

## Irrigation

115,000 million gallons per day

Irrigation water use includes water that is applied by an irrigation system to sustain plant growth in all agricultural and horticultural practices. Irrigation also includes water that is used for pre-irrigation, frost protection, application of chemicals, weed control, field preparation, crop cooling, harvesting, dust suppression, and leaching salts from the root zone. Estimates of irrigation withdrawals include water that is lost in conveyance prior to application on fields as well as water that may subsequently return to a surface-water body as runoff after application, water consumed as evapotranspiration (ET) from plants and ground surfaces, or water that recharges aquifers as it seeps past the root zone. Irrigation of golf courses, parks, nurseries, turf farms, cemeteries, and other self-supplied landscape-watering uses also are included in the estimates. Irrigation water use includes self-supplied withdrawals and deliveries from irrigation companies or districts, cooperatives, or governmental entities. Some irrigation water is reclaimed wastewater from nearby treatment facilities or industries although these quantities are not included in irrigation withdrawals reported here. All irrigation withdrawals are considered freshwater. Irrigated acres are reported by three types of irrigation methods: sprinkler, microirrigation, and surface (flood) systems.

Irrigation withdrawals and irrigated acres by type of irrigation system are listed by State in table 7. For 2010, total irrigation withdrawals were 115,000 Mgal/d, or 129,000 thousand acre-ft/yr, which accounted for 38 percent of total freshwater withdrawals and 61 percent of total freshwater withdrawals for all categories excluding thermoelectric power. Total irrigation withdrawals were 9 percent less than in 2005. Withdrawals from surface-water sources were 65,900 Mgal/d, which accounted for 57 percent of the total irrigation withdrawals, and were almost 12 percent less than in 2005. Groundwater withdrawals for 2010 were 49,500 Mgal/d, or 6 percent less than in 2005.

About 62,400 thousand acres were irrigated in 2010, an increase of about 950 thousand acres (1.5 percent) from 2005. About 31,600 thousand acres (51 percent) were irrigated with sprinkler systems, 26,200 thousand acres with surface (flood), and 4,610 thousand acres with microirrigation systems. The national average application rate for 2010 was 2.07 acre-feet per acre, or 11 percent less than the 2005 average of 2.32 acre-feet per acre.

The geographic distribution of total, surface-water, and groundwater withdrawals for irrigation is shown in figure 7. The majority of total U.S. irrigation withdrawals (83 percent) and irrigated acres (74 percent) were in the 17 conterminous Western States (west of solid line in figure 7), which are typical of areas where average annual precipitation is less than 20 inches and generally insufficient to support crops without

supplemental water. Surface water was the primary source of water in the arid West, except in Kansas, Oklahoma, Nebraska, Texas, and South Dakota, where more groundwater was used. The 17 Western States cumulatively accounted for 93 percent of total surface-water irrigation withdrawals and 69 percent of total groundwater irrigation withdrawals.

Because the 17 Western States accounted for the majority of total irrigation withdrawals, changes in those States had a great effect on the overall total. Total irrigation withdrawals declined noticeably in Nebraska, Montana, Idaho, Colorado, and California. Groundwater irrigation withdrawals declined in the West and increased in the East, and surface-water irrigation withdrawals declined in both regions. Total irrigated acres increased in both regions—1 percent (568 thousand acres) in the West, and 2 percent (381 thousand acres) in the East. In the West, the total number of acres irrigated by the less-efficient surface-irrigation methods decreased by about 500 thousand acres, and the number of acres irrigated by more efficient sprinkler (including microirrigation) methods increased by about 1,080 thousand acres.

