Applied Economics Teaching Resources

AAEA Agricultural & Applied Economics Association

Teaching and Educational Methods

Teaching Principles of Water Economics to Non-Economists: Lessons from California

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JEL Codes: A22, L95, Q25, Q51, Q53, Q58
Keywords: California, non-economist, policy, teaching, water economics, water literacy

Abstract
Economic analyses are essential in water management and allocation among sectors and regions that face water scarcity. State and local agencies in charge of water management in California play a major role in making appropriation decisions and designing policies on such issues. Economic decisions are even more critical with the predicted, more frequent water scarcity due to population increases and climate change impacting water resources. Since most of the staff members in these agencies are non-economists, they may lack the skills to develop accurate analyses and make economic decisions on water management. In addition, university graduates, to be placed in water agencies after graduation, often lack an economic background from the various courses offered on water issues. For those reasons, we present in this paper the building blocks and content of a water economics and management course targeted toward university upper-level non-economist students while providing details on the weekly course content and learning assignments. In addition, we evaluate course achievement results from a learning assessment survey, comparing the knowledge and understanding gained between the first and last week of the course.

1 Introduction

The rising population combined with increased frequency, longevity, and severity of climate change-induced droughts have resulted in elevated pressure on water resources in California and greater competition among all water-consuming sectors. In addition to these effects, water in California is not evenly distributed temporally (i.e., year-to-year variations) and spatially (i.e., northern versus central and southern California) to meet water demands in terms of quantity with adequate quality. All of that makes water management even more complex and essential. Most precipitation occurs during the winter months in the northern part of the state, while more water is needed during the summer months in the Central Valley and Southern California (Cheng et al. 2016; Escriva-Bou et al. 2017; Hanak and Lund 2012; Lee, Nemati, and Dinar 2021, 2022; Mann and Gleick 2015; Sandoval-Solis 2020; UNESCO UN-Water 2020).

To manage this complex water system, alternative policies, and infrastructures were introduced and implemented to improve water quality, water-use efficiency, and water supply security. These policies are based on economic and engineering principles. Examples of such policies include water transfers or exchanges, building reservoirs, introducing conservation programs, and implementing the Sustainable Groundwater Management Act (SGMA), to name a few (Hanak et al., 2011). Economic perspectives can provide insights into the implications of various water policy options and decisions and could help with the management of what otherwise might be an overwhelmingly complex system (Green 1997). A recent report estimates that in 2016 about 1.7 million workers were directly involved in "designing, constructing, operating, and governing" U.S. water infrastructure.[1] However, water

[1] https://www.brookings.edu/research/water-workforce/

management decision-makers in many states are engineers, teams of engineers, and other technical staff that are usually non-economists. Water managers typically have civil engineering and environmental science degrees, and those with economic degrees are not common (less than 2 percent).[2] In California, state and local agencies are involved in making decisions on their water management systems to meet stresses from climate, population, and land-use changes. The California Department of Water Resources (DWR) and the California State Water Resources Control Board (the Board) are the principal regulatory agencies with jurisdiction over California's water resources at the state level (Gray 1993, 2015). However, only 72 of the 2,038 employees (3.53 percent) in DWR and 16 of 970 employees (1.67 percent) on the Board have economic degrees (Table 1). In the Metropolitan Water District of Southern California, a major wholesaler and decision maker in Southern California, only 13 of about 774 employees (1.72 percent) have economic degrees. This portion gets even smaller in local agencies; for example, in the Eastern Municipal Water District—a major water retailer in Southern California—only one of 347 employees (0.15 percent) has an economic degree (SignalHire 2022).[3]

Table 1. Most Common Majors of the Employees at the California Department of Water Resources and the California State Water Resources Control Board

	Social Sciences			Non-social Sciences			
	Business	Economics	Management	Environ-mental Science	Engineering	Geology	Other*
# Employees	138	106	183	313	680	138	1,449
% Employees	4.59	3.53	6.09	10.41	22.61	4.59	48.19

Source: Authors' calculation based on the survey data from all the employees in 2022 using the SignalHire database at https://www.signalhire.com/.
Note: *The category "Other" includes majors such as accounting, biology, computer science, chemistry, and law.

