Participatory Model" (2011) 3 *Sustainability* 720 (discussing the Palouse Basin Aquifer in Idaho and Washington); Jane Braxton Little, "The Ogallala Aquifer: Saving a Vital US Water Source", *Scientific American*, 1 May 2009 <http://www.scientificamerican.com/article/the-ogallala-aquifer/?page=1> (discussing the Ogallala Aquifer in the Great Plains region of the United States); National Water Commission, *Allocating Water and Maintaining Springs in the Great Artesian Basin* (2013) Vol VII: Summary of Findings for Natural Resource Management of the Western Great Artesian Basin, NWC, Canberra (discussing the portions of the Great Artesian Basin) <http://archive.nwc.gov.au/library/topic/groundwater/allocating-water-and-maintaining-springs-in-the-great-artesian-basin>.

The management of surface water and groundwater as a connected resource, referred to as "conjunctive management", is rare.[97] One barrier to conjunctive management is the fact that interaction between surface water and groundwater is highly complex. Differences between ground and surface water include, among other things: groundwater is comprised of both non-renewable storage and a renewable component or recharge, and withdrawal from the storage component may result in aquifer compaction leading to permanent loss of storage space; impacts of groundwater pumping propagate out in all directions; the effects of changes in groundwater pumping may be delayed over years and even decades; and because groundwater cannot be directly observed, sophisticated models are generally required to understand the impact of groundwater pumping on surface water resources.[98] In short, straight application of law developed to manage surface water to a groundwater resource, connected or not, is not prudent. The following paragraphs explore how Australia and the western United States have responded to the increase in groundwater pumping during drought.

Groundwater management in Australia began with the common law of England,[99] that gave landowners the right to exploit the groundwater beneath their land, including groundwater they could draw from beneath neighbouring land by a well entirely on their own land. In the era of hand-dug wells, this was probably an adequate approach. With the development of modern drilling technology, and the adaptation of turbine pumps used in the oil industry for use in irrigation wells beginning in the 1940s,[100] the right to capture what groundwater you could beneath your land became a means to significant third party impacts. Most Australian States have seen a substantial increase in groundwater extraction since the 1980s.[101] Between 1983 and 1997, groundwater extraction increased by 58% due to the combination of drought and caps on water use that applied to surface water but not groundwater.[102] The NWI sought to change this by bringing groundwater within the system for surface water regulation.

The NWI recognises the need for consideration of the ground/surface water connection, including calling for: the treatment of connected surface water and groundwater as a single source;[103] integrated accounting where there is close interaction between streams and aquifers;[104] and recognition of the contribution of groundwater to environmental benefits.[105] The NWI also calls for the inclusion of groundwater in water plans[106] and, in particular, those plans intended to address over-allocated systems of both surface water and groundwater.[107] What is most notable about the NWI is not that

[97] For example, under "waters subject to appropriation" pursuant to California water law, only surface water and groundwater flowing in subterranean streams (a rare occurrence) are included. Most groundwater was unregulated (until passage of SGM Act in 2014): *California Water Code*, s 1200. Under Colorado water law, water considered "non-tributary" to surface water or to groundwater within a designated basin is not regulated: *Colorado Revised Statutes*, s 37-90-103(10.5).

[98] Winter et al, n 90.

[99] *Dunn v Collins* (1867) 1 SALR 126; J McKay, "Groundwater as the Cinderella of Water Laws, Policies, and Institutions in Australia" in Ger Bergkamp and Jennifer McKay (eds), *The Global Importance of Groundwater in the 21st Century: Proceedings of the International Symposium on Groundwater Sustainability* (National Groundwater Association International Symposium on Groundwater Sustainability 2007, IUCN-UNESCO, Spain, 2007) 317-331.

[100] Bill Ganzel, "Irrigation Pumps", *Farming in the 1940s: Wessels Living History Farm* <http://www.livinghistoryfarm.org/farminginthe40s/water_04.html>.

[101] Harrington and Cook, n 90, 7.

[102] Brodie et al, n 92.

[103] NWI, n 36, cl 23(x).

