



PPIC

PUBLIC POLICY
INSTITUTE OF CALIFORNIA

Improving the Federal Response to Western Drought

Technical Appendix

Jeffrey Mount, Ellen Hanak, Caitrin Chappelle, Bonnie Colby, Richard Frank,
Greg Gartrell, Brian Gray, Douglas Kenney, Jay Lund, Leon Szeptycki
With research support from Jelena Jezdimirovic

CONTENTS

Western States Water Use	2
Table A1	2
Farm and Nonfarm Gross Domestic Product (GDP)	3
Table A2	3
Number of Endangered Fish Species	4
Table A3	4
Federal Lands	9
Table A4	9
Federal Water and Drought Management Payments	10
Table A5	11
Water- and Weather-Related Forecasting, Observations, and Research Spending	16
Table A6	17

Supported with funding from The William and Flora Hewlett Foundation

Technical Appendix

This appendix provides additional information on data sources and methods used to describe water use, economic activity, endangered fish species listings, federal land ownership, and federal spending, as summarized in the main report *Improving the Federal Response to Western Drought: Five Directions for Reform*. We focus on 11 western states: Arizona, California, Colorado, Idaho, Montana, New Mexico, Nevada, Oregon, Utah, Washington and Wyoming.

Western States Water Use

To estimate water use in western states, we used the latest available United States Geological Survey (USGS) water use data from 2010. Table A1 presents the data used for Figure 2a in the main report.

TABLE A1

Water use in the west (2010)

State	Urban share (TAF/y)	Agricultural share (TAF/y)	Total (TAF/y)	Urban share % of total	Agricultural share % of total
Arizona	1,405	5,152	6,558	21%	79%
California	7,608	26,057	33,665	23%	77%
Colorado	1,139	10,932	12,070	9%	91%
Idaho	412	15,792	16,204	3%	97%
Montana	254	8,074	8,328	3%	97%
Nevada	690	1,770	2,460	28%	72%
New Mexico	359	3,062	3,421	10%	90%
Oregon	815	5,913	6,727	12%	88%
Utah	893	3,628	4,521	20%	80%
Washington	1,696	3,559	5,255	32%	68%
Wyoming	128	4,917	5,045	3%	97%
Total	15,399	88,854	104,254	15%	85%

SOURCE: Maupin, Molly, Joan Kenny, Susan Hutson, John Lovelace, Nancy Barber, and Kristin Linsey. 2014. *Estimated Use of Water in the United States in 2010*. US Geological Survey Circular 1405.

NOTES: TAF/y – thousand acre-feet per year

Water use estimates are for applied water, which excludes the portion of water that returns to rivers or groundwater basins after use. The total also excludes water for the energy sector, most of which is available for reuse. To estimate the urban share of water use we summed the following USGS categories:

- 1) Domestic total self-supplied withdrawals (fresh).
- 2) Industrial total self-supplied withdrawals (fresh).
- 3) Public supply total withdrawals (fresh).

To estimate the agricultural share of water use we summed the following USGS categories:

- 1) Livestock total withdrawals (fresh).
- 2) Irrigation total withdrawals (fresh).

Farm and Nonfarm Gross Domestic Product (GDP)

To estimate state farm and nonfarm Gross Domestic Product (GDP), we used Bureau of Economic Analysis data for 2010, corresponding to the year of the water use estimates. Data in Table A2 are used for Figure 2b in the main report.

TABLE A2

Farm and nonfarm GDP (2010) (\$ millions)

State	Nonfarm GDP	Farm GDP	Total GDP	Nonfarm GDP percentage of total	Farm GDP percentage of total
Arizona	242,603	3,345	245,948	99%	1%
California	1,887,381	49,420	1,936,801	97%	3%
Colorado	247,910	5,607	253,517	98%	2%
Idaho	50,730	4,082	54,812	93%	7%
Montana	34,927	1,494	36,421	96%	4%
Nevada	117,428	834	118,262	99%	1%
New Mexico	79,567	1,802	81,369	98%	2%
Oregon	185,584	5,145	190,729	97%	3%
Utah	114,219	1,791	116,010	98%	2%
Washington	348,895	9,225	358,120	97%	3%
Wyoming	36,882	476	37,358	99%	1%
Total	3,346,126	83,221	3,429,347	98%	2%

SOURCE: US Bureau of Economic Analysis (2015)

NOTES: Values are in millions of 2009 chained dollars. Total GDP is the all-industry total value. Farm GDP includes primary crop and livestock production and food and beverage processing. Nonfarm GDP is the difference between total GDP and farm GDP.

Number of Endangered Fish Species

For counts of anadromous and freshwater fish species listed as endangered or threatened under the federal Endangered Species Act, we used data available from each state. Data in Table A3 are used in Figure 2c of the main report. Sources are hyperlinked below the table.

TABLE A3

Number of Endangered Fish Species

Arizona		Count: 21
Common Name	Scientific Name	
Apache trout	<i>Oncorhynchus apache</i>	
Beautiful shiner	<i>Cyprinella formosa</i>	
Bonytail	<i>Gila elegans</i>	
Colorado pikeminnow	<i>Ptychocheilus lucius</i>	
Desert pupfish	<i>Cyprinodon macularius</i>	
Gila chub	<i>Gila intermedia</i>	
Gila topminnow	<i>Poeciliopsis occidentalis occidentalis</i>	
Gila trout	<i>Oncorhynchus gilae</i>	
Humpback chub	<i>Gila cypha</i>	
Little Colorado spinedace	<i>Lepidomeda vittata</i>	
Loach minnow	<i>Tiaroga cobitis</i>	
Quitobaquito pupfish	<i>Cyprinodon eremus</i>	
Razorback sucker	<i>Xyrauchen texanus</i>	
Sonora chub	<i>Gila ditaenia</i>	
Spikedace	<i>Meda fulgida</i>	
Virgin River chub	<i>Gila seminuda</i>	
Woundfin	<i>Plagopterus argentissimus</i>	
Yaqui catfish	<i>Ictalurus pricei</i>	
Yaqui chub	<i>Gila purpurea</i>	
Yaqui topminnow	<i>Poeciliopsis occidentalis sonoriensis</i>	
Zuni bluehead sucker	<i>Catostomus discobolus yarrowi</i>	
California		Count: 29
Common Name	Scientific Name	
Bonytail	<i>Gila elegans</i>	
Bull trout	<i>Salvelinus confluentus</i>	
Chinook salmon, California coastal ESU ^{a/}	<i>Oncorhynchus tshawytscha</i>	
Chinook salmon, spring run	<i>Oncorhynchus tshawytscha</i>	
Chinook salmon, winter run	<i>Oncorhynchus tshawytscha</i>	
Coho salmon, Punta Gorda to the northern border of California	<i>Oncorhynchus kisutch</i>	
Colorado pikeminnow	<i>Ptychocheilus lucius</i>	