In addition, previous work finds a lack of fundamental knowledge about water resource management among students across the disciplinary spectrum who will be the next generation of decision-makers and analysts. Importantly, previous studies suggest that complex and interdisciplinary topics related to water resources were found to have the lowest levels of understanding. Some studies highlight that most students do not know where their drinking water comes from or the treatment processes it undergoes before and after use (Brody 1993; McCarroll and Hamann 2020; Sadler, Nguyen, and Lankford 2017; Sherchan et al. 2016). At the University of California, Riverside (UCR), we also realize problems regarding our students' fundamental knowledge of the major economic principles and policy issues affecting California's water systems and their management.

To help address these issues at UCR, we planned a general water economics and policy course. This course focuses on strengthening undergraduate non-economic students' understanding of water economics principles and how it can be used to provide insights into the implications of various water policy options and decisions. To achieve this goal, we designed and taught an innovative upper-level undergraduate course, "Water Economics, Management, and Policy: California and Beyond." In this

[2] See here for the most common majors for water resources managers in the United States: https://www.zippia.com/water-resource-manager-jobs/education/?survey_step=step2.
[3] Numbers are calculated by the authors using the survey data from all the employees in these agencies in 2022 using the SignalHire database. See here for more information: https://www.signalhire.com/.

article, we discuss the details of the course content, student's assignments, and evaluations, present a measure of learning outcomes, and describe the lessons learned from teaching it in 2021 and 2022.

2 The Course: Water Economics, Management, and Policy—California and Beyond

2.1 Components and Learning Objectives

This course was created to introduce students to the complexities of water resource management and policy in California and, through this conduit, to extrapolate from what they learn to other states and countries with similar water issues, such as Arizona, Colorado, Texas, Australia, Israel, Mexico, Spain, and South Africa (all featured in the course). California is a water-scarce state that exhibits special characteristics that make it a microcosm for water policy challenges that confront other regions worldwide as well. Students learn, evaluate, and discuss the main elements of the water economy in California, the problems it faces, and the economic, institutional, policy, and engineering approaches used to address them. By the end of the course, students should be able to (i) describe contemporary water problems in California and the other states or countries discussed; (ii) describe the reasons for the problems and how different types of policy interventions and economic principles may or may not be successful; (iii) explain the major features of California water policies, and (iv) discuss the efficiency and equity goals of, and the challenges faced by water policymakers.

The course is a four-unit senior-level undergraduate elective course. The course was offered in Spring 2021 for the first time and then again in Spring 2022. Each quarter about 40 students enrolled in the course. The students enrolled in the course were 3rd and 4th-year students from various colleges across the campus with majors in biology, economics, education, environmental sciences, math, public policy, psychology, political science, and sustainability studies. For each course topic (i.e., each weekly unit), students were assigned a short and informative reading list to be prepared ahead of the class. All the readings required for the course were provided to the students through an online learning management system (Canvas).

The class assessments were amended after we first taught the course in 2021. The initial assessments were eight in-class quizzes (10 percent), eight problem sets (40 percent), a mid-term (20 percent), and a final exam (30 percent). We interviewed the students in an informal group setting (after the midterms) for their feedback on the content, delivery methods, assessment methods, content, and any other major issues with the course in general. After presenting the module in Spring 2021 and receiving feedback from the students, we decided that the number of quizzes and problem sets was excessively high and needed a more in-depth assessment method. So, we reduced the number of quizzes and problem sets from eight to four and added a couple of policy brief assignments. The course components and their grade distributions in Spring 2022 are reported in Table 2.