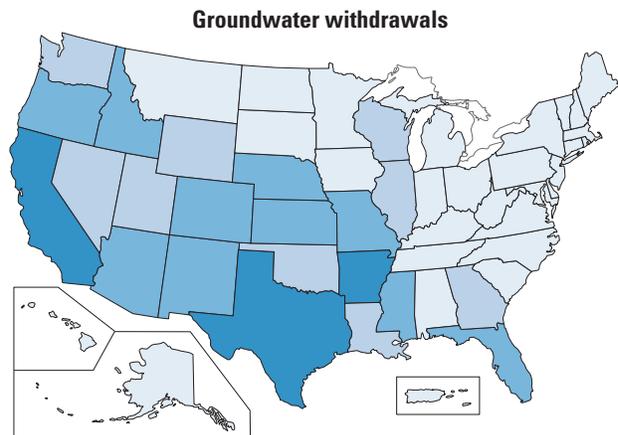
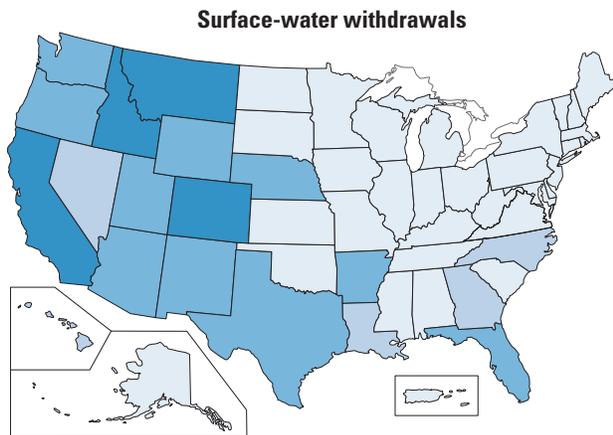
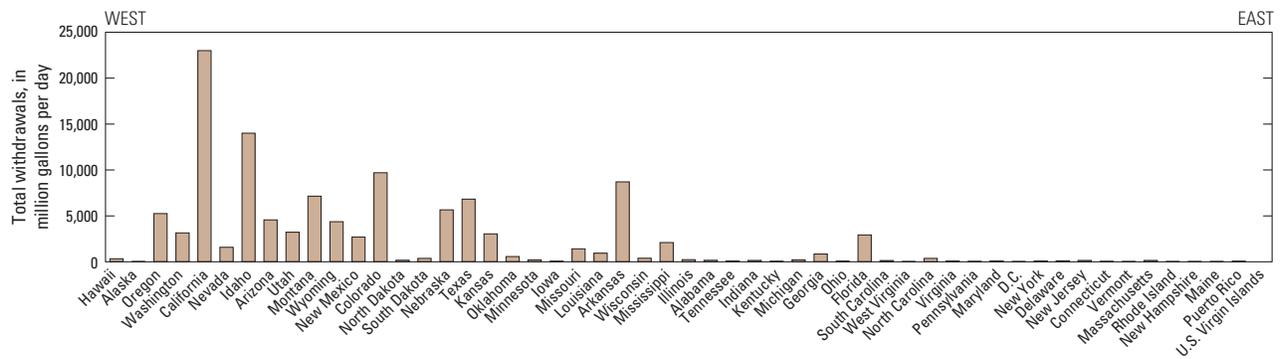
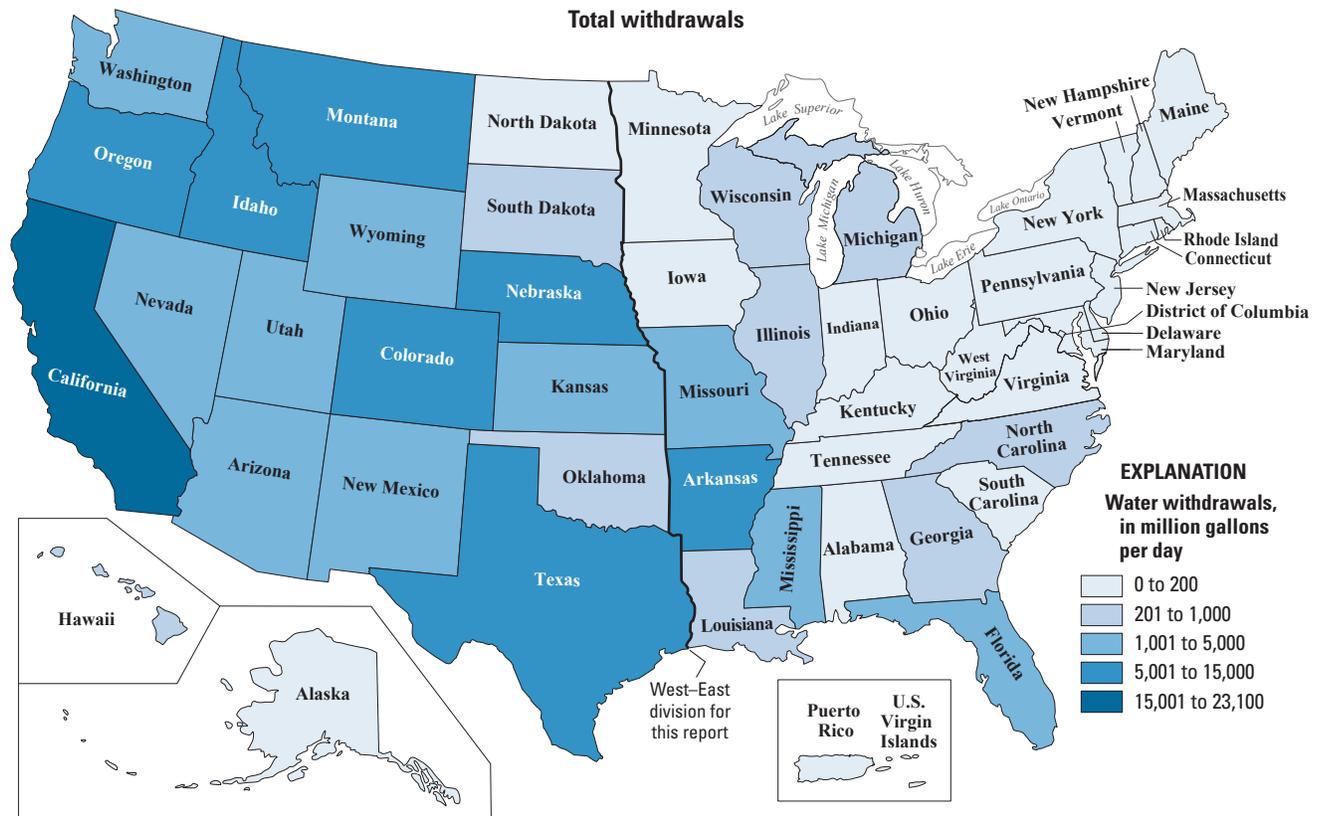
Average application rates are calculated as a function of total irrigation withdrawals and total irrigated acres. The highest application rates are found in arid Western States, where more surface water than groundwater is used for irrigation and water typically is conveyed longer distances in canals between the points of diversion and use. Among the Western States, cumulatively, more lands were irrigated with sprinkler (including microirrigation) systems than surface methods, and land using the microirrigation system are increasing at a faster rate than the other two types of systems. Several States that used the large quantities of water for irrigation in 2010, such as California, Idaho, Colorado, Texas, and Nebraska, showed declines in application rates from 2005 levels, and in all of these States the number of acres irrigated by sprinkler or microirrigation systems increased in 2010.