Delta smelt	<i>Hypomesus transpacificus</i>
Desert pupfish	<i>Cyprinodon macularius</i>
Green sturgeon, southern DPS ^{b/}	<i>Acipenser medirostris</i>
Lahontan cutthroat trout	<i>Oncorhynchus clarki henshawi</i>
Little Kern golden trout	<i>Oncorhynchus mykiss</i>
Lost River sucker	<i>Deltistes luxatus</i>
Mohave tui chub	<i>Siphateles bicolor mohavensi</i>
Owens pupfish	<i>Cyprinodon radiosus</i>
Owens tui chub	<i>Siphateles bicolor snyderi</i>
Pacific eulachon, southern DPS ^{b/}	<i>Thaleichthys pacificus</i>
Paiute cutthroat trout	<i>Oncorhynchus clarki seleniris</i>
Razorback sucker	<i>Xyrauchen texanus</i>
Santa Ana sucker	<i>Catostomus santaanae</i>
Shortnose sucker	<i>Chasmistes brevirostris</i>
Steelhead, California Central Valley DPS ^{b/}	<i>Oncorhynchus mykiss</i>
Steelhead, Central California coast DPS ^{b/}	<i>Oncorhynchus mykiss</i>
Steelhead, Northern California DPS ^{b/}	<i>Oncorhynchus mykiss</i>
Steelhead, South Central California coast DPS ^{b/}	<i>Oncorhynchus mykiss</i>
Steelhead, Southern California DPS ^{b/}	<i>Oncorhynchus mykiss</i>
Tecopa pupfish (extinct)	<i>Cyprinodon nevadensis calidae</i>
Tidewater goby	<i>Eucyclogobius newberryi</i>
Unarmored threespine stickleback	<i>Gasterosteus aculeatus williamsoni</i>
Colorado	Count: 5
Common Name	Scientific Name
Colorado pikeminnow	<i>Ptychocheilus lucius</i>
Greenback cutthroat trout	<i>Oncorhynchus clarki stomias</i>
Razorback sucker	<i>Xyrauchen texanus</i>
Bonytail	<i>Gila elegans</i>
Humpback chub	<i>Gila cypha</i>
Idaho*	Count: 5
Common Name	Scientific Name
Bull trout	<i>Salvelinus confluentus</i>
Chinook salmon	<i>Oncorhynchus tshawytscha</i>
Kootenai River white sturgeon	<i>Acipenser transmontanus</i>
Sockeye salmon	<i>Oncorhynchus nerka</i>
Steelhead trout	<i>Oncorhynchus mykiss</i>
*The state information does not include details on the salmon and steelhead runs	
Montana	Count: 3
Common Name	Scientific Name

Bull trout	<i>Salvelinus confluentus</i>
Kootenai River white sturgeon	<i>Acipenser transmontanus</i>
Pallid sturgeon	<i>Scaphirhynchus albus</i>
Nevada	Count: 26
Common Name	Scientific Name
Ash Meadows Amargosa pupfish	<i>Cyprinodon nevadensis mionectes</i>
Ash Meadows speckled dace	<i>Rhinichthys osculus nevadensis</i>
Big Spring spinedace	<i>Lepidomeda mollispinis pratensis</i>
Bonytail	<i>Gila elegans</i>
Bull trout, Jarbidge River DPS ^{b/}	<i>Salvelinus confluentus</i>
Clover Valley speckled dace	<i>Rhinichthys osculus oligoporus</i>
Colorado pikeminnow	<i>Ptychocheilus lucius</i>
Cui-ui	<i>Chasmistes cujus</i>
Desert dace	<i>Eremichthys acros</i>
Devil's Hole pupfish	<i>Cyprinodon diabolis</i>
Hiko White River springfish	<i>Crenichthys baileyi grandis</i>
Humpback chub	<i>Gila cypha</i>
Independence Valley speckled dace	<i>Rhinichthys osculus lethoporus</i>
Lahontan cutthroat trout	<i>Oncorhynchus clarkii henshawi</i>
Moapa dace	<i>Moapa coriacea</i>
Pahranagat roundtail chub	<i>Gila robusta jordani</i>
Pahrump poolfish	<i>Empetrichthys latos</i>
Paiute cutthroat trout	<i>Oncorhynchus clarkii seleniris</i>
Railroad Valley springfish	<i>Crenichthys nevadae</i>
Razorback sucker	<i>Xyrauchen texanus</i>
Virgin River chub	<i>Gila seminuda</i>
Warm Springs pupfish	<i>Cyprinodon nevadensis pectoralis</i>
Warner sucker	<i>Catostomus warnerensis</i>
White River spinedace	<i>Lepidomeda albivallis</i>
White River springfish	<i>Crenichthys baileyi baileyi</i>
Woundfin	<i>Plagopterus argentissimus</i>
New Mexico	Count: 15
Common Name	Scientific Name
Arkansas River shiner	<i>Notropis girardi</i>
Beautiful shiner	<i>Cyprinella formosa</i>
Chihuahua chub	<i>Gila nigrescens</i>
Colorado pikeminnow	<i>Ptychocheilus lucius</i>
Gila chub	<i>Gila intermedia</i>
Gila topminnow	<i>Poeciliopsis occidentalis</i>
Gila trout	<i>Oncorhynchus gilae</i>

