

ESM 225
Bren School of Environmental Science and Management

Water Policy
Toward Sustainable Water Management

Course Information and Syllabus

Fall 2018

Only through enlightened public understanding of these complex issues can we hope to integrate divergent viewpoints and contending interests into a wise policy of water management which will have sufficient resiliency to cope with climatic change and other developments in our society...

William L. Kahrl, *The California Water Atlas*

Instructor: Robert Wilkinson, Ph.D. Phone: 805 893 8768
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Class Time: Monday / Wednesday 2:00pm-3:15pm

Class Location: Bren 1424

Office: Bren 4426

Office Hours: Monday / Wednesday 1:00pm-2:00pm and by appointment

Course Description:

This course examines water policy in the context of science, technology, law, politics, economics, and the practical management of water systems. We will explore the nexus between water policy and energy, climate, and environmental policy. The course will provide an opportunity to focus on issues of broad environmental, social, and economic significance. We will examine the basics of water supply and use, key concepts in water policy and management, and we will cover the basics of water law as a fundamental element of the context for water policy.

Course Information and Requirements:

- Prerequisites for the course: second year standing or consent of the instructor
- 4 units

Grading:

The course grade will be based on the following point scale:

Class Participation	200
Policy Briefs (3)	450
Research Project	300
Presentations	100
Total Points	1050

Please submit all class assignments in two forms:

- 1) e-mail with ESM225 in the subject line, as an attachment (word, powerpoint, etc.) AND***
- 2) hard copy on paper, due at the beginning of the class session on the day assigned***

Readings:

- Ellen Hanak, Jay Lund, Ariel Dinar, Brian Gray, Richard Howitt, Jeffrey Mount, Peter Moyle, and Barton "Buzz" Thompson, 2011. *Managing California's Water: From Conflict to Reconciliation*, Public Policy Institute of California. <http://www.ppic.org/main/publication.asp?i=944> (This book is available for free on line. It is out of print already, but you may find used copies on line and/or in bookstores, and there is one in the Bren library.)
- Reisner, Marc, 1993. *Cadillac Desert: The American West and its Disappearing Water*, Penguin, New York.
- Beard, Daniel P., 2015. *Deadbeat Dams: Why We Should Abolish the U.S. Bureau of Reclamation & Tear Down Glen Canyon Dam* Johnson Books, ISBN-10: 1555664601, ISBN-13: 978-1555664602 <http://www.deadbeatdams.com/>
- Gaucho Space. Most readings may be accessed directly on the web from the URLs listed in this syllabus. If there is not a URL for the reading, it will be posted on Gaucho space. Please check each class for additional readings posted on Gaucho Space.

On-Line Resources:

- Water policy clippings: Please sign up right away for the following free clipping service: "DWR's California Water News is distributed to California Department of Water Resources management and staff, for information purposes, by the DWR Public Affairs Office." For reader's services, including new subscriptions, please email your request to [DWR WATER NEWS EDITORS](mailto:DWR_WATER_NEWS_EDITORS).
- Maven's blog <http://mavensnotebook.com/> and California Water Library at CAWaterLibrary.net
- Circle of Blue <http://www.circleofblue.org/> (sign up for free info and check web site)
- Water Deeply, www.newsdeeply.com/water and at info@newsdeeply.org.

Resources

(NOTE: Additional readings, models, data, and other resources are listed each class session by topic.)

Recommended Books (There are many good books on water. Here are a few recommendations.):

- Hundley, Norris Jr., 2001. *The Great Thirst*, University of California Press, Berkeley
- Kelley, Robert. 1989. *Battling the Inland Sea, American Political Culture, Public Policy, and the Sacramento Valley, 1850-1986*, University of California Press, Berkeley.
- Stegner, Wallace, 1954. *Beyond the Hundredth Meridian: John Wesley Powell and the Second Opening of the American West*, Houghton Mifflin, Boston.
- Wilkinson, Charles, 1992. *Crossing the Next Meridian*, Island Press, Washington D.C.
- Worster, Donald, 1985. *Rivers of Empire*, Pantheon Books, New York
- Glennon, Robert, 2002. *Water Follies: Groundwater Pumping and the Fate of America's Fresh Waters*, Island Press
- Glennon, Robert, 2009. *Unquenchable: America's Water Crisis and What To Do About It*, Island Press
- Reisner, Marc and Sarah Bates, 1990. *Overtapped Oasis, Reform or Revolution For Western Water*, Island Press, Washington D.C.
- Hiltzik, Michael, 2010. *Colossus: The Turbulent, Thrilling Saga of the Building of Hoover Dam*, Free Press
- Richter, Brian, 2014. *Chasing Water: A Guide for Moving from Scarcity to Sustainability* Island Press.
- Gleick, Peter, et. al: *The World's Water* (various years), Island Press

Useful Resources:

- Pacific Institute <http://pacinst.org/>
- Public Policy Institute of California. <http://www.ppic.org/>
- California Water Foundation www.cwea.org and <http://californiawaterfoundation.org/page.php?id=107>
- Alliance for Water Efficiency <http://www.allianceforwaterefficiency.org/>
- EPA Water Sense <http://www.epa.gov/watersense/>
- Western Resources Advocates <http://www.westernresourceadvocates.org/about/>
- American Rivers <https://www.americanrivers.org/>
- UC Davis, Center for Watershed Sciences <https://watershed.ucdavis.edu/org/center-watershed-sciences?destination=node/13>
- National Geographic, <http://newswatch.nationalgeographic.com/blog/water-currents/>
- DWR drought web site <http://www.ca.gov/drought/>
- Drought Monitor <http://droughtmonitor.unl.edu/Home/StateDroughtMonitor.aspx?CA>
- CA DWR <http://www.water.ca.gov/>
- USGS <http://water.usgs.gov/> (A good web site for information on US water.)
- US Bureau of Reclamation <http://www.usbr.gov/mp/cvo/index.html>
- Data Exchange <http://cdec.water.ca.gov/index.html>
- Reservoirs <http://www.water.ca.gov/serp.cfm?q=reservoir+conditions&cx=001779225245372747843%3Amxwnbyjgliw&cof=FORID%3A10&ie=UTF-8>
- National Geographic [Water Footprint Calculator](#)
- [Wholly H2O](#): Water calculators, online resources, DVDs, videos and more.
- This PG&E map shows the service territory of some northern California water districts, and also indicates the location of the water source for each district. http://www.pge.com/includes/docs/pdfs/shared/edusafety/training/pec/water/map-waterdistricts_48x52_0307.pdf
- Rocky Mountain Institute www.rmi.org
- NRDC, <http://www.nrdc.org/>
- Sierra Club, Restore Hetch Hetchy, <http://www.sierraclub.org/ca/hetchhetchy/>
- California Hydropower Reform Coalition, www.calhrc.org
- Environmental Working Group, www.ewg.org
- California Trout, www.caltrout.org
- Friends of the River, www.friendsoftheriver.org
- Surfrider Foundation USA <http://www.surfrider.org/>

Water Glossaries:

- [Water Basics Glossary](#)
- [Hydrologic Definitions](#)
- [Water Science-Glossary of Terms](#)
- [National Water Quality Assessment Glossary](#)
- [Glossary of Water-Quality Monitoring Terms](#)
- [Water Resources Data - Definition of Terms](#)
- [Glossary of water-use terminology](#)
- [A-Z Index of Hydrologic Terms](#)

Films:

- Cadillac Desert <http://www.youtube.com/watch?v=hkbebOhnCjA>
- [California's Water TV Series](#): This series hosted by Huell Howser deals with all the many aspects of water in our state - from reclaimed rivers to recycled water, from aqueducts and pipelines to recreation and fishing on the Delta, from agriculture to water friendly native plants.