The purpose of the graded quizzes is to verify basic knowledge of the topics and engage the students in class discussions. Each quiz consists of 10 True/False and multiple-choice questions and is based on the most recent topics studied (i.e., not cumulative). In addition, we designed the problem sets and policy briefs to test for a deeper understanding of the material and for students to develop practical knowledge of the current water issues, policies, and alternative solutions from an economic perspective. Specifically, we included a question in each problem set regarding issues with the current policies in place and alternative solutions practiced in California.

In the policy briefs, we asked the students to provide a concise summary of a particular issue, the policy options, including principles of economic instruments used, and their recommendations on the preferred option. Policy briefs are aimed at informing readers who are acting as federal, state, and local policy makers and regulators. Previous studies show that policy briefs as an assessment method serve multiple functions: tests students' deeper understanding of the material, encourage students to develop

Table 2. Course Components and Grade Distributions

Activity	Percentage of Final Grade
In-Class Quizzes (4 + 2[a])	10% total (2.5% each)
Problem Sets/Assignments (4)	20% total (5% each)
1-page Policy Brief (2)	20% total (10% each)
Midterm Exam	20%
Final Exam	30%

[a] 2 Learning-outcomes quizzes on the first and last sessions are not for grading.

"real-world" skills, engage students, and help them practice a distinct form of writing (Lightfoot 2020; Mathews 2022; Moody and Bobic 2011). To prepare the students and make the structure of the policy briefs as uniform as possible, we provided a template (see Appendix A) that outlines the key elements in the brief and a grading rubric as well as the suggested topics for the brief to select from (see Appendix A). The key aspects of the one-page policy briefs include: (1) a concise, attractive, and clear title for the non-specialists; (2) a list of authors (up to 2 students); (3) a 130-word summary that includes a description of the problem addressed, a statement on why the current approach or policy option needs to be changed, and suggested recommendations for improvement of current legislation or immediate action; (4) a description of the problem in which students discuss the important issues related to the problem, why they are important in California's water economy, and highlighted positive and negative effects on regions and subsectors; (5) the economic and management aspects that need policy intervention in which students focus on economic, management, institutional, and legal aspects (such as overuse of water, malfunctioning of water right system, decrees that were issued) that call for policy intervention; and (6) policy intervention recommendations in which students describe the suggested policy intervention or reform and their opinion or criticism on the reform or policy interventions using concepts from the class. Finally, we also require students to pay attention to the in-text references and provide a complete list of the sources used in the text.

2.2 The Course Content

Table 3 presents the topics and content covered during each week of the quarter. The course is 10 weeks long,[4] and one topic is covered per week. All the topics are related to California's major water issues and policies, as well as the role of economic principles in providing insights into the implications of various water policy options and decisions. We invited relevant water managers, regulators, and practitioners as guest speakers to the class when available.

2.2.1 Week 1: Introduction to the course: Work arrangements, water endowment, and the water system of California

During the first week of the class, we focus on the "water endowment and the water system of California." First, we provide an overview of water availability in California and compare it to other similar states and countries. Next, we review the various water sources in California, unpredictable water availability, and the population concentration that leads to an imbalance between supply and

[4] Classes at UCR are quarter-based in which each quarter is 10 weeks long. This class was offered twice a week at 80 minutes per meeting.

Table 3. Weekly Topics Covered in the Course[a]

Week	Topic	Required Reading List
Week 1	Water endowment and the water system of California	Brown and Matlock (2011); Carle (2015); and Dinar et al. (2020)
Week 2	Regional and sectoral water uses	Hanak et al. (2011); Lee et al. (2021, 2022); and Mount and Hanak (2016)
Week 3	The California water hardware and software	Carle (2015) and Hanak et al. (2011)
Week 4	Water markets, The 1991 Drought Water Bank, and groundwater banks	California Department of Water Resources (1991); Grafton et al. (2010); Jezdimirovic, Sencan, and Hanak (2019); Luxem (2017); and Schwabe et al. (2020)
Week 5	Climate change and California's water	EPA (2016); Escriva-Bou et al. (2017); Jessoe, Mérel, and Ortiz-Bobea (2020); and Smith and Mendelsohn (2007)
Week 6	Review, midterm exam, and students' feedback	-
Week 7	Policies to address water scarcity in California	California Department of Water Resources and State Water Resources Control Board (2018); Gleick (2010); Hanak et al. (2018); and Maggioni (2015)
Week 8	The SGMA of 2014	Conrad et al. (2016) and Kiparsky (2016)
Week 9	The San-Joaquin—Sacramento Delta	Hanak et al. (2018); Lund et al. (2010); Tanaka et al. (2011); and Sunding et al. (2002)
Week 10	The salinity and drainage problems	Chang and Brawer Silva (2016) and the San Joaquin Valley Drainage Program (1990)