Loach minnow	<i>Tiaroga cobitis</i>
Pecos bluntnose shiner	<i>Notropis simus pecosensis</i>
Pecos gambusia	<i>Gambusia nobilis</i>
Razorback sucker	<i>Xyrauchen texanus</i>
Rio Grande silvery minnow	<i>Hybognathus amarus</i>
Spikedace	<i>Meda fulgida</i>
Yaqui topminnow	<i>Poeciliopsis occidentalis</i>
Zuni bluehead sucker	<i>Catostomus discobolus yarrowi</i>
Oregon	Count: 26
Common Name	Scientific Name
Borax Lake chub	<i>Gila boraxobius</i>
Bull trout	<i>Salvelinus confluentus</i>
Chinook salmon, Lower Columbia River	<i>Oncorhynchus tshawytscha</i>
Chinook salmon, Snake River fall run	<i>Oncorhynchus tshawytscha</i>
Chinook salmon, Snake River spring/summer run	<i>Oncorhynchus tshawytscha</i>
Chinook salmon, Upper Columbia River spring run	<i>Oncorhynchus tshawytscha</i>
Chinook salmon, Upper Willamette River	<i>Oncorhynchus tshawytscha</i>
Chum salmon, Columbia River	<i>Oncorhynchus keta</i>
Coho salmon, Lower Columbia River	<i>Oncorhynchus kisutch</i>
Coho salmon, Oregon coast	<i>Oncorhynchus kisutch</i>
Coho salmon, Southern Oregon	<i>Oncorhynchus kisutch</i>
Foskett speckled dace	<i>Rhinichthys osculus ssp.</i>
Green sturgeon, southern DPS ^{b/}	<i>Acipenser medirostris</i>
Hutton Spring tui chub	<i>Gila bicolor ssp.</i>
Lahontan cutthroat trout	<i>Oncorhynchus clarki henshawi</i>
Lost River sucker	<i>Deltistes luxatus</i>
Oregon chub	<i>Oregonichthys crameri</i>
Pacific eulachon/smelt, Southern DPS ^{b/}	<i>Thaleichthys pacificus</i>
Shortnose sucker	<i>Chasmistes brevirostris</i>
Sockeye salmon, Snake River	<i>Oncorhynchus nerka</i>
Steelhead, Lower Columbia River	<i>Oncorhynchus mykiss</i>
Steelhead, Middle Columbia River	<i>Oncorhynchus mykiss</i>
Steelhead, Snake River	<i>Oncorhynchus mykiss</i>
Steelhead, Upper Columbia River	<i>Oncorhynchus mykiss</i>
Steelhead, Upper Willamette River	<i>Oncorhynchus mykiss</i>
Warner sucker	<i>Catostomus warnerensis</i>
Utah	Count: 8
Common Name	Scientific Name
Bonytail	<i>Gila elegans</i>
Colorado pikeminnow	<i>Ptychocheilus lucius</i>

Humpback chub	<i>Gila cypha</i>
June sucker	<i>Chasmistes liorus</i>
Lahontan cutthroat trout	<i>Oncorhynchus clarkii henshawi</i>
Razorback sucker	<i>Xyrauchen texanus</i>
Virgin River chub	<i>Gila seminuda</i>
Woundfin	<i>Plagopterus argentissimus</i>
Washington	Count: 18
Common Name	Scientific Name
Bull trout	<i>Salvelinus confluentus</i>
Chinook salmon, Lower Columbia	<i>Oncorhynchus tshawytscha</i>
Chinook salmon, Puget Sound	<i>Oncorhynchus tshawytscha</i>
Chinook salmon, Snake River fall run	<i>Oncorhynchus tshawytscha</i>
Chinook salmon, Snake River spring/summer run	<i>Oncorhynchus tshawytscha</i>
Chinook salmon, Upper Columbia spring run	<i>Oncorhynchus tshawytscha</i>
Chum salmon, Hood Canal summer run	<i>Oncorhynchus keta</i>
Chum salmon, Lower Columbia	<i>Oncorhynchus keta</i>
Coho salmon, Lower Columbia	<i>Oncorhynchus kisutch</i>
Pacific eulachon	<i>Thaleichthys pacificus</i>
Green sturgeon	<i>Acipenser medirostris</i>
Sockeye salmon, Ozette Lake	<i>Oncorhynchus nerka</i>
Sockeye salmon, Snake River	<i>Oncorhynchus nerka</i>
Steelhead, Lower Columbia	<i>Oncorhynchus mykiss</i>
Steelhead, Middle Columbia	<i>Oncorhynchus mykiss</i>
Steelhead, Puget Sound	<i>Oncorhynchus mykiss</i>
Steelhead, Snake River	<i>Oncorhynchus mykiss</i>
Steelhead, Upper Columbia	<i>Oncorhynchus mykiss</i>
Wyoming	Count: 5
Common Name	Scientific Name
Bonytail	<i>Gila elegans</i>
Colorado pikeminnow	<i>Ptychocheilus lucius</i>
Humpback chub	<i>Gila cypha</i>
Pallid sturgeon	<i>Scaphirhynchus albus</i>
Razorback sucker	<i>Xyrauchen texanus</i>

SOURCES: [Arizona](#), [California](#), [Colorado](#), [Idaho](#), [Montana](#), [Nevada](#), [New Mexico](#), [Oregon](#), [Utah](#), [Washington](#), [Wyoming](#)

NOTES:

^{a/} ESU: evolutionarily significant unit, a Pacific salmon population or group of populations that is substantially reproductively isolated from other conspecific populations and that represents an important component of the evolutionary legacy of the species.

^{b/} DPS: distinct population segment, a vertebrate population or group of populations that is discrete from other populations of the species and significant in relation to the entire species.