Summary Course Calendar

October 1	Introduction to Water Policy and Course Overview
October 3	Historical Context for Water Policy <u>Assignment #1 due</u>
October 8	Legal Foundations of Water Policy and Doctrines of Water Law Guest Speaker: Russ McGlothlin
October 10	The Energy-Water-Climate Nexus
October 15	Price Signals, Water Rates, and Revenues <u>Brief #1 due</u> Guest Speaker: Sanjay Gaur, Vice President, Raftelis
October 17	Climate Change and Water Systems
October 22	Water Use Efficiency, Water Services, and Systems Thinking
October 24	Stormwater Management and Rainwater Harvesting
October 29	Water Plans and the Policy Process <u>Brief #2 due</u>
October 31	Water Policy and Management: Toward an Integrated Approach
November 5	Economics and Market-Based Approaches to Water Management
November 7	<u>12:00-1:30pm Tour of SB Desalination Facility (Downtown)</u> Ocean Desalination and Water Recycling
November 12	NO CLASS: UCSB HOLIDAY
November 14	Canada's Water Policy and More <u>Brief #3 due</u> Guest Speaker: Robert Patrick
November 16-17	Sustainable Water Markets and Management Symposium Students in ESM 225 are invited and encouraged to attend the symposium at the Bren School. It will take place all day Friday and Saturday morning. Participants may also be invited on a field trip on Sunday TBD. More details to follow. This is not a requirement of the class, but participation is strongly encouraged.
November 19	NO CLASS
November 21	NO CLASS
November 26	River Restoration and Water Policy
November 28	Water Policy in the United States: Federal and International Water Policy
December 3	Student Presentations <u>Research Paper due</u>
December 5	Student Presentations

NOTE: This course will place heavy emphasis on written and oral communication. You will be expected to stay on schedule with the readings, produce thoughtful and well-crafted written products and presentations, and contribute to class discussions. Full participation in this class is expected.

October 1

Water is an immensely complex subject which requires the mastery of many disciplines from the practical sciences of hydrology, engineering, and chemistry to an understanding of history, social organization, and the law.

William L. Kahrl, *The California Water Atlas*

Topic: Introduction to Water Policy and Course Overview

We will begin with an overview of the course including a review of the quarter calendar, schedule and requirements, and other logistics. This will be followed by a discussion of the topic and purpose of the course. The subject of this course is Water Policy. We will begin with an examination of the topic: What issues are involved in water policy? What roles do science, economics, and social and political factors play in the policy process?

Assignments:

Please submit the following at the next class, **and** e-mail it to me: **subject line "ESM225"**

- a full resume (don't worry about page length)
- statement of personal and professional *aspirations* (I do not need exact plans or notions of what you are certain you will do. Think about what you *want* to do. Please be a bit bold.) Be prepared to discuss it.

Two books to read during the quarter:

- Ellen Hanak, Jay Lund, Ariel Dinar, Brian Gray, Richard Howitt, Jeffrey Mount, Peter Moyle, and Barton "Buzz" Thompson, 2011. *Managing California's Water: From Conflict to Reconciliation*, Public Policy Institute of California. <http://www.ppic.org/main/publication.asp?i=944> (This book is available for free on line. It is out of print already, but you may find used copies on line and/or in bookstores, and there is one in the Bren library.)
- Reisner, Marc, 1993. *Cadillac Desert: The American West and its Disappearing Water*, Penguin, New York.

Logistics:

- Possible field trips
- Films, guest speakers, and special talks
- Student Presentations / no final

October 3

My parents generation gloried in the construction of dams across America's rivers. My generation saw how those rivers were changed, deformed, killed by dams. Your generation must help decide if, how and where those dams stand or fall.

Bruce Babbitt, "Dams are Not Forever"

Topic: Historical Context for Water Policy

Why do we do things the way we do? In water law and policy the answer has much to do with historical precedent. An essential aspect of understanding water policy issues is an awareness of the history behind present circumstances. We will explore the history of key water policy and development strategies.

Readings:

- Ellen Hanak, Caitrin Phillips Chappelle, Alvar Escrivá-Bou, Brian Gray, and Jeffrey Mount, January 2017. *California's Future: Water*, http://www.ppic.org/content/pubs/report/R_117EHR.pdf
- Meadows, Donella H., 1997. "Places to Intervene in a System", *Whole Earth Magazine*, Winter 1997 http://www.developerdotstar.com/mag/articles/places_intervene_system.html
- California Water Action Plan, 2014. http://resources.ca.gov/california_water_action_plan/docs/Final_California_Water_Action_Plan.pdf
- *California Water*, Water Education Foundation

Recommended Readings:

- McPhee, John, 1971. *Encounters With the Archdruid*, Farrar, Straus and Gioux, New York

October 8

The development and use of water in California is governed by a complex system of State and federal laws... This system of law governing water is not fixed but evolves year by year as new issues are raised which require changes and new interpretations.

DWR, *California Water: Looking to the Future*, Bulletin 160-87

Topic: Legal Foundations of Water Policy and Doctrines of Water Law
Guest Speaker: Russ McGlothlin

Water law, and the ideas and circumstances that created it, are fundamental to the issues we are discussing in the context of current water policy. We will examine the basis for water law and doctrine, the way it has been applied, and the implications of legal structures for water policy. The class will review the concepts, doctrines, key cases, and other aspects of water law.

Readings:

- *Water Rights Law*, Water Education Foundation
- Richard Frank, August 29, 2018, California Court Finds Public Trust Doctrine Applies to State Groundwater Resources <http://legal-planet.org/2018/08/29/california-court-finds-public-trust-doctrine-applies-to-state-groundwater-resources/>
- Addressing Institutional Vulnerabilities in California's Drought Water Allocation, 2018 (read the summary at this site, download the two reports if interested) <https://www.law.berkeley.edu/research/cee/research/wheeler/drought-water-allocation/>
- State Water Board http://www.waterboards.ca.gov/waterrights/board_info/water_rights_process.shtml#public and <http://www.waterboards.ca.gov/waterrights/404.shtml?>
- Summary <http://www.gallerybartonlaw.com/basics.html>
- Gary W. Sawyers, Esq., A Primer On California Water Rights http://aic.ucdavis.edu/events/outlook05/Sawyer_primer.pdf
- LAO on water rights (12 pages) <http://www.lao.ca.gov/laoapp/PubDetails.aspx?id=1959>
- The "Audubon Case" *National Audubon Society et al., Petitioners v. The Superior Court of Alpine County, Respondent* 33 Cal. 3d 419; 658 P.2d 709; 189 Cal. Rptr. 346; (1983). <http://scocal.stanford.edu/opinion/national-audubon-society-v-superior-court-30644> (just skim case)
- California Constitution. Article 10, Section 2. http://www.leginfo.ca.gov/const/article_10

Resources:

- California Law <http://www.leginfo.ca.gov/calaw.html>
- <http://projects-ca.statewater.org/water-rights>
- California State Water Resources Control Board, www.swrcb.ca.gov/
- SWRCB water rights: <http://www.waterboards.ca.gov/waterrights/>
- Environmental Protection Agency. <http://www.epa.gov/lawsregs/laws/index.html#cwa>
- California Environmental Quality Act (CEQA). (Pub. Resources Code, § 21000 et seq.) CEQA on line: <http://ceres.ca.gov/ceqa/>
- California River Law, <http://c2.com/kaweah/riverlaw.html>
- California's Rivers: A Public Trust Report. State Lands Commission. 1993. http://www.slc.ca.gov/Reports/CA_Rivers_Rpt.html
- Reclamation Projects Authorization and Adjustment Act of 1992 (CVPIA) http://www.usbr.gov/mp/cvpia/title_34/public_law_complete.html

Recommended Readings:

- Governor's Commission, 1978. *Governor's Commission to Review California Water Rights Law*. http://www.waterboards.ca.gov/publications_forms/publications/general/docs/l584a.pdf
- Littleworth, Arthur L. and Eric L. Garner, 2007, *California Water II*, Solano Press Books, Point Arena, CA
- Sax, Joseph (1970). "The Public Trust Doctrine in Natural Resources Law: Effective Judicial Intervention" <http://www.uvm.edu/~gflomenh/PA395-CMN-ASSTS/articles/sax.pdf>

October 10

California's very existence is premised on epic liberties taken with water.

Marc Reisner, *Cadillac Desert*

The moment we began settling California, we overran our water supply. We've never gotten to the point where you could just stop. And we never will.

William Warne, Former Director, Department of Water Resources

Topic: The Energy-Water-Climate Nexus

Water systems are major consumers of energy. In California, for example, the State Water Project is the largest electricity consumer in the state, and its major pumping facility in the southern San Joaquin Valley is the largest single electricity user. In total, water systems consume about 19% of the state's electricity. Water is also a source of energy, and hydroelectric power is a significant contributor to electricity grids around the world. We will discuss the links between energy, water, and climate various policy implications of this nexus.