[a] We are happy to share the details in each topic along with the discussions/slides for each week upon a reasonable request.

demand, complicating water management in the state. Topics include the hydrological cycle, the role of snowfall/snowmelt, the water conveyance system, primary surface water sources, groundwater and their relations to rivers, recycled water, and desalinated water. We introduce a couple of water scarcity indexes used in the literature to assess water scarcity in California over time and discuss future concerns for the California water sector. Once the students learned about available water in California, we moved to the next section of the course, which discusses water use both between different regions of the state as well as various sectors (i.e., agriculture, environment, and urban). We emphasize how economics can help make such decisions on resource allocation.

2.2.2 Week 2: Regional and sectoral water uses

During week 2, we focus on the "regional and sectoral water uses" in California. Following our discussions in week 1, we continue with the unusual water supply situation in California (and in several other states and countries, such as Colorado, Israel, and Spain) of having most of the water resources in one region (such as Northern California) and most of the population and economic activity in another part (such as Southern California). We review how much available water in California is used in various parts of the state (e.g., Northern, Southern, and Central). For each region, the class also focuses on agricultural, municipal (residential), and environmental water use. We also discuss various water use measures and apply them to the state and the representative regions or subregions. In this week, students learn to distinguish between the concepts "crop per drop" and "economic value per drop" and their implications in the case of the irrigation sector. We try to conclude with the role of water in the state's economy. Once the students learn about the water availability and water allocations among regions and sectors in California, we move to the next section of the course, where we discuss both infrastructure and connectivity between the regions as well as the instructions and regulations which could play a major role in allocating the available water beside the economics logic.

2.2.3 Week 3: The California water hardware and software: The delivery system, allocation rules, institutions, and water rights

The third topic of the course focuses on "California water hardware and software: the delivery system, allocation rules, institutions, and water rights." During this class, we connect all water projects in California into one network and try to understand how that network operates. We realize that such a pipe/canal network (hardware) needs support from another system of institutions (software). During this week's class, we review several important legal and institutional arrangements in California and compared them to the system in other water-scarce countries, such as Australia, Spain, and Israel. Also, during this week, we discuss important water institutions (e.g., water rights, water markets, pricing, water districts) used in California, and discuss their advantages and disadvantages, given the state's unstable water supply situation over time. Once students learn about the available infrastructure and regulations, we move to the next section of the course, that focuses on the water markets and how its economic concepts could improve the efficiency of the resource allocation using markets while considering both institutional as well as the available infrastructure constraints.

2.2.4 Week 4: Water markets, The 1991 Drought Water Bank, and groundwater banks

For week 4, we focus on the role of water trade and surface and groundwater banking in addressing water scarcity. We review statistics on trends in water supply and demand by source and sector and how they have changed over time. We analyze recent data showing how water trading has changed over time—in terms of transactions and volume—both at the state and sector level aggregates. In addition, to put these numbers in perspective, we compare the performance of water markets in California to other western states and other countries, such as Chile and Australia. Students also learn about water banking and managed aquifer recharge as additional tools to move water from abundant to scarce places and between years with ample supply to years with limited supply. We review the principles and

performance of the 1991 State Water Bank that was active during and after the prolonged drought of 1986–1991.

Now that students learned about water availability, allocation, and markets, we turn our focus to climate change impacts and how these impacts will reduce the available water and lead to competition among sectors and between regions for the available water even further, and how economic concepts, such as pricing, water markets, can help us reach better allocation solutions.