Federal Lands

Table A4 shows the amount of land owned by federal agencies by state, as illustrated in Figure 2d of the main report. The numbers in the table are from the Congressional Research Service (CRS), and the map layers in Figure 2d are from the US Geological Survey.¹

TABLE A4
Federal lands

State	Total State Acres	Bureau of Land Management Acres	US Forest Service Acres	US Fish and Wildlife Service Acres	National Park Service Acres
Arizona	72,688,000	12,204,369	11,204,428	1,683,348	2,644,964
California	100,206,720	15,343,828	20,747,885	291,640	7,583,469
Colorado	66,485,760	8,335,703	14,482,727	174,230	661,472
Idaho	52,933,120	11,612,848	20,444,413	49,652	511,600
Montana	93,271,040	7,985,092	17,151,047	639,785	1,214,346
Nevada	70,264,320	47,782,464	5,759,760	2,345,956	774,751
New Mexico	77,766,400	13,454,702	9,311,527	331,919	376,883
Oregon	61,598,720	16,142,471	15,674,661	573,416	192,127
Utah	52,696,960	22,853,486	8,187,926	109,805	2,097,756
Washington	42,693,760	429,083	9,323,705	150,024	1,834,543
Wyoming	62,343,040	18,375,734	9,214,708	70,677	2,344,972
Total	752,947,840	174,519,780	141,502,787	6,420,452	20,236,883

SOURCE: Vincent, Carol, Laura Hanson and Jerome Bjelopera. 2014. R42346 *Federal Land Ownership: Overview and Data*. Congressional Research Service.

NOTES: Acreage data in the table is from 2013.

¹ US Geological Survey. 2015. 1997-2014 “US National Atlas Federal Lands” (accessed November 19, 2015).

Federal Water and Drought Management Payments

To help identify relevant programs, we drew on two sources: White House drought response fact sheets and reports from the Congressional Research Service.

Since August 2012 the White House has issued several fact sheets outlining some federal actions and relief available for drought-stricken communities in the West.² An examination of underlying agency budgets revealed that the sheets included a combination of new assistance for drought-related programs (such as emergency feed subsidies to ranchers), as well as non-drought programs already in existence at various federal agencies (such as food and housing assistance for disadvantaged communities). At the same time, the sheets do not include all federal funding programs that are relevant for water- and drought-related management.

Three Congressional Research Service (CRS) reports were also useful regarding the federal program landscape.³

Table A5 summarizes federal water- and drought-related funding for state and local entities in three broad areas: water infrastructure, agricultural water and land stewardship, and emergency response. Detailed funding information was obtained from agency budgets, budget justifications, program annual reports, and fact sheets. Sources for each program are provided in the table notes. The amounts shown in most cases are obligations made in fiscal year (FY) 2014—definite, binding financial agreements entered into by the federal government. Payment based on the agreement might be made immediately, or in a later year. Where obligations were not available, we used FY 2014 payments, which could reflect obligations made in prior years. In several cases (described in table notes), FY 2013 was the latest year available.

Under emergency response, the table includes funding triggered by drought emergency declarations, wildfire emergency declarations, and drought-related crop insurance. It excludes food and housing assistance programs that have been listed in the White House fact sheets, because they do not appear to be additional to existing social programs.⁴ Additional funding for Native American tribes is available through Bureau of Indian Affairs programs, not shown here. BIA's nationwide budget for water resources was approximately \$10.5 million in FY 2014. Finally, the table excludes the Emergency Watershed Protection Program of the Natural Resources Conservation Service, which funds projects that relieve imminent hazards to life and property caused by floods, fires, windstorms, and other natural occurrences. In FY 2015, NRCS allocated \$84 million to fund more than 150 projects nationally. The two western state recipients were Colorado and New Mexico. Colorado received \$56 million for work to address damages caused by 2013 floods. New Mexico received \$43,197 to stabilize Whitewater Creek, damaged in the 2013 Whitewater-Baldy fire.

² See fact sheets issued on the following dates: [August 7, 2012](#); [February 14, 2014](#); [June 9, 2014](#); [June 12, 2015](#); and [December 15, 2015](#).

³ Shields, Dennis. 2015. [RS21212 Agricultural Disaster Assistance](#). Congressional Research Service; Stubbs, Megan. 2015. [R40763 Agricultural Conservation: A Guide to Programs](#). Congressional Research Service; Copeland, Claudia, Nicole Carter, Betsy Cody, Megan Stubbs, and Mary Tiemann. 2015. [RL30478 Federally Supported Water Supply and Wastewater Treatment Programs](#). Congressional Research Service.

⁴ In 2014, the White House announced \$60 million in aid to California's food banks. [Blackmore \(2014\)](#) quotes the USDA's Food and Nutrition Services public affairs director Mike Ladd saying that the money is not an additional allocation to California or TEFAP (the emergency food program), but an amount that was earmarked for emergency food assistance well ahead of the drought. Meanwhile, cuts in federal [SNAP and food stamps budgets](#) increased the numbers of patrons going to foodbanks.

TABLE A5

Federal funding for state and local water and drought management, FY 2014 (thousands of dollars)

Agency/program	AZ	CA	CO	ID	MT	NM	NV	OR	UT	WA	WY	Total
Water Infrastructure												
US Bureau of Reclamation												
Water Smart ¹	300	6,975	850	598	118	300	809	198	5,200	–	–	15,348
Title XVI ²	–	19,977	–	–	–	–	–	–	–	–	–	19,977
Title XVI Studies ³	–	675	150	–	–	–	132	–	–	–	–	957
Rural Water Supply Projects ⁴	–	–	–	–	20,600	2,349	–	–	–	–	–	22,949
Bay Delta Restoration Water Conservation Projects ⁵	–	2,000	–	–	–	–	–	–	–	–	–	2,000
Water Conservation Field Services ⁶												4,475
Environmental Protection Agency												
Clean Water State Revolving Fund ⁷	16,954	103,088	11,216	6,953	7,066	6,953	8,828	15,999	7,462	24,629	6,953	216,101
Drinking Water State Revolving Fund ⁸	17,687	83,644	15,394	8,845	8,845	12,614	8,845	12,563	9,229	19,741	8,845	206,252
USDA, Rural Utilities Service												
Water & Waste Disposal Grants for Rural Communities, including colonias and Native American Tribes ⁹	5,499	7,486	354	–	–	15,401	–	–	–	–	–	28,740
Technical Assistance Grants for Rural Water Systems ¹⁰	500	110	–	–	–	–	300	–	–	–	–	910
Emergency Community Water Assistance Grants ¹¹	–	9,731	–	100	–	–	–	–	–	–	–	9,831
Direct Water & Waste Disposal Loans ¹²	9,700	10,628	1,253	3,742	11,862	5,496	–	17,784	6,258	5,590	1,295	83,608
Water & Waste Disposal Grants ¹³	–	2,243	2,809	2,923	11,274	4,153	–	6,475	8,694	4,547	5,612	48,730
HHS, Indian Health Services												
The Sanitation Facilities Construction Program ¹⁴												36,526
HUD, Community Development Block Grant												
Water/Sewer Improvements (PY 2013) ¹⁵	4,485	7,376	1,451	4,139	674	4,024	248	5,182	1,605	6,722	1,590	37,495
Army Corps of Engineers												
Army Civil Works Program, Construction ¹⁶	3,100	210,000	53	3,000	1,800	28,000	5,900	7,100	–	110,000	–	368,953
TOTAL Water Infrastructure:	58,225	463,932	33,530	30,300	62,239	79,290	25,061	65,301	38,448	181,229	24,295	1,102,851