Readings:

- Climate Change Program, California Department of Water Resources, 2017. *Connecting the Dots between Water, Energy, Food, and Ecosystem Issues for Integrated Water Management in a Changing Climate* http://www.water.ca.gov/climatechange/docs/2017/QLf2017FinalWhitePaper_jta_edits_fk_format_2.pdf
- Wilkinson, Robert, 2011. "The Water-Energy Nexus: Methodologies, Challenges, and Opportunities" in Kenney, Douglas S., and Robert Wilkinson (editors), 2011. *The Water-Energy Nexus in the Western United States*. Cheltenham: Edward Elgar
- California Energy Commission, 2005 *Integrated Energy Policy Report*, (read the summary info at this web page, then read chapter 8 on water): http://www.energy.ca.gov/2005_energy_policy/index.html Also see the full staff report (not required)

Recommended Readings:

- Heather Cooley, Kristina Donnelly, Newsha Ajami, 2013. *Energizing Water Efficiency: California Energy Sector Experiences Can Advance State's Water Conservation and Efficiency*, <http://pacinst.org/publication/energizing-water-efficiency/>
- Heather Cooley and Kristina Donnelly, 2013. *Water-Energy Synergies: Coordinating Efficiency Programs in California* <http://pacinst.org/publication/water-energy-synergies/>
- US DOE, 2013. *U.S. Energy Sector Vulnerabilities to Climate Change and Extreme Weather* <http://energy.gov/downloads/us-energy-sector-vulnerabilities-climate-change-and-extreme-weather>
- United Nations, *World Water Development Report 2014, Water and Energy (Vol. 1)* <http://www.unesco.org/new/en/natural-sciences/environment/water/wwap/wwdr/2014-water-and-energy/> and <http://unesdoc.unesco.org/images/0022/002257/225741E.pdf> also

http://www.circleofblue.org/Waternews_MultiMedia/Uploads/WWDR2014.pdf and *Facing the Challenges* (vol 2) <http://unesdoc.unesco.org/images/0022/002257/225741E.pdf#page=153>

- Western Resource Advocates reports, <http://www.westernresourceadvocates.org/media/pdf/laststraw2009.pdf> and <http://www.westernresourceadvocates.org/water/value/EveryDropCounts.pdf>
- Park, Laurie, Bill Bennett, Stacy Tellinghuisen, Chris Smith, Robert Wilkinson, 2008. *The Role of Recycled Water In Energy Efficiency and Greenhouse Gas Reduction*, California Sustainability Alliance. http://sustainca.org/programs/water_energy/recycled_water_study
- Cohen, Ronnie, et. Al, *Energy Down the Drain*, 2004. NRDC and Pacific Institute. www.pacinst.org/reports/energy_and.../energy_down_the_drain.pdf
- Park, Laurie, 2012. *California's Water-Energy Nexus: Pathways to Implementation*, GEI Consultants, written on behalf of the Water-Energy Team of the Governor's Climate Action Team (WET-CAT). at: <http://www.waterenergyinnovations.com/publication/californias-water-energy-nexus-pathways-to-implementation-2/>
- Wilkinson, Robert C., 2000. *Methodology For Analysis of The Energy Intensity of California's Water Systems, and an Assessment of Multiple Potential Benefits Through Integrated Water-Energy Efficiency Measures*, Exploratory Research Project, Ernest Orlando Lawrence Berkeley Laboratory, California Institute for Energy Efficiency. <http://large.stanford.edu/courses/2012/ph240/spearrin1/docs/wilkinson.pdf>
- Michael E. Webber, "Energy versus Water: Solving Both Crises Together," *Scientific American*, Scientific American, October 2008. See: <http://www.sciam.com/article.cfm?id=the-future-of-fuel>
- GEI Consultants/Navigant Consulting, 2010. *Embedded Energy in Water Studies. Study 1: Statewide and Regional Water-Energy Relationship* http://www.cpuc.ca.gov/PUC/energy/Energy+Efficiency/EM+and+V/Embedded+Energy+in+Water+Studies1_and_2.htm *Study 2: Water Agency and Function Component Study and Embedded Energy-Water Load Profiles*. California Public Utilities Commission, Energy Division, Managed by California Institute for Energy and Environment, August 31, 2010. http://www.cpuc.ca.gov/PUC/energy/Energy+Efficiency/EM+and+V/Embedded+Energy+in+Water+Studies1_and_2.htm

Resources:

- AWE-ACEEE Water and Energy Research Work Group, <http://www.allianceforwaterefficiency.org/Water-Energy-Research-Group.aspx> (see: Blueprint for Action, Water-Energy Nexus Research: Recommendations for Future Opportunities, Water and Energy Nexus Research Database, and presentations)
- Useful source for studies on the subject: http://en.openei.org/wiki/Water_and_energy_studies
- WESim - The Water-Energy Simulator <http://www.pacinst.org/resources/wesim/index.htm> *The Water-Energy Simulator (WESim)* is an easy-to-use analytical tool that can be used to evaluate the energy and greenhouse gas implications of water management decisions. The Excel-based model allows the user to explore a range possible scenarios, such as increased demand for water resources, the development of alternative water and energy sources, and needed water treatment improvements resulting from emerging contaminants and stricter water-quality guidelines. WESim can be applied by individual water and energy utilities, groups of utilities, and policymakers and decision makers.

October 15

Unaware of the realities, Americans expect to receive water of the highest quality, at the lowest price, and in unlimited quality.

Federal Water Policy: Toward an Agenda for Action

Topic: Price Signals, Water Rates, and Revenues

Guest Speaker: Sanjay Gaur, Vice President, Raftelis

Price signals provide critically important information for the allocation scarce resources. Sufficient revenues are needed to provide reliable and high quality water services. The structure of rates is key to both efficient and equitable allocation and to the solvency of water providers. Sanjay is a leading expert on the subject, and he will share his insights.

Readings:

- Ellen Hanak, Brian Gray, Jay Lund, David Mitchell, Caitrin Chappelle, Andrew Fahlund, Katrina Jessoe, Josué Medellín-Azuara, Dean Misczynski, James Nachbaur, and Robyn Suddeth, 2014. *Paying for Water in California* <http://www.ppic.org/main/publication.asp?i=1086>
- Richter, Brian, 2014. *Chasing Water: A Guide for Moving from Scarcity to Sustainability* Island Press. (Chapter 1, free download) <http://islandpress.org/ip/books/book/islandpress/C/bo9492254.html>
- Ceres, Value Every Drop, and Connect the Drops in California <http://www.ceres.org/issues/water>

October 17

Climate change has the potential of affecting a wide variety of water resource elements. These range from water supply, hydroelectric power, sea level rise, more intense precipitation events, and water use.

Maurice Roos, California's State Hydrologist

In keeping with the Governor's effort to fight climate change head on, re-examining the way we work and making adjustments accordingly is in many ways the most important thing we can do. Of all the difficult challenges that we've faced on this planet, environmental or otherwise, the greatest positive influence has happened when people acknowledge the problem, recognize their role in solving that problem and alter their behavior so that the change lasts. Adapting to climate change is a fundamental example of this principle

Mike Chrisman, Secretary for Natural Resources

Topic: Climate Change and Water Systems

Water systems underpin both economies and ecosystems. Climate change and variability will impact these critical systems in a number of ways. All elements of water systems, from natural watersheds and water courses to reservoirs and conveyance systems to wastewater treatment systems, will be impacted by climate change and variability. In some cases change may be beneficial. In others it may pose difficult challenges. We will examine the potential impacts of climate change with a specific focus on water resources.

Policy responses to climate change include efforts to reduce (GHG emissions), which are referred to in the climate dialogue as “mitigation” measures, and efforts to deal with impacts and changes already occurring and anticipated which are referred to as “adaptation” measures. There are important links between them. We will review the most current policies, plans, and strategies for both climate adaptation and mitigation at both the state and national/international levels.