2.2.5 Week 5: Climate change and California's water

Week 5 focuses on climate change and California's water, in which we go beyond the physical impact of having less water or altered precipitation over time. Based on California's climate change assessment report, we discuss the long-term implications of climate change on all water subsectors and summarize the relative vulnerability of water-using sectors and regions.[5] In addition, students learn about the interaction between climate change and the groundwater system, as well as adaptation and mitigation strategies to cope with the impacts of climate change on the water system in the state.

2.2.6 Week 6: Midterm exam

During week 6, students take a midterm exam, and we provide an overview of the materials covered and the expected materials in the next four weeks. This week, we also urge the students to provide, in a general discussion format, their mid-quarter feedback on the course content, assignments, grading, and other. The feedback was very useful in terms of understanding where the students are struggling, what would encourage them to engage in our discussions, how they feel about the course content, and its delivery as well as our assessments. As mentioned before, we used this feedback to change various aspects in the structure as well the delivery of the course. For example, we adjusted our assessment method and weights on each activity in Spring 2022 based on the feedback from students enrolled in Spring 2021.

The second half of the course is dedicated to major water polices in California (urban water polices, ground water policy, salinity, the Delta, and salinity) and how we can use economic principles to evaluate these polices, improve them, and suggest alternative polices.

2.2.7 Week 7: Policies to address water scarcity in California

During the second meeting in week 6, we focus on policies to address water scarcity in California. We discuss principles of economic tools, using examples related to addressing water scarcity, increasing water conservation, and improving water use efficiency. Students learn about the advantages and disadvantages of demand-side management strategies, such as water pricing, rebate programs and subsidies to water users, water-use restrictions, and programs to enhance new technologies that increase water use efficiency and encourage conservation. In addition, we discuss supply-side management strategies, including increased supply of treated wastewater, desalinated water, stormwater, and imported water (water transfers). We compare different water sources (traditional and new) using simple cost-benefit analysis principles.

2.2.8 Week 8: The SGMA of 2014—A paradigm shift in managing California's dwindling aquifers

Building on the discussion from week 7, week 8 focuses on the recent groundwater policy in California, known as the SGMA of 2014. During the long drought in California (2012–2016), water users turned to groundwater as a substitute for the dwindling surface water sources that were critically reduced. The groundwater law in California allowed at that time for each landowner to pump as much as they needed (and were able to) from the aquifer to which they had access. Lowering groundwater levels in many aquifers due to the open access nature of groundwater in many locations in California led to negative

[5] See here for more information: http://www.climateassessment.ca.gov.

externalities in terms of depth and quality and affected groundwater availability for users.[6] Realizing the potential long-term damage from unregulated groundwater pumping, in 2014, the state of California enacted SGMA, a revolutionary institution by which groundwater is managed and developed in California. The class describes the situation for groundwater pumping in the Central Valley of California, the impacts of pumping on groundwater levels and related problems (e.g., land subsidence), economic principles of the SGMA, plans for future operations of SGMA, institutions identified and created by SGMA, and the prospect of groundwater sustainability in the state of California.

2.2.9 Week 9: The San-Joaquin—Sacramento Delta

During week 9, we examine from different perspectives the special role and the fragility of the "Delta" as the main water hub of California. We discuss the threats to the Delta, different plans to modify the way the Delta operates, and the state's plans to modify them. The class was exposed to considerations of water quality effects on the Delta ecosystem and the economic value of constraints placed on water transfer from the Delta; to the evaluation of different plans to sustain the Delta while keeping the agricultural demand for water satisfied and cost-benefit principles used to compare between these alternative plans; and the political economy of interest groups in the region and outside the region regarding such an important ecosystem.