Sources of data for irrigation withdrawals and irrigated acres included State and Federal crop reporting programs, irrigation districts, canal companies, incorporated management areas, and satellite data depicting 2010 cropland landscapes. Withdrawals also were estimated using information on irrigated crop acreages by crop type and specific crop water-consumption coefficients, or irrigation-system application rates, as well as soil moisture balance models. Estimation methods varied from one State to the next and sometimes between geographic areas within a State. Estimation methods ideally included adjustments for climate, system efficiencies, conveyance losses, and other irrigation practices such as pre-irrigation, salt leaching, or frost protection. Other methods for estimating irrigation withdrawals included extrapolation of sample data on crop water-application rates or power-consumption coefficients.

**Table 7.** Irrigation water withdrawals, 2010.

[Values may not sum to totals because of independent rounding]

State	Irrigated land (in thousand acres)				Withdrawals (in million gallons per day)			Withdrawals (in thousand acre-feet per year)			Average application rate (in acre-feet per acre)
	By type of irrigation			Total	By source		Total	By source			
	Sprinkler	Micro- irrigation	Surface		Ground- water	Surface water		Ground- water	Surface water	Total	
Alabama.....	150	1.42	0.52	152	84.9	74.0	159	95.2	83.0	178	1.18
Alaska.....	3.10	0	0.07	3.17	1.57	0.02	1.59	1.76	0.02	1.78	0.56
Arizona.....	195	28.1	770	993	1,690	2,880	4,570	1,900	3,220	5,120	5.16
Arkansas.....	518	0	4,150	4,670	7,380	1,340	8,720	8,270	1,500	9,770	2.09
California.....	1,790	2,890	5,670	10,400	8,690	14,400	23,100	9,740	16,100	25,800	2.50
Colorado.....	1,410	0.20	1,930	3,340	1,300	8,420	9,710	1,450	9,440	10,900	3.26
Connecticut.....	24.0	1.83	0	25.8	0.85	23.1	24.0	0.95	25.9	26.9	1.04
Delaware.....	132	1.11	0	133	86.1	15.2	101	96.5	17.1	114	0.85
District of Columbia.....	0.32	0	0	0.32	0.05	0.05	0.10	0.06	0.06	0.11	0.35
Florida.....	548	712	731	1,990	1,580	1,340	2,920	1,770	1,500	3,270	1.64
Georgia.....	1,280	152	0	1,430	636	202	839	713	227	940	0.66
Hawaii.....	11.2	158	0	169	101	223	323	113	249	363	2.14
Idaho.....	2,420	4.57	1,180	3,600	3,820	10,200	14,000	4,280	11,500	15,700	4.37
Illinois.....	483	0	0	483	208	17.5	226	233	19.6	253	0.52
Indiana.....	397	0	0	397	98.4	38.7	137	110	43.4	154	0.39
Iowa.....	187	0	0	187	41.6	1.18	42.8	46.7	1.32	48.0	0.26
Kansas.....	2,840	18.0	217	3,080	2,880	160	3,040	3,230	179	3,410	1.11
Kentucky.....	54.4	3.56	2.35	60.3	1.65	27.4	29.0	1.85	30.7	32.5	0.54
Louisiana.....	87.3	0	839	926	670	258	928	751	289	1,040	1.12
Maine.....	46.6	0.06	1.18	47.8	2.51	8.77	11.3	2.81	9.83	12.6	0.26
Maryland.....	102	3.43	0	105	53.4	18.6	72.1	59.9	20.9	80.8	0.77
Massachusetts.....	26.2	2.02	12.0	40.3	118	21.4	139	132	24.0	156	3.87
Michigan.....	477	27.2	1.54	506	147	62.6	209	164	70.1	235	0.46
Minnesota.....	516	0	24.5	540	171	26.7	197	191	29.9	221	0.41
Mississippi.....	409	0	1,380	1,790	1,960	133	2,090	2,200	149	2,350	1.31
Missouri.....	544	2.08	760	1,310	1,350	49.6	1,400	1,520	55.6	1,570	1.20
Montana.....	753	0.64	886	1,640	127	7,030	7,160	142	7,880	8,030	4.90
Nebraska.....	6,370	0.57	2,360	8,730	4,300	1,360	5,660	4,820	1,520	6,340	0.73
Nevada.....	258	0.07	319	577	653	921	1,570	732	1,030	1,760	3.06
New Hampshire.....	4.87	0.82	0.23	5.92	1.25	0.67	1.92	1.40	0.75	2.15	0.36
New Jersey.....	68.8	25.6	4.93	99.3	67.6	70.1	138	75.8	78.5	154	1.55
New Mexico.....	461	19.6	397	878	1,240	1,460	2,700	1,390	1,640	3,020	3.44
New York.....	81.1	24.6	2.77	108	30.2	40.2	70.4	33.9	45.0	78.9	0.73
North Carolina.....	262	6.18	0	268	88.3	279	367	98.9	312	411	1.53
North Dakota.....	192	0	42.2	234	77.5	87.2	165	86.9	97.8	185	0.79
Ohio.....	59.8	6.06	0	65.9	17.2	35.4	52.6	19.2	39.7	58.9	0.89
Oklahoma.....	440	5.28	89.1	534	429	135	564	481	151	632	1.18
Oregon.....	1,210	97.0	594	1,900	1,910	3,350	5,260	2,140	3,750	5,890	3.10
Pennsylvania.....	53.0	15.1	0	68.1	7.39	19.8	27.1	8.28	22.1	30.4	0.45
Rhode Island.....	4.93	1.24	0.02	6.19	2.30	0.39	2.69	2.58	0.44	3.02	0.49
South Carolina.....	141	8.05	4.04	154	67.7	57.4	125	75.9	64.4	140	0.91
South Dakota.....	144	0	49.6	194	198	165	362	221	185	406	2.10
Tennessee.....	74.0	9.80	7.98	91.8	44.3	27.6	71.9	49.6	31.0	80.6	0.88
Texas.....	3,770	244	1,910	5,920	5,100	1,730	6,830	5,710	1,940	7,660	1.29
Utah.....	625	1.45	710	1,340	494	2,730	3,220	554	3,060	3,610	2.70
Vermont.....	2.98	0.69	0.31	3.98	0.77	1.68	2.45	0.86	1.88	2.75	0.69
Virginia.....	102	14.6	0	117	16.0	45.4	61.4	18.0	50.8	68.8	0.59
Washington.....	1,270	86.1	221	1,580	798	2,350	3,150	894	2,630	3,530	2.24
West Virginia.....	2.52	0	1.09	3.61	0.05	0.04	0.09	0.06	0.04	0.10	0.03
Wisconsin.....	356	0	50.3	406	256	123	379	287	138	425	1.04
Wyoming.....	184	4.12	893	1,080	437	3,930	4,370	490	4,410	4,900	4.53
Puerto Rico.....	8.17	32.7	0	40.8	22.4	15.7	38.2	25.1	17.6	42.8	1.05
U.S. Virgin Islands.....	0	0	0	0	0	0	0	0	0	0	0
TOTAL	31,600	4,610	26,200	62,400	49,500	65,900	115,000	55,400	73,900	129,000	2.07



**Figure 7.** Irrigation withdrawals by source and State, 2010.