Readings:

- California’s Fourth Climate Change Assessment summary <http://www.climateassessment.ca.gov/state/index.html> and regional reports <http://www.climateassessment.ca.gov/regions/> (read key findings of summary and look over these docs)
- State Water Resources Control Board, Office Of Research, Planning & Performance, February 22, 2017, Resolution Adopting A Comprehensive Response To Climate Change http://www.waterboards.ca.gov/board_info/agendas/2017/feb/022217_8.pdf
- *Climate Change 2013: The Physical Science Basis: Summary for Policymakers*. Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change, http://www.climatechange2013.org/images/report/WG1AR5_SPM_FINAL.pdf
- Water Scarcity and Climate Change: Growing Risks for Businesses and Investors, http://www.pacinst.org/reports/ungc_climate_water/index.htm
- The National Academies; The Royal Society, 2014. *Climate Change: Evidence and Choices* http://www.nap.edu/catalog.php?record_id=18730
- National Academy of Sciences, *What We Know*, 2014. <http://whatweknow.aas.org/get-the-facts/>
- AB 32 and Scoping Plan. Start here, these web sites provide links to an AB 32 fact sheet, the Scoping Plan, the timeline, and more: California Air Resources Board. <http://www.arb.ca.gov/cc/facts/facts.htm> and <http://www.arb.ca.gov/cc/ab32/ab32.htm>
- California Natural Resources Agency. *California Climate Adaptation Strategy*, (this site includes the plan as well as FAQs and other useful information) <http://climatechange.ca.gov/adaptation/index.html> (click on “water” and review the sources briefly)
- California Department of Water Resources Final Climate Action Plan Phase I: Greenhouse Gas Emissions Reduction Plan, 2012. (read the intro material and quickly skim the contents) <http://www.dwr.water.ca.gov/climatechange/CAP.cfm>
- Update to the AB 32 Scoping Plan (posted February 10, 2014): <http://www.arb.ca.gov/cc/scopingplan/scopingplan.htm> (look over the site)
- Alvar Escriva-Bou, Brian Gray, Ellen Hanak, and Jeffrey Mount, January 2017, California's Future: Climate Change. http://www.ppic.org/content/pubs/report/R_117AER.pdf

Recommended Readings:

- USGCRP National Assessments <http://www.globalchange.gov/resources/reports.html>
- United States Global Change Research Program (USGCRP), *National Climate Assessment, 2014*. <http://www.globalchange.gov/what-we-do/assessment/draft-report-information.html>
- IPCC at: Intergovernmental Panel on Climate Change. <http://www.ipcc.ch/> for all reports.
- Wilkinson, Robert C., 2002. *The Potential Consequences of Climate Variability and Change for California, The California Regional Assessment*. Full report at: <http://www.ncgia.ucsb.edu/products.html>
- National Assessment Synthesis Team. 2001. *Climate Change Impacts on the United States*. Report for the United States Global Change Research Program. Cambridge Univ. Press. <http://www.usgcrp.gov/usgcrp/nacc/> (See overview report and water sector report in particular)
- National Research Council, 2001. *Climate Change Science: An Analysis of Some Key Questions, Committee on the Science of Climate Change, Division on Earth and Life Studies*, National Academy Press, 2101 Constitution Avenue, N.W., Lockbox 285, Washington, D.C. 20055, (800) 624-6242, <http://www.nap.edu>
- Synthesis Report, *Climate Change, Global Risks, Challenges & Decisions*, Copenhagen 2009, 10-12 March <http://climatecongress.ku.dk/>
- *California Energy Commission Public Interest Energy Research Papers* (CEC 2012) http://www.energy.ca.gov/research/new_reports.html

Resources:

- National Academy Reports: http://nas-sites.org/americasclimatechoices/other-reports-on-climate-change/?utm_source=NASEM+News+and+Publications&utm_campaign=34d935d695-NAP_mail_new_2017-03-20&utm_medium=email&utm_term=0_96101de015-34d935d695-102154273&goal=0_96101de015-34d935d695-102154273&mc_cid=34d935d695&mc_eid=ee4e71c50c
- Global Warming Solutions Act of 2006 (AB 32): <http://www.arb.ca.gov/cc/docs/ab32text.pdf> (this is the enabling legislation)
- *Climate Change Handbook for Regional Water Planning* (EPA, CDWR, Resources Legacy Fund, and the US Army Corps of Engineers 2011) <http://www.dwr.water.ca.gov/climatechange/CCHandbook.cfm>
- *Using Future Climate Projections to Support Water Resources Decision-Making* (California Climate Center 2009) http://www.dwr.water.ca.gov/pubs/climate/using_future_climate_projections_to_support_water_resources_decision_making_in_california/usingfutureclimateprojtosuppwater_jun09_web.pdf
- *Cal-Adapt Website* (CNRA) http://resources.ca.gov/climate_adaptation/science/cal-adapt.html
- Legal Analysis of Barriers to Adaptation for California’s Water Sector (CEC, 2012), <http://www.energy.ca.gov/2012publications/CEC-500-2012-019/CEC-500-2012-019.pdf>

October 22

Sustainable development should be the primary goal of environmental and economic policy.

National Commission on the Environment

Topic: Water Use Efficiency, Water Services, and Systems Thinking

Increased water use efficiency is one of the largest “new” water supply options available. There is an emerging focus in water policy discussions on the provision of water *services* as opposed to ever-increasing volumes of water. We will discuss the role of water use efficiency and where it fits in the policy process in the context of systems approaches to policy.

Readings:

- Pacific Institute, <http://pacinst.org/making-conservation-california-way-life/>
- USGS, <https://www.usgs.gov/news/how-much-water-do-we-use> People and industries are changing how they use water as populations grow, technology advances, and regulations evolve. To assess these changes, the USGS developed an [interactive data visualization](#) that
- Soft Path for Water, in Christian-Smith, Juliet and Peter Gleick, 2012. *A Twenty-First Century U.S. Water Policy*, Oxford. http://www.pacinst.org/us_water_policy/index.htm
- WaterSmart, Tapping into the Power of Behavioral Science, Insights & Opportunities for Water-Use Efficiency, http://www.watersmart.com/wp-content/uploads/2014/11/WSS_TappingintoBehaviorScience.pdf
- Heather Cooley, Juliet Christian-Smith, Peter H. Gleick, Michael J. Cohen, Matthew Heberger, 2010. "California's Next Million Acre-Feet: Saving Water, Energy, and Money," Pacific Institute, <http://www.pacinst.org/publications/>
- CEO Water Mandate's *Guide to Responsible Business Engagement with Water Policy*. <http://pacinst.org/publication/the-ceo-water-mandate-guide-to-responsible-business-engagement-with-water-policy/>
- Jason Morrison and Peter Schulte (Pacific Institute); Rob Greenwood, Rob Willis, and Morgan Hoening (Ross Strategic); Guy Pegram and Hannah Baleta (Pegasys Strategy and Development); Robin Farrington (Deutsche Gesellschaft für Internationale Zusammenarbeit [GIZ] and Water Futures Partnership), 2013. *Guide to Water-Related Collective Action* <http://pacinst.org/publication/guide-to-water-related-collective-action/>

Recommended Readings:

- Urban Water Demand in California to 2100: Incorporating Climate Change, report and model: <http://pacinst.org/publication/urban-water-demand-to-2100/>
- CE2 Model: Evaluating the Costs and Benefits of Urban Water Conservation and Efficiency Measures http://www2.pacinst.org/resources/CE2_model/index.htm
- *Arizona Water*, Water Education Foundation
- Wolff, Gary and Peter H. Gleick, 2003. "The Soft Path for Water" In *The World's Water*, 2002-03, Island Press.
- Gleick, Peter, 2005. "California Water 2030: An Efficient Future," Pacific Institute, <http://www.pacinst.org/publications/>
- Gleick, Peter H., D. Haasz, C. Henges-Jeck, V. Srinivasan, G. Wolff, K. Kao Cushing, A. Mann, *Waste Not, Want Not: The Potential for Urban Water Conservation in California*, Pacific Institute, <http://www.pacinst.org/publications/>
- Cohen, Ronnie, et al. 2009 "Increasing Water Efficiency in Commercial, Industrial, and Institutional (CII) Sector". Natural Resources Defense Council <http://www.nrdc.org/water/cacii/files/cii.pdf>
- Sustaining California Agriculture in an Uncertain Future, Pacific Institute: http://www.pacinst.org/publications/online_update/aug_2009_online_update.html
- More with Less: Agricultural Water Conservation and Efficiency in California: A Special Focus on the Delta http://www.pacinst.org/reports/more_with_less_delta/index.htm
- Michael Cohen, Juliet Christian-Smith, and John Berggren, 2013. *Water to Supply the Land: Irrigated Agriculture in the Colorado River Basin* <http://pacinst.org/publication/water-to-supply-the-land-irrigated-agriculture-in-the-colorado-river-basin/>

Resources:

- Alliance for Water Efficiency, water use calculator <http://www.home-water-works.org/calculator>
- US EPA Region 9: <http://www.epa.gov/region9/waterinfrastructure/index.html>
- CA Senate Bill x7-7 was enacted in November 2009, requiring all water suppliers to increase water use efficiency. <http://www.water.ca.gov/wateruseefficiency/sb7/>
- Water conservation: "20 x 2020" Plan: http://www.swrcb.ca.gov/water_issues/hot_topics/20x2020/index.shtml
- Best Management Practices, California Urban Water Conservation Council. <http://www.cuwcc.org>

October 24

The success of environmentally sustained development depends on creative, environmentally sensitive engineering. It depends on engineering that looks beyond the immediate problem, the immediate gain, and considers the long term and wide ranging effects.