Agency/program	AZ	CA	CO	ID	MT	NM	NV	OR	UT	WA	WY	Total
Agricultural Water and Land Stewardship												
USDA, Farm Service Agency												
Conservation Reserve Program (CRP) (FSA part) ¹⁷	–	3,621	67,104	30,579	45,729	16,226	–	32,613	5,927	76,380	5,087	283,266
USDA, Natural Resources Conservation Services												
Environmental Quality Incentives Program (EQIP) ¹⁸	12,082	114,702	37,167	16,035	20,206	26,508	11,332	23,891	26,515	17,254	13,578	319,270
Regional Conservation Partnership Program (RCCP) ¹⁹	12	31	17	18	19	10	6	18	16	20	10	177
Conservation Stewardship Program (CSP) ²⁰	7,667	9,069	27,921	8,057	41,872	27,135	1,115	20,512	5,595	19,897	9,645	178,485
Agricultural Conservation Easement Program (ACEP) ²¹	263	19,511	4,946	3,682	6,189	218	4,383	1,716	5,491	1,814	1,808	50,021
Conservation Reserve Program (CRP) (NRCS part) ¹⁷	36	74	720	618	287	282	14	521	70	369	204	3,195
TOTAL Agricultural Water and Land Stewardship:	20,060	147,008	137,875	58,989	114,302	70,379	16,850	79,271	43,614	115,734	30,332	834,414
Emergency Response												
USDA, Farm Service Agency²²												
Livestock Forage Program ²³	12,354	68,625	26,700	8,201	–	14,677	45,288	23,414	9,298	985	–	209,543
Livestock Indemnity Program ²⁴	2	1	–	22	1,653	–	75	129	2	527	177	2,588
Emergency Loans (FY 2013) ²⁵	–	722	316	–	469	1,374	200	–	360	–	667	4,108
Disaster Set-Aside (FY 2013) ²⁶	19	104	131	59	123	50	10	31	212	–	30	769
Emergency Conservation Program ²⁷	683	3,481	2,863	252	549	950	316	150	11	1,096	577	10,928
Emergency Forest Restoration ²⁸	–	–	765	–	–	–	–	686	–	–	–	1,451
USDA, Risk Management Agency												
Drought-related Crop Insurance Indemnities ²⁹	13,400	277,600	60,870	17,400	15,340	14,123	9,800	28,300	1,893	84,000	185	522,911
Crop Insurance Premium, Government Subsidy ³⁰	1,000	240,000	120,000	40	99,000	19,000	4,700	21,000	2,900	79,000	11,000	607,640
Crop Insurance Total Premium ³¹	16,000	390,000	190,000	68	160,000	29,000	7,900	35,000	4,000	130,000	18,000	979,968
FEMA												
Fire Management Assistance Grant ³²	997	83,937	–	–	–	–	–	11,411	–	201	–	96,545
Major Disaster Declaration Assistance for Wildfires ³³	–	–	–	–	–	–	–	–	–	23,692	–	23,692
TOTAL Emergency Response (excludes crop insurance premium):	27,455	434,471	91,645	25,934	18,135	31,173	55,689	64,120	11,776	110,501	1,636	872,534

SOURCE: Agency budgets, hyperlinked in notes

NOTES:

- ¹ Water Smart grants provide 50/50 cost share funding to irrigation and water districts, tribes, states, and other entities with water or power delivery authority. Projects seek to conserve and use water more efficiently, increase the use of renewable energy, protect endangered species, or facilitate water markets. Numbers in the table are aggregated by state from a sheet with details on projects [selected in FY 2014](#).
- ² Title XVI includes funding for the planning, design, and construction of water recycling and reuse projects. See details on [Title XVI projects here](#).
- ³ Title XVI studies include feasibility study funding for communities to decide whether the water recycling and reuse projects would meet their future water needs. See [details on FY 2014 studies here](#).
- ⁴ USBR is authorized directly by Congress to design and construct six rural potable water supply projects, benefiting tribal nations and rural communities in Montana, North and South Dakota, and New Mexico. Details on projects are available in [USBR's budget justification](#).
- ⁵ Water Conservation projects are a part of Bay-Delta Restoration efforts; USBR offers financial cost-share assistance to agencies with water delivery authority to implement water conservation. Examples of projects include irrigation system evaluations, system retrofits and upgrades, installation of water measurement devices, canal lining and piping, leak detection, and canal delivery system automation. More details are available in [USBR's budget justification](#).
- ⁶ Water Conservation Field Services Program provides funding for smaller-scale water conservation planning activities, on-the-ground efficiency improvements, and demonstration projects, as well as technical assistance from Reclamation staff. The funding was not available by state; the total number in table is for all 17 Western States in USBR's jurisdiction. More details are available in [USBR's budget justification](#).
- ⁷ The Clean Water State Revolving Fund (CWSRF) program is administered by Environmental Protection Agency as a federal-state partnership that provides financing for a variety of water quality projects—wastewater infrastructure, nonpoint source pollution control, and estuary management. Amounts shown are from EPA's [FY 2015 Budget In Brief](#).
- ⁸ The Drinking Water State Revolving Fund (DWSRF) program is administered by Environmental Protection Agency as a federal-state partnership that provides financing for safe drinking water projects, including improvements to drinking water treatment, fixes to leaky or old pipes, improvements to water supply sources, and replacement or construction of water storage tanks. Amounts shown are from EPA's [FY 2015 Budget In Brief](#).
- ⁹ Water & Waste Disposal Grants for Rural Communities, including colonias and Native American tribes, is a category that combines three different USDA Rural Utilities Services assistance types: Water and Waste Disposal Grants – Native American Grants, Water and Waste Disposal Grants – Colonias, and finally Rural Water and Waste Individually-Owned Water Well System Grants. Amounts shown are FY 2014 obligations from [USDA Rural Utilities Services FY 2016 budget justification](#).
- ¹⁰ Technical assistance is provided in the form of grants or training to eligible non-profits to identify solutions to rural water supply issues, assist applicants in preparing water/waste disposal grants and loans applications, or assist associations in improving operation and maintenance of existing water and waste facilities in rural areas. Eligible rural areas have fewer than 10,000 inhabitants. Amounts shown in table are FY 2014 obligations from [USDA Rural Utilities Services FY 2016 budget justification](#).
- ¹¹ Emergency Community Water Assistance Grants are provided to rural communities with less than 10,000 inhabitants and median household income less than \$62,883 that are experiencing a decline in capacity to provide safe drinking water to households. Eligible projects include repairs to breaks and leaks and construction of new water supply source, intake or treatment facilities. Amounts shown in table are FY 2014 obligations from [USDA Rural Utilities Services FY 2016 budget justification](#).
- ¹² Direct water and waste disposal loans are made to cities and towns with populations of less than 10,000 and rural areas. Eligible projects include developing water and wastewater systems, including solid waste disposal and storm drainage. Eligible applicants include state and local government entities, tribes, and non-profits. Amounts shown in table are FY 2014 obligations from [USDA Rural Utilities Services FY 2016 budget justification](#).
- ¹³ Waste and Water Disposal Grants are available to reduce water and waste disposal costs to a reasonable level for users of the system (covering up to 75% of the project costs). Eligible areas have less than 10,000 inhabitants. Amounts shown in table are FY 2014 obligations from [USDA Rural Utilities Services FY 2016 budget justification](#).
- ¹⁴ Through the Sanitation Facilities Construction Program, IHS works in partnership with tribes to ensure that tribal communities have access to water and sanitation facilities. Program components include surveying sanitation deficiencies in American Indian/Native communities, engineering assistance, utility master planning and construction services, technical consultation and training to tribes and assistance to tribes with sanitation facility emergencies. Individual state obligations for FY 2014 were not available; the Sanitation Facilities Construction Program breaks out funding by regions as follows: Portland Region (ID, OR, WA): \$3.4 million, Phoenix Region (AZ, NV, UT): \$5.3 million, California Region (CA): \$3.5 million, Albuquerque Region (NM, CO): \$3.9 million, Billings Region (MT, WY): \$3.2 million, Tucson Region (AZ): \$1.2 million, Navajo Nation: \$15.8 million. [See more here](#).
- ¹⁵ Community Block Development Grants are provided to states and local communities for a wide variety of purposes, from housing to business retention. CDBG funds must be used to benefit low- or moderate-income persons. One of the funding categories is water and sewer improvement. Amounts shown in table for Water and Sewer Improvements are for Program Year 2013 (June 2013–June 2014). The state numbers are aggregated from expenditure reports provided to HUD by individual grantees. [See more detail here](#).

¹⁶ Numbers are aggregated by state from [Army Corps Civil Works Construction Work Plan for FY 2014 and include](#) Civil Works construction projects range from flood control to environmental stewardship and navigation. The Work Plan provides details on all the projects that received construction funding in FY 2014.

¹⁷ CRP is shared by two USDA services: FSA and NRCS. FSA provides financial assistance and administers the program, and NRCS provides technical assistance. In exchange for a yearly rental payment, farmers enrolled in the program agree to remove environmentally sensitive land from agricultural production and plant species that will improve environmental health and quality. Contracts for land enrolled in CRP are 10-15 years in length. Amounts shown in table are FY 2014 total obligations, [available by state here](#). Land unit acres under the program by state are [available here](#).

¹⁸ EQIP is a voluntary program that provides financial and technical assistance to agricultural producers through contracts of up to a maximum term of 10 years in length (though in practice these are generally limited to 3 years). These contracts provide financial assistance to help plan and implement conservation practices that address natural resource concerns and opportunities to improve soil, water, plant, animal, air and related resources on agricultural land and non-industrial private forestland. For FY 2014 obligations by state see [USDA NRCS FY 2016 budget justification](#). Details on number of EQIP contracts and land unit acres under the program by state are [available here](#).

¹⁹ The RCPP combines the authorities of four former conservation programs – the Agricultural Water Enhancement Program, the Chesapeake Bay Watershed Program, the Cooperative Conservation Partnership Initiative, and the Great Lakes Basin Program. RCPP receives mandatory funding of \$100 million, and draws 7 percent of the funds from each of four other programs (EQIP, CSP, ACEP, and HFRP). RCPP provides funding in the form of financial and technical assistance to participating partners, landowners, and producers. RCPP funding is allocated across three competitive funding pools. The funding pools split the total available RCPP funds as required by statute: 40 percent are allocated to the national pool; 35 percent are allocated to the Critical Conservation Area (CCA) pool; and 25 percent are allocated to the state pool. The Critical Conservation Areas are determined by the Secretary of Agriculture. Because RCPP was a new program authorized by the 2014 Farm Bill, obligations shown in the table are not very high. For FY 2014 obligations by state, see [USDA NRCS FY 2016 budget justification](#). Summaries of 2015 RCPP projects are [available here](#).

²⁰ The Conservation Stewardship Program (CSP) provides two types of payments through five-year contracts: annual payments for installing new conservation activities and maintaining existing practices; and supplemental payments for adopting a resource-conserving crop rotation. Producers may be able to renew a contract if they have successfully fulfilled the initial contract and agree to achieve additional conservation objectives. For FY 2014 obligations by state see [USDA NRCS FY 2016 budget justification](#). Data on number of contracts and acreage enrolled in CSP is [available here](#).