2.2.10 Week 10: The Salinity and Drainage Problems on the West Side of the San Joaquin Valley

The last week of the course focuses on the salinity problems in the San Joaquin Valley. In the early 1950s, the state and the federal government started developing two giant water projects to convert California from a desert state to a blooming state. We discuss the pros (benefits) and cons (costs/negative externalities) of these water projects, focusing on the salinity and drainage issues that emerged in the mid-1980s in the form of elevated salinity and selenium contamination and their associated social costs. This class also covers several of the policy interventions to deal with the damages of salinity and drainage, such as land retirement, groundwater management, discharge of drainage to the San Joaquin River, protection of species, restoration of infected locations, provision of alternative sources of water, and introduction of new institutions, policies, and technologies such as pricing of water and subsidies for more efficient irrigation technologies to enhance conservation of applied water.

3 Learning Outcomes Survey

To assess the knowledge gained and understanding of concepts realized by the students during the course, we developed a California water knowledge survey and tested students' water literacy at the beginning and end of the course. The survey also serves as a measure of the class "success" rate. The survey consists of 10 True/False and multiple-choice questions (Table 4). A total of 63 students in our Spring 2021 and Spring 2022 classes responded to the survey questions. This survey also is a tool to assess if the learning objectives were met in the course. As indicated earlier, the course has five learning objectives, and the questions below address one or more of these objectives.

As indicated in Table 4, on average, 60 percent of the students answered the questions correctly at the beginning of the course. This number increased to 85 percent by the end of the class. The improvement was much more significant for some basic knowledge-type questions (e.g., questions 2 and 3). To measure the improvement (knowledge gain), we calculated the ratio of week 10 vs. week 1 for each question presented in the last column of Table 4. Calculating the ratio considers the relative

[6] Open access institutions allow any groundwater user to tap into the aquifer, leading to the tragedy of the commons that has been transformed into lower water level in the aquifer, thus making pumping more expensive, and intrusion of lower quality water from adjacent aquifers or from the ocean, when aquifers are close to the ocean.

Table 4. Water Literacy Survey Questions (Percent of Correct Responses to True/False Questions)

Survey Question	Percent Answered Correctly		Ratio (Week10/ Week 1)
	Week 1	Week 10	
1. The majority of California's population resides in Northern California.	88	94	1.06
2. The California water system's primary water sources originate in Southern California.	54	88	1.62**
3. Statewide, average water use is roughly 50% environmental, 40% agricultural, and 10% urban.	39	92	2.35***
4. The water we drink in the Inland Empire (IE) region originates within the IE.	75	84	1.13
5. The sale value of agricultural products that are produced in California is in the range of:	41	64	1.58**
6. Approximately___ percent of statewide electricity and ___ percent of natural gas go to pumping, treating, and heating water.	65	88	1.34*
7. The California Delta is the confluence of:	58	89	1.53**
8. SGMA stands for:	81	98	1.22*
9. Water is moved from Northern to Southern California using ___.	79	97	1.22**
10. The Colorado River supplies roughly ___ percent of all water for Southern California cities and suburbs.	24	59	2.47***
Average	**60**	**85**	**1.41**

Notes: Based on the authors' calculations using the student survey results in the first and last session of the classes in 2021 and 2022. ***, **, * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

percentage values of weeks 1 and 10.[7] As indicated in this column, students' overall performance increased by 1.41, on average. For some basic knowledge questions and those related to Southern California, the gain was much more significant (e.g., questions number 2, 3, and 10). The results in this table and our discussion with the students indicate that, on average, the course met the learning objectives.

4 Lessons Learned and Concluding Remarks

Given that we have had two rounds of teaching in this class (Spring 2021 and Spring 2022), learning from our experience and students' feedback is essential for future considerations. Students indicated in their evaluation feedback that this course opened a new horizon and understanding of the interaction between water users and the environment in California. Indeed, we feel that in a state such as California, where water scarcity is a way of life, such courses, with emphasis on economics and policy (even if simplified), should be offered to any student.