Lieutenant General Henry J. Hatch, Commander,
U.S. Army Corps of Engineers, Los Angeles, 1989

Topic: Stormwater Management and Rainwater Harvesting

Rainwater harvesting and stormwater management involves attenuating flows to avoid damage and pollution, and capturing the rainwater and storing it in the ground or in tanks. This is also referred to as “low impact development” or “LID” in the literature. LID is a land planning and engineering design approach to stormwater management that enables cities, states, and individuals to increase access to safe and reliable sources of water while reducing the amount of energy consumed and global warming pollution generated by supplying the water. Implementing LID practices can increase

water supplies, reduce pollution, save energy, and reduce greenhouse gas emissions. We will discuss this approach to water management and review quantification of multiple benefits.

Readings:

- Garrison, Noah, Robert C. Wilkinson, Richard Horner, 2009. *A Clear Blue Future: How Greening California Cities Can Address Water Resources and Climate Challenges in the 21st Century*, Natural Resources Defense Council and Water Policy Program, Bren School of Environmental Science and Management, University of California, Santa Barbara, <http://www.nrdc.org/water/lid/default.asp>
- NRDC, *Rooftops to Rivers II: Green Strategies for Controlling Stormwater and Combined Sewer Overflows* <http://www.nrdc.org/water/pollution/rooftopsii/> (read the update and look over the full report)

Resources:

- The Center for Watershed Health <http://www.watershedhealth.org/Default.aspx>
- The U.S. Environmental Protection Agency (EPA) has released an updated version of its [National Stormwater Calculator](#). The desktop application estimates the annual amount of stormwater runoff from a specific location. The new version includes changes in seasonal precipitation levels and the effects of more frequent high-intensity storms. Details are available in an [EPA news release](#).
- National Stormwater Calculator and Climate Assessment Tool package: <http://www.epa.gov/nrmrl/wswrd/wq/models/swc/>
- Virtual climate resilience toolkit: <http://www.whitehouse.gov/sites/default/files/image/president27sclimateactionplan.pdf>
- EPA's Green Infrastructure research: <http://water.epa.gov/infrastructure/greeninfrastructure/index.cfm>
- EPA. 1997. Economic Benefits of Runoff Controls. <http://www.epa.gov/OWOW/NPS/runoff.html>
- EPA. 1997. Managing Urban Runoff: Pointer No. 7. <http://www.epa.gov/OWOW/NPS/facts/point7.htm>

October 29

We must build now and ask questions later.

Harvey Banks, Former Director, Department of Water Resources

Before 1960, planning for future water allocation and use in California seemed to be a fairly straightforward process. With few exceptions, damming rivers ... was not regarded as having a serious detrimental impact on the environment.

DWR, California Water: Looking to the Future, Bulletin 160-87

I loved building things. I wanted to build that goddamned water project. I was absolutely determined I was going to pass this California water project. I wanted this to be a monument to me.

Governor Pat Brown

Topic: Water Plans and the Policy Process

Local water planning and management is a significant component of water supply systems. These include the Los Angeles aqueduct, San Francisco's Hetch Hetchy system, along with many other significant local systems. Most of the resources devoted to water supply and management come from local agencies, not from the state and federal governments. We will look at California's official water plan, and the planning process, as a case study. California's official water plans have guided policy and infrastructure development for more than half a century. We will explore a variety of interesting issues that attend water planning and policy in California. We will consider questions such as: Why have we plumbed the state of California as we have? What is the relationship between the environmental problems we are facing and the way we have approached water policy in the past? What is the state water plan? How have the state's plans changed through the years? Why have we created the policy and norms that prevail today? What is driving important policy decisions we are currently making?

Readings:

- *The California Water Plan*, Bulletin 160-13 California Department of Water Resources, at: <http://www.waterplan.water.ca.gov> Read the Executive Summary and look over the table of contents.
- Report of the Blue Ribbon Committee, 2011. The Metropolitan Water District of Southern California, April 12, 2011 (Skim and look at financials and trends in data presented.) <http://www.mwdh2o.com/BlueRibbon/index.shtml>
- UCSB Water Action Plan, 3013. (Web sites) <http://www.sustainability.ucsb.edu/uc-santa-barbaras-water-action-plan/> and <http://www2.bren.ucsb.edu/~wateraction/> document at http://www2.bren.ucsb.edu/~wateraction/documents/WAP_Final_Thesis_2013.pdf
- City of Santa Barbara, 2014. Look over the web site at <http://www.santabarbaraca.gov/gov/depts/pw/resources/system/docs/default.asp> the water supply management report at <http://www.santabarbaraca.gov/civicax/filebank/blobdload.aspx?BlobID=38066> and review the slides in this recent presentation by staff. http://services.santabarbaraca.gov/CAP/MG116415/AS116419/AS116433/AS116444/AI120692/DO120693/DO_120693.pdf
- Los Angeles County Economic Development Corporation (LAEDC). 2008. *Where Will We Get the Water? Assessing Southern California's Future Water Strategies*. <http://www.laedc.org/sc/c/water/studies.html>
- Wilkinson, Robert C., 2008. Invited Testimony to Congress, *Water Supply Challenges for the 21st Century*, Committee on Science and Technology, United States House of Representatives. http://www.bren.ucsb.edu/people/Faculty/wilkinson_more.htm
- Gleick, Peter and Meena Palaniappan, 2010. "Peak Water Limits to Freshwater Withdrawal and Use" *Proceedings of the National Academy of Sciences* (PNAS). <http://www.pnas.org/content/107/25/11155.full.pdf> and also Peter in Forbes: "Is the U.S. Reaching Peak Water" <http://www.forbes.com/sites/petergleick/2011/09/07/is-the-u-s-reaching-peak-water/>
- Go to the Delta Stewardship Council site, look at the basics (who is on the council, newsletters, etc.) at <http://deltacouncil.ca.gov/>
- Delta Stewardship Council, 2013. *The Delta Plan: Ensuring a Reliable Water Supply For California, a Healthy Delta Ecosystem, and a Place of Enduring Value* http://deltacouncil.ca.gov/sites/default/files/documents/files/DeltaPlan_2013_CHAPTERS_COMBINED.pdf (read the intro material)

- Legislative Analyst's Office, 2014. *Improving Management of the State's Groundwater Resources* <http://www.lao.ca.gov/handouts/resources/2014/Groundwater-Resources-03-11-14.pdf>
- PPIC Chapters 4-6

Recommended Readings:

- Jury, William A. and Henry Vaux, Jr., 2005. The role of science in solving the world's emerging water problems, PNAS. www.pnas.org/cgi/doi/10.1073/pnas.0506467102
- *The California State Water Plans*, Bulletin 160-98, Bulletin 160-05, and Bulletin 160-09 <http://www.waterplan.water.ca.gov> and the early water plans (Bulletin 1 and 3) at <http://www.waterplan.water.ca.gov/previous/index.cfm> and specific sites are (Bulletin 1) http://www.waterplan.water.ca.gov/docs/previous/DWR_Bulletin1.pdf and (Bulletin 3) <http://www.waterplan.water.ca.gov/docs/previous/californiawaterp03cali.pdf>
- Gottlieb, Robert, 1988. *A Life of Its Own: The Politics and Power of Water*, Harcourt Brace Jovanovich, New York
- Kahrl, William, 1982. *Water and Power*, University of California Press, Berkeley
- Biological Indicators of Watershed Health, <http://www.epa.gov/bioiweb1/>
- EPA's Offices of Water and Wastewater Management, <http://www.epa.gov/ow/> and <http://www.epa.gov/owm/>
- EPA. Economic Benefits of Runoff Controls. <http://www.epa.gov/OWOW/NPS/runoff.html>
- Environmental Protection Agency. 1999. Managing Non-point Source Pollution From Households: Pointer No. 10. <http://www.epa.gov/OWOW/NPS/facts/point10.htm>
- EPA. 1997. Managing Non-point Source Pollution From Agriculture: Pointer No. 6. <http://www.epa.gov/OWOW/NPS/facts/point6.htm>
- Environmental Protection Agency. 1997. The Non-point Source Management Program: Pointer No. 4. <http://www.epa.gov/OWOW/NPS/facts/point4.htm>
- *Water Recycling 2030, Recommendations of California's Recycled Water Task Force*, California Department of Water Resources, June 2003. <http://www.water.ca.gov/recycling/TaskForce/> (click on report image for download)

Resources:

- The SB urban water plan is at: <http://www.santabarbaraca.gov/civicax/filebank/blobdload.aspx?BlobID=34154>
- US EPA watershed site: <http://water.epa.gov/type/watersheds/approach.cfm>
- Julian Fulton, Heather Cooley, Peter Gleick, 2012. *Assessment of California's Water Footprint* <http://pacinst.org/publication/assessment-of-californias-water-footprint/>
- Bay Delta Conservation Plan (BDCP) <http://baydeltaconservationplan.com/Home.aspx>
- Heal The Bay <http://www.healthebay.org/>
- LAO on Delta: <http://www.lao.ca.gov/laoapp/PubDetails.aspx?id=1931>

October 31

Integrated Regional Water Management (IRWM) is a collaborative effort to manage all aspects of water resources in a region. IRWM crosses jurisdictional, watershed, and political boundaries; involves multiple agencies, stakeholders, individuals, and groups; and attempts to address the issues and differing perspectives of all the entities involved through mutually beneficial solutions.

California Department of Water Resources

We are coming increasingly to appreciate the essential role of water in our total environment and also the importance of our environment to human well-being and to the maintenance of numerous delicately balanced life-support systems which sustain us.

William L. Kahrl, *The California Water Atlas*

Topic: **Water Policy and Management: Towards an Integrated Approach**

Water policy is evolving rapidly from an era of single-issue focus on water or wastewater systems to an integrated approach that includes water supply, flood control, wastewater, stormwater, energy, climate, environment, and more. Policy strategies seeking to integrate different aspects of water management have been developed and implemented over the past few decades. Building on experience in electric utility management, water managers have crafted "integrated resource plans" (IRPs), "integrated regional water management plans" (IRWMPs), and other similar approaches. We will start with a discussion of this context for water policy and how it is advancing at the local, state, and federal levels.

Readings:

- California Water Action Plan. http://resources.ca.gov/california_water_action_plan/
- NRDC Drought Recommendations to the State Water Resources Control Board, February 26, 2014 http://www.swrcb.ca.gov/waterrights/water_issues/programs/drought/docs/workshops/nrdc_drought_recommend.pdf
- Postel, Sandra L., Gretchen C. Daily, Paul R. Ehrlich, 1996, "Human Appropriation of Renewable Fresh Water", *Science*, Vol. 271, 9 February 1996, p. 785.
- Testimony of Dr. Peter Gleick, Pacific Institute, to the California State Water Resources Control Board on the California Drought (Urban Efficiency Panel, February 26, 2014 <http://pacinst.org/wp-content/uploads/sites/21/2014/02/urban-water-efficiency-testimony.pdf>
- Christian-Smith, Juliet and Peter Gleick, 2012. *A Twenty-First Century U.S. Water Policy*, Oxford. http://www.pacinst.org/us_water_policy/index.htm (Read the intro – Soft Water Path – free at this site. The book is recommended.)
- *Strategic Plan for the Future of Integrated Regional Water Management in California 2013* <http://www.dwr.water.ca.gov/irwm/stratplan/>
- IRWM documents at <http://www.water.ca.gov/irwm/grants/index.cfm> and <http://www.water.ca.gov/irwm/grants/guidelines.cfm>
- *Integrated Regional Water Management Planning Act of 2008, Proposition 50 (2002), Proposition IE and Proposition 84 (2006)* http://www.water.ca.gov/irwm/grants/fundsource_legis.cfm

- LAO on California Water: <http://www.lao.ca.gov/laoapp/PubDetails.aspx?id=1889>
- [Ellen Hanak, Jay Lund](#), Brad Arnold, [Alvar Escriba-Bou](#), [Brian Gray](#), Sarge Green, Thomas Harter, [Richard Howitt](#), Duncan MacEwan, Josué Medellín-Azuara, Peter Moyle, and Nathaniel Seavy. *Water Stress and a Changing San Joaquin Valley*, March 2017. This report assesses water stress and related challenges facing California's largest agricultural region, and summarizes cooperative management solutions to address them. <http://www.ppic.org/main/publication.asp?i=1224>

Recommended Readings:

- Global Water Partnership on IWRM <http://www.gwp.org/The-Challenge/What-is-IWRM/>
- California Legislative Analyst's Office, 2010. *Liquid Assets: Improving Management of the State's Groundwater Resources* http://www.lao.ca.gov/reports/2010/rsrc/groundwater/groundwater_032410.pdf

Resources:

- Sustainable Water Resources Roundtable <http://acwi.gov/swrr/swrr-sc.html> and a good link to federal water programs is at http://acwi.gov/wicp_sitemap.html

November 5

It is increasingly obvious that the water policies that helped the state to become the agricultural and economic giant it is today are not up to the challenges of the 21st century.

Peter Gleick, et.al., *California Water 2020: A Sustainable Vision*

Topic: Economics and Market-Based Approaches to Water Management

Economics has often not figured prominently in water policy. Market signals (e.g. price signals) for water are commonly distorted. Water policy throughout the world has often systematically ignored market feedback. The result is predictable. Subsidies have seriously distorted “demand” for this scarce resource, many water supplies are seriously over-allocated, large “external” costs have been – and are being – paid by both the environment and society, and allocation of the resource is decidedly “sub-optimal” from an economic perspective. At the same time, many people are concerned that markets and market-oriented policies will harm both the poor and the environment. We will explore key issues related to the links between economics and water policy, and we will discuss the role, and the limits, of market tools and approaches – from pricing to water markets – as they are being employed as part of an emerging policy toolkit. Market tools and mechanisms hold promise for improved economic and environmental benefits. The team will introduce water markets and explore three key questions: How is water different from other goods traded in a market? What are the opportunities and challenges of water markets? Can water markets create environmental benefit?

Readings:

- Hanak, Ellen, Jay Lund, Barton "Buzz" Thompson, W. Bowman Cutter, Brian Gray, David Houston, Richard Howitt, Katrina Jessoe, Gary Libecap, Josué Medellín-Azuara, Sheila Olmstead, Daniel Sumner, David Sunding, Brian Thomas, and Robert Wilkinson, 2012. *Water and the California Economy*. Public Policy Institute of California. <http://www.ppic.org/main/publication.asp?i=1015>
- Ellen Hanak and Elizabeth Stryjewski, 2012. California's Water Market, By the Numbers, Public Policy Institute of California, http://www.ppic.org/content/pubs/report/r_1112ehr.pdf
- Peter Culp, Robert Glennon, Gary Libecap, 2014. Shopping for Water: How the Market Can Mitigate Water Shortages in the American, Hamilton Project Brief, Stanford, http://www.hamiltonproject.org/papers/shopping_for_water_how_the_market_can_mitigate_water_shortages_in_west/
- CEO Water Mandate's Water Action Hub, on-line platform to unite companies, governments, NGOs, and other stakeholders on a range of critical water projects in specific river basins around the planet. <https://wateractionhub.org/>
- Leurig, Sharlene, 2010. *The Ripple Effect: Water Risk in the Municipal Bond Market* Ceres, <http://www.ceres.org/resources/reports/water-bonds>

Recommended Readings:

- Ellen Hanak and Elizabeth Stryjewski, 2012. *California's Water Market, By the Numbers*, http://www.ppic.org/content/pubs/report/R_1112EHR.pdf
- Newsha Ajami, Juliet Christian-Smith, 2013. *Beyond Water Pricing: An Overview of Water Financing Options in California* <http://pacinst.org/publication/beyond-water-pricing/>
- Kristina Donnelly, Juliet Christian-Smith, Heather Cooley, 2013. *Pricing Practices in the Electricity Sector to Promote Conservation and Efficiency: Lessons for the Water Sector* <http://pacinst.org/publication/water-rates-pricing-practices/>
- Kristina Donnelly, Juliet Christian-Smith, 2013. *California Water Rates and the “New Normal”: How Water Rate Structure Can Help Foster Resiliency in the Face of California's Changing Conditions* <http://pacinst.org/publication/water-rates-series/>
- “Priceless: A Survey of Water”, 2003. *Economist*, July, 19, 2003.