[104] NWI, n 36, cl 82(iii)(b).

[105] NWI, n 36, cll 78-79 and 5, 25(ii), (x), 79(i)(f); see also, Cameron Holley, Darren Sinclair, Elena Lopez-Gunn and Edella Schlarger, "Collective Management of Groundwater" in Tony Jakeman, Olivier Barreteau, Randall Hunt, Jean-Daniel Rinaudo, Andrew Ross (eds), *Integrated Groundwater Management: Concepts, Approaches and Challenges* (Springer, 2016).

[106] NWI, n 36, cl 36.

[107] NWI, n 36, cl 26(i).

groundwater is mentioned, but that it is pervasive. Every policy or action articulated in relation to surface water, also applies to groundwater. Individual States have discretion in how to implement the NWI.

The South Australian NRM Act once again provides an example. In addition to allowing designation of prescribed areas in which plans are required to address impacts on water quantity and quality as well as ecosystems,[108] s 132 authorises the Minister to impose reductions in both surface and groundwater diversion during drought if taking water from a surface source will impact groundwater quality or groundwater extraction will cause subsidence/aquifer collapse. Other than in the instance of subsidence, the South Australian NRM Act does not specifically address development of aquifers with little or no recharge.

Similar to Australia, groundwater regulation in the United States began with adoption of the common law of England concept that a land owner had the right to exploit the water beneath their land, but has evolved in the western United States into three different doctrines. The common law approach continues to be followed by Texas, but now with an overlay of regional regulation.[109] A number of States apply the doctrine of prior appropriation to groundwater, including Idaho, Montana, Nevada, New Mexico, Utah, Washington and Wyoming,[110] thus managing shortage in order of the date on which the particular groundwater right was first developed. Even before the recent drought, several States had experienced conflict over aquifer use and begun to experiment with governance approaches to allow more intensive regulation in areas of concern. Thus, Arizona allows designation of an active groundwater management area (AMA), generally in a region in which severe overdraft is already occurring. Within an AMA, substantial restrictions in use, and in particular on new use, may be imposed.[111] Montana allows designation of a controlled groundwater area in which limits may be placed on new development and pumping may be regulated without adherence to the doctrine of prior appropriation.[112] Montana's controlled groundwater designation has been used adjacent to Yellowstone National Park to prevent harm to the park's spectacular hydrothermal system, including through loss of recharge.[113]

Until 2014, California followed the doctrine of correlative rights under which a landowner has the right of access to groundwater beneath their land, but that right is tempered by the rule that the use must be reasonable and shortage is shared in proportion to ownership of land overlying a shared aquifer.[114] Unfortunately, mere decline in the water table is not considered "shortage" and, in the recent extended drought, irrigators in California have chased falling aquifers resulting in levels of subsidence so substantial as to be measurable using remote sensing.[115] In response, California's legislature passed the *Sustainable Groundwater Management Act* (SGM Act) in 2014.[116] The SGM Act requires development of local sustainable groundwater management plans in areas of overdraft, leaving the formation of the appropriate management entity to local control. Nevertheless, the SGM Act allows the State to step in if either the plan is not developed, is inadequate, or if impacts to senior surface water rights occur. The approach of the SGM Act can be characterised as government assisted self-organisation. It remains to be seen if this approach will facilitate local decisions on tradeoffs.

[108] *Natural Resources Management Act 2004* (SA) s 76.

[109] *Houston & Texas Central Railroad Co v East* 98 Tex 146 (1904); *Texas Water Code*, s 35.001.

[110] Gary Bryner and Elizabeth Purcell, *Groundwater Law Sourcebook of the Western United States* (Natural Resources Law Center, University of Colorado, 2003) <http://cacoastkeeper.org/document/groundwater-law-sourcebook-of-the-western-united-states.pdf>.

[111] *Arizona Revised Statutes*, Title 45, Art 2 "Arizona Groundwater Code".

[112] *Montana Code*, s 85-2-506.

[113] *Montana Code*, s 85-20-401 Art IV "Montana-National Park Service Compact".

[114] *Katz v Walkinshaw*, 141 Cal 116 (1903).