²¹ Agricultural Conservation Easement Program (ACEP) is split into Agricultural Land Easements (30-year easements) and Wetland Reserve Easements (permanent easements). While Agricultural Land Easements keep farmland in production, Wetland Reserve Easements take land out of production to provide habitat for fish and wildlife, improve water quality by filtering sediments and chemicals, reduce flooding, recharge groundwater, protect biological diversity and provide opportunities for educational, scientific and limited recreational activities. For FY 2014 obligations by state, see [USDA NRCS FY 2016 budget justification](#). For acreage enrolled in ACEP, see [program results](#).

²² All USDA FSA disaster assistance Farm Bill programs are listed, except the Tree Assistance Program (TAP) (~\$800,000 in FY 2014 nationally) and Emergency Assistance for Livestock, Honey Bees, and Farm-raised Fish (ELAP) for which no funds were obligated in FY 2014.

²³ The Livestock Forage Program (LFP) provides payments to eligible livestock producers that have suffered grazing losses for covered livestock on land that is native or improved pastureland with permanent vegetative cover or is planted specifically for grazing. Losses must be due to drought or qualifying fire. For details on LFP payments by state, see [FSA's Disaster Assistance website](#).

²⁴ The Livestock Indemnity Program (LIP) provides payments to eligible livestock producers for livestock deaths in excess of normal mortality caused by adverse weather. For details on LIP payments by state, see [FSA's Disaster Assistance website](#).

²⁵ Emergency Loans are given to producers to help them recover from losses and damages caused by drought, flooding, and other natural disasters. Amounts are for FY 2013. A geographical breakdown of obligations is [available here](#).

²⁶ Disaster Set-Aside provides producers who have existing direct loans with FSA and who are unable to make the scheduled payments to move up to one full year's payment to the end of the loan. Amounts are for FY 2013. A geographical breakdown of obligations is [available here](#).

²⁷ The Emergency Conservation Program (ECP) provides assistance to producers if their land was damaged by a natural disaster and needs conservation practices. More information is available in the [FSA FY 2016 budget justification](#).

²⁸ The Emergency Forest Restoration Program (EFRP) provides payments to owners of private forests to restore forests damaged by natural disasters. More information is available in the [FSA FY 2016 budget justification](#).

²⁹ Crop insurance is a risk management tool producers can purchase to protect against losses caused by natural disasters or drops in price. USDA's RMA provides insurance policies for approximately 100 crops. Crop insurance indemnities are payments made to producers with insurance policies for qualifying losses. Although crop insurance is not considered emergency response in the traditional sense, we include it in the emergency section and count only indemnities caused by drought, heat, and water supply failure. Data are from crop insurance summary of business files for 2014, by state, available at [RMA's website](#). Data on [causes of loss are available here](#).

³⁰ Approximately two-thirds of the crop insurance premium is paid for by the federal government.

³¹ Crop insurance total premiums is a sum of the government subsidy and producer payments.

³² Fire Management Assistance Grant (FMAG) assistance is granted by the FEMA regional director and requested by the state governor or state governor's representative. The approval process is expedited and accomplished in a matter of hours, but the state has to show that fire costs exceed thresholds established by FEMA. FMAG provides a 75 percent cost share reimbursement to states, for costs such as firefighting (covers overtime, but not salaries of regular employees), evacuations, sheltering, emergency operations centers, etc. For FMAG declarations and assistance by state [see FEMA's website](#). FEMA also provides non-emergency grants to firefighting departments (not reported in the table): 1) Assistance to Firefighters Grants (approximately \$44 million for western states in 2014); and 2) Staffing for Adequate Fire and Emergency Response (SAFER) grants (approximately \$72 million for western states in 2014).

³³ Major disaster assistance funds listed in the table are for fire disasters only. At the request of a state governor, the president can declare a major disaster for any natural event, including drought, under the Stafford Act. No drought major disaster has been declared in the continental US since 1980. Major disaster declarations carry different types of financial assistance, e.g. repair of public infrastructure, temporary housing, and in some cases unemployment assistance and crisis counseling. For major disaster declarations and assistance by state [see FEMA's website](#).

Water- and Weather-Related Forecasting, Observations, and Research Spending

To get a picture of agency spending on water- and weather-related forecasting, observations, and research, we used budgets of the key agencies involved. For on-the-ground systems, we looked at the National Oceanic and Atmospheric Administration’s Office of Oceanic and Atmospheric Research (NOAA–OAR), the National Weather Service (NOAA–NWS), the US Department of Agriculture’s Natural Resource Conservation Service (USDA–NRCS), the US Geological Survey (USGS), and the Department of Energy’s Environmental Research. For satellite systems, we looked at NOAA’s National Environmental Satellite, Data, and Information Service (NOAA–NESDIS) and the National Aeronautics & Space Administration Agency (NASA).

Using descriptions from budget justifications, we allocated budget lines into the categories of forecasting and services, observations (sustained and experimental), and research (basic and applied), following the lead of the Office of Science and Technology Council’s *National Plan for Civil Earth Observations* (2014). Table A6 summarizes this information, and table notes provide details on how we broke out the agency budgets.

TABLE A6

Federal spending on water- and weather-related forecasting, observations, and research, FY 2014 (\$ millions)

Agencies	Descriptions	Forecasting and Related Services	Observations		Research		Total
			Sustained	Experimental	Applied	Basic	
Department of Energy ¹	Climate and earth system modeling					\$298	\$298
NASA ²	Satellites: Landsat, Suomi NPP, Aqua, etc.		\$40	\$1,054	\$95	\$636	\$1,825
NOAA-NESDIS ³	Product development, readiness and application; satellite and product operations		\$2,087				\$2,087
NOAA-NWS ⁴	Weather and climate forecasting	\$1,063					\$1,063
NOAA-OAR ⁵	NIDIS, Weather and air chemistry research, climate research				\$247		\$247
USDA-NRCS ⁶	Snow and soil surveys	\$9	\$80				\$89
USGS ⁷	Water use, streamflow gages, groundwater studies, water quality	\$162	\$68		\$109		\$339
Total		\$1,234	\$2,275	\$1,054	\$451	\$934	\$5,948
		21%	38%	18%	8%	16%	

SOURCE: Agency budgets, hyperlinked in notes.