Resources and Recommended Readings:

- <http://www.thefreshwatertrust.org/rivers-matter/>The Freshwater Trust, <http://www.thefreshwatertrust.org/rivers-matter/>
- Western Governors Association, 2012. *Water Transfers in the West: Projects, Trends, and Leading Practices in Water Trading*, http://www.westernstateswater.org/wp-content/uploads/2012/12/Water_Transfers_in_the_West_2012.pdf
- An Integrated Assessment of Water Markets: A Cross-Country Comparison, with Grafton, R.Q.; McGlennon, S.; Landry, C.; O'Brien, B., *Review of Environmental Economics and Policy*, 2011, Vol. 5 No. 2, pp. 219-239
- A Comparative Assessment of Water Markets: Insights from the Murray-Darling Basin of Australia and the Western US R. Quentin Grafton, Gary D. Libecap, Eric C. Edwards, R.J. (Bob) O'Brien, Clay Landry, *Water Policy*, 2011
- Bren School SWM Program: http://www.bren.ucsb.edu/academics/swm_further_reading.htm
- Environmental Working Group, water subsidies, <http://www.ewg.org/Throwing-Good-Money-at-Bad-Land>
- Ravinder P.S. Malik, 2008. *Towards A Common Methodology For Measuring Irrigation Subsidies*, Global Subsidies Initiative (GSI) of the International Institute for Sustainable Development (IISD) Geneva, <http://www.globalsubsidies.org/en/resources>

November 7

... attitudes toward and methods for managing the State's natural resources have gone through many changes. Californians have become more environmentally sensitive, as reflected in statutes such as the California Environmental Policy Act, the Endangered Species Act, and the Wild and Scenic Rivers Act.

California Water Plan Update, 1993

Topic: Ocean Desalination and Water Recycling

Advances in technology have made it possible to treat salt water to high-quality water usable for any purpose. Applications of various technologies are proven, and they are being used successfully in a number of places around the world. They are not inexpensive, however, and there are environmental implications to their use. We will discuss the specific technologies currently being used, their costs, and other hurdles to their application.

Readings:

- California Ocean Plan Amendments (these were just released; Board adoption hearing is May 5 – tons of background/context on ocean desalination) – http://www.swrcb.ca.gov/water_issues/programs/ocean/desalination/
- Desalination – With a Grain of Salt – this is the environmental community's view of desalination (note that there are some factual and many policy/context disagreements here from a water supply perspective) – <http://pacinst.org/issues/sustainable-water-management-local-to-global/desalination-and-alternative-supplies/>
- Desalination White Papers – these provide the water supply agency's perspective on desalination – <https://www.watereuse.org/information-resources/desalination/resources> (under "Desalination Committee White Papers")
- Heather Cooley, Newsha Ajami, Matthew Heberger, 2013. *Key Issues in Seawater Desalination in California: Marine Impacts* <http://pacinst.org/publication/desal-marine-impacts/>
- Heather Cooley, Matthew Heberger, 2013. *Key Issues in Seawater Desalination in California: Energy and Greenhouse Gas Emissions* <http://pacinst.org/publication/energy-and-greenhouse-gas-emissions-of-seawater-desalination-in-california/>
- *Desalination, With a Grain of Salt: A California Perspective*, http://www.pacinst.org/wp-content/uploads/sites/21/2013/02/desalination_report3.pdf
- PPIC Chapters 8-10

Resources:

- International Desalination Association: <http://www.idadesal.org/>
- National Oceanic and Atmospheric Administration. 2001. Legislative Summaries: Coastal Zone Act Reauthorization Amendments Of 1990. <http://www.csc.noaa.gov/opis/html/summary/czra.htm>
- California Coastal Commission, *Seawater Desalination and the California Coastal Act*, <http://www.coastal.ca.gov/energy/Th3a-10-2003.pdf>
- California Water Desalination Task Force recommendations, and California Desalination Planning Handbook <http://www.water.ca.gov/desalination/>
- Heather Cooley, Newsha Ajami, 2012. *Key Issues in Seawater Desalination in California: Costs and Financing* <http://pacinst.org/publication/costs-and-financing-of-seawater-desalination-in-california/>

November 12

NO CLASS: UCSB HOLIDAY

November 14

How, in the remaking of nature, do we remake ourselves?

Karl Wittfogel

A Canadian Perspective

Guest Speaker: Robert Patrick, University of Saskatchewan, Canada

(2-part talk)

see Gaucho space for readings

Topic 1: Canada's Water Policy. Federal/Provincial relations, fragmented regimes. Water Governance in Canada. Water Management Challenges facing Canada. (Broad overview)

Overview: This lecture will introduce the unique characteristics of Prairie hydrology and the big water issues facing Canada today. Foundational topics including water law in Canada, fragmented water governance and the call for a federal water strategy will be discussed.

Recommended Reading:

- Government of Canada. Environment Canada. Federal Water Policy 1987. http://publications.gc.ca/collections/collection_2014/ec/En4-247-1987-eng.pdf
- Irvine JT. 2002. Water Law in Canada: Federal and Provincial Jurisdiction. Just Add Water Conference. Saskatoon, Oct 3,4, 2002. Government of Saskatchewan.
- Bakker, Karen and Christina Cook. 2011. Water Governance in Canada: Innovation and Fragmentation. *Water Resources Development* 27(2) 275-289.

Topics: Prairie (weird) hydrology; water governance; water law in Canada

Title (Part 2): Community-Based Participatory Research (CBPR) Water Planning with Indigenous Communities. Case study: The Saskatchewan River Delta Water Stewardship Plan.

Overview: In this lecture, we reflect on a water stewardship planning process for the Saskatchewan River Delta (SRD) that continues to engage representatives from the Indigenous community of Cumberland House, Saskatchewan, with researchers from the University of Saskatchewan. The absence of a provincial government watershed plan for the SRD, combined with upstream development activity, motivated this planning process. The goal of the water stewardship plan was to document and identify specific management actions to eliminate, or at least mitigate, the negative aspects of upstream development activity on the community. The planning process took place in this northern community over a 2-year period utilizing a community-engaged scholarship model wherein researchers, students and the community formed a collaborative partnership. The result of this planning process produced much more than management actions to mitigate upstream affects on the community. The planning process helped to coalesce community and university faculty while empowering community members. Lessons learned from this process will help inform community-engaged scholarship generally and Indigenous planning more specifically.

Topics: Community-engaged scholarship; water stewardship planning; Indigenous planning; water security; colonization.

Recommended Reading:

- Patrick, RJ; Strickert, G. and T. Jardine. Submitted. The Utility of Community-Engaged Scholarship: A Collaborative Approach to Indigenous Water Stewardship Planning (*please do not copy or distribute outside this class at UCSB*).
- Arsenault R. S. Diver, D. McGregor, A. Witham and C. Bourrassa. 2018, Shifting the Framework of Canadian Water Governance through Indigenous Research Methods: Acknowledging the Past with an Eye on the Future. *Water* 10(49).

Nov 16-17 Sustainable Water Markets and Management Symposium

November 19

NO CLASS

November 21

NO CLASS

November 26

For too long, this water ran unused to the sea. For too long, surface water from one area was wasted, while there was a deficit nearby.

President John F. Kennedy, September, 1963

Dams are not America's answer to the pyramids of Egypt. We did not build them for religious purposes and they do not consecrate our values (even if some are named after Presidents).

Bruce Babbitt, "Dams are not Forever"

The 1940's dams were synonymous with progress, and the rivers were to be conquered with the fervor of a pioneer wielding an axe.