[115] J Famiglietti et al, *Satellite Observations of Epic California Drought* (Abstracts AGU Fall Meeting, 15-19 December 2014) <https://agu.confex.com/agu/fm14/meetingapp.cgi#Paper/14433>.

[116] California AB 1739, SB 1168, 1319, 2014, codified in *California Water Code*, s 10720 et seq.

Similar to Australia, the western United States also faces issues where ground and surface water interact and Idaho is the most recent State to address this as a result of both overdevelopment and periods of drought. Surface water in the arid Eastern Snake Plain of Idaho (annual precipitation of 8-14 inches or 200-350mm)[117] was heavily developed by the US Bureau of Reclamation through the construction of 12 dams in the early to middle parts of the 20th century.[118] Most of the irrigation in the region developed since 1960 relies on the vast aquifer known as the Eastern Snake Plain Aquifer (ESPA). By 1992, 800,000 acres (320,000 hectares) out of 1.4 million irrigated acres in the region (570,000 hectares) were irrigated by groundwater.[119] Through two decades of litigation and promulgation of rules to allow the unique attributes of groundwater to be considered in governmental regulation of groundwater and surface water as one source, Idaho has addressed many of the issues that will arise. Two aspects of the rules for conjunctive management,[120] the evolving concept of beneficial use captured in the requirement of "material injury"[121] and the allowance of "mitigation plans",[122] are most instructive for understanding the adjustments that must be made in applying management developed over years of experience with surface water, to a groundwater resource, as well as the avenues for flexibility.

The rules only allow curtailment of groundwater pumping if the senior surface water user is experiencing "material injury" to their actual reasonable use, rather than their paper right.[123] Regulators may consider a number of variables in determining if material injury to the senior use exists, including factors that reflect water supply, investment in and efficiency of the senior water use, availability of reasonable alternative means of diversion, and the use of metering devices.[124] These concepts are based on the common law notion of reasonable use described above, but are only recently playing a major role in water management. Similar to the Australian distinction between water entitlement and water allocation, reasonable use reflects an effort to accommodate and give legal meaning to the somewhat fickle nature of the water resource as well as its basis as a public good. More importantly, it is a concept that allows evolution of both the scientific understanding of the resource and the technology of its development. What is "reasonable" depends on the circumstances.[125]

Among the difficulties in applying water law developed for surface water to groundwater are the differences in the physical response of the groundwater system. Due to lag times, water saved by curtailing groundwater pumping may not reach the surface water diversion in a timely manner, yet the cumulative effect of pumping is nevertheless harmful. In addition, because the impact of pumping propagates out from a well in all directions, the effect on nearby surface water use is not 1:1. The rules provide a reprieve for junior water users about to be curtailed by allowing them to come up with and

[117] Jon E Hortness, *Surface-Water/Ground-Water Interaction along Reaches of the Snake River and Henrys Fork, Idaho*, USGS Scientific Investigations Report 2004 – 5115 (2004) <http://pubs.usgs.gov/sir/2004/5115/SIR2004_5115.pdf>.

[118] US Bureau of Reclamation, "Reclamation Receives Biological Opinions on Upper Snake River Basin Projects Operations" (News Release, 1 April 2005) <http://www.usbr.gov/newsroom/newsrelease/detail.cfm?RecordID=4921>; Mark Fiege, *Irrigated Eden: The Making of an Agricultural Landscape in the American West* (University of Washington Press, 1999).

[119] Idaho Department of Water Resources, *Upper Snake River Basin Study* (January 1997) 27 <https://www.idwr.idaho.gov/WaterInformation/GroundWaterManagement/Petition/pdf/Upper%20Snake%20River%20Basin_%20Study%201997.pdf>.

[120] *Idaho Administrative Code*, s 37.03.11 "Rules for Conjunctive Management of Surface and Ground Water Resources, Section 37: Department of Water Resources" <http://adminrules.idaho.gov/rules/current/37/index.html>.

[121] *Idaho Administrative Code*, s 37.03.11.042.

[122] *Idaho Administrative Code*, s 37.03.11.043.