NOTES:

¹ Based on FY 2014 numbers from [FY 2016 Department of Energy, Science Budget Justification](#). The entire Department of Energy's budget related to Environmental Research is categorized as basic research.

² Based on FY 2014 numbers from [NASA Earth Science budget](#). **Sustained observations:** 1) Landsat Continuity Mission/Sustainable Land Imaging (SLI): Under the SLI program, NASA and USGS will continue to work together to ensure sustained access to land remote sensing observations for US research and operational users. NASA will continue to develop, launch, and check space systems; USGS will develop the associated ground systems. 2) Suomi National Polar-Orbiting Partnership (Suomi NPP) is operated by NOAA and NASA and provides data on atmospheric composition, climate variability and change, carbon cycle, ecosystems, water and energy cycles, and weather. **Experimental observations:** 1) All Earth Systematic Missions (excluding Landsat and Suomi NPP) 2) Earth Science System Pathfinder. **Applied research:** 1) Earth Science Technology Program (ESTP) improves existing measurement capabilities and reduces the cost, risk, and/or development times for Earth science instruments and information systems; 2) Applied Science Program uses NASA Earth Science satellite measurements and new knowledge to provide practical uses for public and private sector organizations. Examples include: development of drought indicators with National Drought Mitigation Center, improvements in fishery stock assessments with National Marine Fisheries Service, etc. **Basic research:** 1) Earth Science Research (a program addressing complex, interdisciplinary Earth science problems in pursuit of a comprehensive understanding of the Earth system) and 2) Earth Science Multi-mission Operations.

³ Based on FY 2014 numbers from [NOAA FY 2015 Budget Justification](#). NESDIS satellite acquisition and operations are categorized under sustained observations. The NESDIS network of satellites provides data and information services including Earth system monitoring, performs official assessments of the environment, and conducts related research.

⁴ Based on FY 2014 numbers from [NOAA FY 2015 Budget Justification](#). The entire National Weather Service budget is categorized as **forecasting and related services**.

⁵ Based on FY 2014 numbers from [NOAA FY 2015 Budget Justification](#). Budget lines categorized as **applied research** include: 1) Climate Research (Regional Climate Data & Information, including NIDIS), 2) Weather and Air Chemistry Research (including US Weather Research Program), and 3) Innovative Research and Technology (High Performance Computing Initiatives)

⁶ Based on FY 2014 numbers from [USDA NRCS budget justification](#). **Forecasting and related services:** The snow survey team collects snow data in the western US (snow depth, snow water equivalent, etc.) and provides managers and users with snowpack data and water supply forecasts. **Sustained observations:** The soil survey provides information on the properties and conservation treatment needs of soils.

⁷ Based on FY 2014 numbers from [FY 2016 USGS budget justification](#). **Forecasting and related services:** 1) Groundwater and Streamflow Information Network program (includes stream gages): collects, manages, and disseminates hydrologic information in real time and over the long term, and 2) National Water Quality Program performs large-scale, long-term monitoring and studies of prominent water-quality issues and detailed, small-scale studies provide critical information for water managers, policy makers and the public about current water-quality conditions. **Sustained observations:** Land Remote Sensing (Under Land Use Change account) collects, interprets, and provides land-surface information using data acquired by satellite and airborne instruments. **Applied research:** 1) Water Use and Availability program, and 2) Land Use & Climate Change program (everything except Land Remote Sensing).

PUBLIC POLICY
INSTITUTE OF
CALIFORNIA

Board of Directors

Donna Lucas, Chair
Chief Executive Officer
Lucas Public Affairs

Mark Baldassare
President and CEO
Public Policy Institute of California

Ruben Barrales
President and CEO
GROW Elect

María Blanco
Executive Director
Undocumented Student Legal Services Center
University of California Office of the President

Louise Henry Bryson
Chair Emerita, Board of Trustees
J. Paul Getty Trust

A. Marisa Chun
Partner
McDermott Will & Emery LLP

Phil Isenberg
Vice Chair, Delta Stewardship Council

Mas Masumoto
Author and Farmer

Steven A. Merksamer
Senior Partner
Nielsen, Merksamer, Parrinello,
Gross & Leoni, LLP

Gerald L. Parsky
Chairman
Aurora Capital Group

Kim Polese
Chairman
ClearStreet, Inc.

Gaddi H. Vasquez
Senior Vice President
Government Affairs
Edison International
Southern California Edison

PPIC WATER
POLICY CENTER

Advisory Council

Frances Spivy-Weber, Chair
Vice Chair
State Water Resources Control Board

Timothy Quinn, Vice Chair
Executive Director
Association of California Water Agencies

Mark Baldassare
President and CEO
Public Policy Institute of California

Celeste Cantú
General Manager
Santa Ana Watershed Project Authority

Dave Cogdill
President & CEO
California Building Industry Association

Lauren B. Dachs
President and Vice Chair of the Board of
Directors
S. D. Bechtel, Jr. Foundation

Daniel M. Dooley
Principal
New Current Water and Land, LLC

Debbie Franco
Community and Rural Affairs Advisor and
Local Drought Liaison
Governor's Office of Planning and Research

Phil Isenberg
Vice Chair
Delta Stewardship Council

Debra C. Man
Assistant General Manager and Chief
Operating Officer
Metropolitan Water District of Southern
California

David Puglia
Executive Vice President
Western Growers Association

Lester Snow
Executive Director
California Water Foundation

Mike Sweeney
Executive Director
The Nature Conservancy California Chapter



PPIC

PUBLIC POLICY
INSTITUTE OF CALIFORNIA

The Public Policy Institute of California is dedicated to informing and improving public policy in California through independent, objective, nonpartisan research.

Public Policy Institute of California
500 Washington Street, Suite 600
San Francisco, CA 94111
T: 415.291.440
F: 415.291.4401
PPIC.ORG

PPIC Sacramento Center
Senator Office Building
1121 L Street, Suite 801
Sacramento, CA 95814
T: 916.440.1120
F: 916.440.1121