We realized that the set of topics and the order in which they were presented in class are important for the connections students need to make in order to understand the water system's complexity and its interaction with water-related production activities and consequences. We also realized that including external speakers to cover some of the more complicated issues, such as

[7] For example, if the performance in weeks 1 and 10 were 25 and 50, the difference is 25. The same is for the performance of 40 and 65. But the ratio in the first case is 2.00, and in the second case, it is 1.625.

groundwater economics and policies for agricultural non-point salinity pollution, is extremely important. Students had an opportunity to extrapolate from our class presentation to the "real-world" issues that face the water sector of the state, learning from presentations by experts that deal with such specific issues and their economic and policy-related aspects daily.

At the end of the class, and while interacting with many students, we realized that this class included a large set of technical data/information that was hard to process and connect with specific locations and situations. Several students mentioned difficulty comprehending the large volume of information we shared with them in a 10-week course. One lesson we would implement in the future is to add case studies of experiences related to sectors and communities (irrigators, households) affected by both the negative effects of water scarcity or quality and the policy interventions they face, which could improve students' understanding of these issues and make them more realistic.[8]

Finally, we realize that the addition of "field trips/water tours" is an important teaching and learning strategy that is essential to such an undergraduate course. Field trips encourage experiential learning and student engagement through direct experience with course material and a firsthand look at the water facilities, rivers, and regions critical in the debate about the future of water resources in California. Such local trips include visiting regional water utility facilities, the Carlsbad desalination plant, the Colorado River, Sacramento and San Joaquin Rivers, the Bay Delta, and the Central Valley Project. In future offerings of this class and in collaboration with water utilities, the DWR, the California Water Board, and Water Education Foundation, we aim to implement such trips.[9]

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Acknowledgements: Material and content was reviewed by the Office Research Integrity and University of California _ Riverside Internal Review Board (HS 22 – 122).

[8] This would certainly change the composition of activities and assignments the students in future courses will face. At this point in time we are unable to assess quantitively how, but we are right now in the process of planning the Spring 2023 quarter of this course and implement such self-recommendation.

[9] Field trips will be integrated with the lectures. We are considering having one field trip for the course offered in Spring 2023. Most likely, this field trip will be to meet a water utility next to UCR. Such field trips could be completed within the time allocated to the class in one weekly meeting and sometime during the lunch break, which the class overlaps with. For future planning, we may need to consider longer field trips.

Appendix 1

Policy Brief Template

1. Title

The title should be concise and clear for non-specialists. It should be easily understandable and attractive.

2. Authors

All authors of the policy brief should be listed.

3. Summary

The word limit for the Summary text is 130 words. The summary commonly includes: (1) a description of the problem addressed; (2) a statement on why the current approach/policy option needs to be changed; and (3) suggested recommendations for improvement of current legislation or immediate action.

4. Description of the problem

Discuss the important issues related to the problem that you identify and why they are important in California's water economy. Highlight positive and negative effects on regions and subsectors.

5. The economic and management aspects that need policy intervention

Focus on economic, management, institutional, and legal aspects (such as losses, overuse of water, malfunctioning of the water rights system, decrees that were issued) that call for a policy intervention.

6. Policy intervention recommendations

What is the suggested policy intervention or reform? Using concepts/materials from the course, what is your opinion/criticism on the suggested reform/policy interventions.

7. Sources

Please indicate all the publications that are relevant to the policy brief or link to other policy briefs or press releases dealing with the same issue. Standard bibliographic information should be provided. **[Do not count toward your 1-page limit.]**

List of Suggested Topics for Policy Briefs

1. Water trade as a mechanism to address water scarcity among regions
2. SGMA as a framework to address groundwater problems in California
3. Use of wastewater for irrigation as a solution for water scarcity
4. Management and policy interventions to address salinity problems in agriculture and pollution of waterways
5. Urban water demand management in California: Role of pricing and non-pricing policies
6. Polices to prepare for future climate change in California [e.g., policies on investment, water sources]
7. Role of water rights in California's water management
8. Water infrastructure bill in the context of California
9. Water quality regulations
10. Proposition 218 and California's urban water management

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