Tim Palmer, *Endangered Rivers and the Conservation Movement*

The clang of sledgehammer on concrete rings in a new era of watershed restoration.

Bruce Babbitt, "Dams are not Forever"

Topic: River Restoration, Dam Removal, and Water Policy

Legal mandates and policies require restoration of habitats, species, and ecosystem functions. From a broader policy perspective, the restoration notion may also include restoration of community and business/jobs viability and profitability. In this class session we will discuss various examples of the restoration concept including dam removal and river restoration. Dams and related infrastructure form an important part of water systems and policy. We will discuss dam removal, dam safety, and proposal for new dams. We will also view the film *Damnation*. The modern environmental movement has shaped, and been shaped by, important water policy controversies. An early issue in California was the damming of Hetch Hetchy Valley in Yosemite National Park and the opposition to it by John Muir and others. The "movement" matured in the 1950s with David Brower and the Sierra Club battling dams on the Colorado River. American water policy – and the environmental movement – were both fundamentally altered in the process. We will examine and discuss the role of water and the environmental movement in the evolution of both the policy processes and outcomes.

Readings:

- American Rivers, meadow restoration <http://www.americanrivers.org/initiative/water-supply/projects/mountain-meadow-restoration/>
- Restoring the Carmel River http://www.scc.ca.gov/webmaster/ftp/pdf/sanclemente/san_clemente_sm.pdf
- Klamath River Restoration (federal agencies site) <http://klamathrestoration.gov/>
- Klamath Riverkeeper <http://www.klamathriver.org/programs/index.html>
- NRDC, San Joaquin River Restoration, <http://www.nrdc.org/water/conservation/sanjoaquin.asp>
- Feather River Restoration <http://www.feather-river-crm.org/>
- Beard, Daniel P., 2015. *Deadbeat Dams: Why We Should Abolish the U.S. Bureau of Reclamation & Tear Down Glen Canyon Dam*
- Dam removal (read summary and follow links) <http://www.americanrivers.org/initiatives/dams/faqs/>
- Beyond Dams: Options and Alternatives, 2004. <http://www.americanrivers.org/assets/pdfs/reports-and-publications/BeyondDamsOptionsandAlternativedec7.pdf>
- Paul Rogers, 2013. *California's biggest dam removal project in history begins in Carmel Valley* http://www.mercurynews.com/ci_23508105/californias-biggest-dam-removal-project-history-begins-carmel
- San Clemente Dam Removal Project, <http://www.sanclementedamremoval.org> and press: <https://ww2.kqed.org/science/2017/02/06/with-dam-gone-california-river-comes-back-to-life/>
- Dam Removal Success Stories, 1999. <http://www.americanrivers.org/assets/pdfs/reports-and-publications/SuccessStoriesReport6f14.pdf>

Recommended Readings:

- Postel, Sandra and Brian Richter. 2003. *Rivers for Life*. Island Press.
- *Rivers Reborn: Removing Dams and Restoring Rivers in California*, Friends of the River <http://www.friendsoftheriver.org/site/PageServer?pagename=FORPublications>
- Gleick, Peter H., 2000. *The Changing Water Paradigm: A Look at Twenty-first Century Water Resources Development*, International Water Resources Association, Water International, Volume 25, Number 1, Pages 127-138, March 2000.
- Evaluating and Prioritizing Meadow Restoration in the Sierra, 2012. <http://www.americanrivers.org/assets/pdfs/meadow-restoration/evaluating-and-prioritizing-meadow-restoration-in-the-sierra.pdf>

Resources:

- Friends of the River <http://www.friendsoftheriver.org/site/PageServer>
- Society for Ecological Restoration, <http://www.ser.org/>
- Restore Hetch Hetchy <http://www.hetchhetchy.org/>
- California Resources Agency, Hetch Hetchy Restoration Study, 2006. <http://www.hetchhetchy.org/>

Videos:

- National Geographic <http://video.nationalgeographic.com/video/news/us-condit-dam-salmon>
- Elwha River <http://video-monitoring.com/construction/olympic/js.htm>
- Discover Hetch Hetchy with Harrison Ford, 2011 <http://vimeo.com/26047094>
- Feather River CRM, Mountain Meadow Restoration, http://www.feather-river-crm.org/index.php?option=com_content&view=article&id=65&Itemid=64
- Mountain Meadow restoration <http://www.youtube.com/watch?v=v7-yWJrgt-Q>

November 28

When a former Commissioner of the U.S. Bureau of Reclamation calls for abolishing the agency and tearing down one of its most iconic dams, you realize this is not just another book about water in the West.

Robert Glennon, author of *Unquenchable: America's Water Crisis and What To Do About It*.

Topic: Water Policy in the United States: Federal and International Water Policy

Federal efforts to develop an overarching water policy for the U.S. have met with difficulty. The last major attempt to craft a federal water policy was in the late 1990s (see Western Water Policy Review Advisory Commission report). Recent discussions indicate a continuing interest in the development of an integrated federal policy on water (for example see the Johnson Foundation's Charting the Waters report below). Individual agencies such as the Bureau of Reclamation are involved in water policy in certain regions. Other agencies deal with certain aspects of water management such as the Army Corps of Engineers with flood control and navigation, and the Environmental Protection agency with water quality and to some extent water use efficiency and stormwater management. At the international level, there are efforts to address water policy through multilateral programs like the Millennium Development goals and the UN Sustainable Development Goals. We will discuss these policy approaches.

"Deadbeat Dams is an insider's story of western water. America is facing a water crisis, and nowhere is this more evident than in the West where significant problems abound. How are we responding to this rapidly growing crisis? We're not. Deadbeat Dams reveals the desperate need to change western water policies and exposes the public to the lack of common sense, corruption, and utter waste of taxpayers' money that the author witnessed over a long government career spanning three decades. The faults of the present system of federally assisted water management efforts are amply detailed, and an agenda for reform is provided that can be used as ammunition by a new generation of water reformers." (From Dan's website <http://www.deadbeatdams.com/>)

"Dan Beard ... has an axe to grind. He thinks our policy is deeply misguided, and he offers some specific ideas about how to fix it. You may not agree with everything he says, but you will almost certainly come away with a deeper understanding of why water policy needs more attention, just in time for us to confront the serious challenges that climate change is posing for how we manage water. Think of it as

a compact (under 150 pages) supplement to and update of Marc Reisner's epic *Cadillac Desert*, one that focuses laser-like on the real politics of western water." John D. Leshy, Harry D. Sunderland Professor of Law, University of California Hastings College of the Law, San Francisco

Readings:

- Beard, Daniel P., 2015. *Deadbeat Dams: Why We Should Abolish the U.S. Bureau of Reclamation & Tear Down Glen Canyon Dam*
- Peter H. Gleick , Heather Cooley , James S. Famiglietti , Dennis P. Lettenmaier, Taikan Oki , Charles J. Vörösmarty , and Eric F. Wood, 2013. *Improving Understanding of the Global Hydrologic Cycle: Observation and Analysis of the Climate System: The Global Water Cycle* <http://pacinst.org/publication/improving-understanding-of-the-global-hydrologic-cycle/>
- Heather Cooley, Newsha Ajami, Mai-Lan Ha, Veena Srinivasan, Jason Morrison, Kristina Donnelly, Juliet Christian-Smith, 2013. *Global Water Governance in the 21st Century: Addressing 21st Century Global Water Challenges* <http://pacinst.org/publication/global-water-governance-in-the-21st-century-2/>

Recommended Readings:

- Western Water Policy Review Advisory Commission, 1998, *Water in the West: Challenge for the Next Century*, National Technical Information Service. <http://www.preventionweb.net/english/professional/publications/v.php?id=1785> (skim intro and look over)
- Johnson Foundation reports at <http://www.johnsonfdn.org/chartingnewwaters>
- New Global Public Opinion Survey Finds Water Issues are Top Environmental Concern Worldwide, Pacific Institute: http://www.pacinst.org/press_center/press_releases/water_survey_08_09.html

Resources:

- Global Water Partnership <http://www.gwp.org/>
- Millennium Development Goals: <http://www.un.org/millenniumgoals/>
- UN Sustainable Development Goals <https://unstats.un.org/sdgs/report/2016/The%20Sustainable%20Development%20Goals%20Report%202016.pdf>

December 3

Student Presentations

December 5

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