[123] *Idaho Administrative Code*, s 37.03.11.010.14 and 11.042.

[124] *Idaho Administrative Code*, s 37.03.11.042.01.

[125] *Glenn Dale Ranches Inc v Shaub* 94 Idaho 585 (1972); *American Falls Reservoir District No 2 v Idaho Department of Water Resources* 154 P3d 433 (2007).

pay for a mitigation plan that eliminates material injury for the senior water user.[126] Settlement is encouraged in this process and has recently resulted in local innovation to resolve the conflict;[127] an example of government assisted self-organisation.

DISCUSSION AND CONCLUSION

Drought has created sufficient crisis in both Australia and the western United States to provide a testing ground for response to long-term climate change. Viewing their experiments in water reforms as occurring within a framework of three approaches to governance of the water commons – government regulation, marketable property rights, and self-organisation – allows the following critique of the adaptive capacity of these regions to climate change.

Australia has substantially increased both the governmental role in regulating water and the monitoring and forecasting necessary to base regulatory decisions on. While clarifying and recording the definition of rights sufficiently to allow development of a market, Australia has not constrained governmental regulation through interpretation of the adjustment of water allocations as a compensatory taking. These factors appear to have increased the adaptive capacity of Australian water law. At the same time, the apparent move from a locally-driven to a top-down planning approach may have reduced both local capacity to respond to crisis and the legitimacy of government regulation. Australia may improve its adaptive capacity through:

- reviving local catchment processes;
- a process to consider secondary impacts of water transfers on water users and the environment, while avoiding the heavy transaction costs of the US process; and
- taking a more robust approach to conjunctive management of surface and groundwater, including development of government assisted local management and mitigation plans.

The western United States is also increasing its adaptive capacity. Experimentation with both emergency powers and the concept of beneficial use has provided some avenue for government intervention, although it remains unclear if this is sufficient. Water markets remain highly constrained. Both California and Idaho are experimenting with a combination of government regulation and local self-organisation to address the over-development of aquifers and other States and Australia should pay attention to the results. The western United States may improve its adaptive capacity through:

- implementation of government assisted local (or watershed based) adaptive planning;
- reduction in the transaction costs of water transfers; and
- clarification of the scope of governmental authority to regulate water.

Developing the authority and capacity to use all of the tools available to govern the water commons is the first step. It must be followed by careful consideration of when each tool is appropriate. With Australia having gone through a full drought cycle first, we can observe that the need for heavy governmental intervention during crisis leads to backlash when the crisis ends. If, instead, we build into our efforts at water reform an adaptive law approach by allowing restrictions and the balance of local versus State control, a degree of regulation on markets, and investment in planning to adjust with the water cycle, the appropriate evolving response might be achieved.

Finally, it would be remiss to end this analysis of water reform in Australia and the western United States to determine what we might learn from each other without remarking on the fact that legal reform alone is not enough. The massive investment in infrastructure undertaken in Australia during the Millennium Drought has no parallel in the United States (with the caveat that 10 more years of drought could change that).[128] In a non-stationary world in which water supply and demand will not only change, but fluctuate beyond historic extremes, governance reform, investment and new

[126] *Idaho Administrative Code*, s 37.03.11.043.

[127] *Settlement Agreement entered into 30 June 2015 between Participating Members of the Surface Water Coalition and Participating Members of the Idaho Ground Water Appropriators Inc*, available from author.

[128] A Turner et al, *Managing Drought: Learning from Australia* (Alliance for Water Efficiency, Institute for Sustainable Futures, University of Technology Sydney, Pacific Institute for the Metropolitan Water District of Southern California, San Francisco Public Utilities Commission, and Water Research Foundation, 2016).

technology are needed to meet the challenge. Indeed, we are past the point that restoration of historic conditions is possible, and quickly learning that sustaining the status quo is also not an option. The new paradigm is captured in the term "reconciliation" – a rethinking of the interactions between society and the natural systems. Reconciling our needs with the planet's limits will require investment in new technology and the development of governance that is itself adaptive to an ever-changing world.