
GENERAL DISCUSSION

(Section B)

GENERAL DISCUSSION

Precipitation for Census Years

The Census of 1940 completed a span of 50 years in which the Federal Census has gathered statistics on irrigation. Table 1 shows the eight individual years when irrigation enumerations were made and the mean annual precipitation and departures from normal for those years, as recorded by the United States Weather Bureau. The average monthly precipitation, by States, for the water year (October 1938 through September 1939), is given in table 2. These data, together with those for recorded rainfall and departures from normal for all years from 1888 to 1939, are presented graphically in charts I to VIII. An analysis of these figures indicates that in most States the annual precipitation was below normal in most of the census years. In many sections of the West the areas most affected by variations in the amount and distribution of precipitation are lands reported as irrigated pasture. This acreage seems to accord largely with the fluctuations in the amount of water available for pasture irrigation in the spring and

fall, before and after the requirements of other more valuable crops are satisfied, a relation and practice which should be taken into consideration in the use of irrigated pasture data. When a census year falls in, or at the end of, a drought or period of excessive precipitation, the available water supply, areas irrigated, and crop yields are correspondingly affected. Therefore, users of Census data should take into consideration, in their interpretation of Irrigation Census statistics, the precipitation factor for the years concerned.

Precipitation for the calendar year 1939 and the water year (October 1938 through September 1939) was below normal in the 19 western Irrigation States. Colorado, California, and Nebraska received the least rainfall during 1939, amounting to 65, 67, and 72 percent of normal, respectively. Idaho, Kansas, eastern Oregon, eastern Washington, and Wyoming received approximately 75 percent of their normal precipitation (see tables 1 and 2). Additional tabulations and discussions of precipitation and temperatures for the years 1938 and 1939 accompany each State report following this summary.

TABLE 1.—PRECIPITATION AND DEPARTURES FROM NORMAL: 1889, 1899, 1902, 1909, 1919, 1929, 1934, AND 1939
(For the 17 western States and Arkansas, Louisiana, and Florida)

STATE	Normal for period	PRECIPITATION																		Percent of normal
		1889		1899		1902		1909		1919		1929		1934		1939				
		Amount	Depart. ¹	Amount	Depart. ¹	Amount	Depart. ¹	Amount	Depart. ¹	Amount	Depart. ¹	Amount	Depart. ¹	Amount	Depart. ¹	Amount	Depart. ¹			
Arizona	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches			
Arkansas	15.89	13.29	-0.80	8.61	-5.28	10.23	-3.68	14.48	+0.59	20.70	+6.81	11.29	-2.60	10.47	-3.42	12.88	-1.01	95		
California	46.25	45.61	-2.64	41.49	-6.76	51.70	+3.45	44.08	-4.20	54.52	+8.27	46.10	-2.15	42.47	-5.78	50.16	+1.91	104		
Colorado	28.72	33.25	+9.53	22.47	-1.25	24.22	+0.50	42.15	+18.41	21.29	-2.43	15.00	-8.72	18.01	-5.71	15.80	-7.92	87		
Idaho	18.98	13.73	-2.85	14.67	-1.71	13.88	-2.50	20.98	+4.58	17.14	+0.76	18.16	+1.78	10.89	-5.49	10.68	-5.70	85		
Kansas	17.96	14.76	-3.20	18.96	+1.00	16.98	-1.00	22.85	+4.87	15.97	-1.99	13.94	-4.02	16.10	-1.86	13.73	-4.23	76		
Louisiana	26.43	29.44	+3.01	26.26	-0.17	34.42	+7.99	31.15	+4.72	25.85	-0.78	27.96	+1.53	20.02	-6.41	20.08	-6.35	76		
Montana	55.45	41.21	-14.24	42.19	-13.26	46.89	-8.56	53.25	-2.20	69.23	+13.78	65.65	+8.20	59.23	+3.78	51.51	-3.94	93		
Nebraska	15.23	8.94	-6.29	15.74	+0.51	15.12	-0.11	19.72	+4.49	10.88	-4.35	13.08	-2.15	11.87	-3.36	12.83	-2.40	84		
Nevada	22.56	22.29	-0.27	19.55	-3.01	29.47	+6.91	24.64	+2.08	25.09	+2.55	22.74	+0.18	14.31	-8.25	16.28	-6.28	72		
New Mexico	9.22	12.41	+3.19	9.12	-0.10	7.25	-1.97	11.03	+1.81	7.08	-2.14	5.83	-3.39	7.12	-2.10	8.48	-0.74	92		
North Dakota	14.43	10.97	-3.46	10.98	-3.45	9.97	-4.46	12.85	-1.60	20.95	+6.52	16.48	+2.05	10.08	-4.35	13.22	-1.21	92		
Oklahoma	16.87	11.54	-5.33	17.62	+0.75	19.35	+2.48	18.10	+1.23	15.59	-1.28	14.51	-2.56	9.51	-7.58	14.15	-2.72	84		
Oregon	32.27	31.01	-1.26	36.07	+3.80	40.54	+8.27	27.01	-5.28	34.41	+2.14	35.59	+5.12	27.46	-4.81	26.71	-5.56	85		
Eastern Division	26.10	29.79	+3.69	31.06	+4.96	29.88	+3.78	32.85	+6.75	26.21	+0.11	19.53	-6.77	25.87	-0.23	20.77	-5.33	80		
Western Division	13.81	16.60	+2.79	15.23	+1.42	12.60	-1.21	17.00	+3.19	12.41	-1.40	11.58	-2.23	14.07	+0.26	10.50	-3.31	76		
South Dakota	53.83	30.38	-23.45	66.70	+12.87	68.76	+14.95	69.31	+15.48	57.28	+3.45	38.66	-15.17	53.53	-0.30	43.90	-9.93	82		
Texas	18.87	18.34	-0.53	18.84	-0.03	19.54	+0.67	22.74	+3.87	19.64	+0.77	20.83	+1.76	12.58	-6.29	15.71	-3.16	85		
Utah	30.63	38.06	+7.43	28.70	-1.93	33.92	+3.29	23.45	-7.18	45.64	+15.01	31.17	+0.54	26.78	-3.85	24.69	-5.94	81		
Washington	12.95	12.67	-0.28	11.83	-1.12	9.17	-3.78	19.31	+6.36	11.83	-1.12	15.60	+0.65	9.52	-3.43	11.49	-1.46	89		
Eastern Division	34.75	31.83	-2.92	45.07	+10.32	40.24	+5.49	35.87	+1.12	31.00	-3.75	23.74	-11.01	38.27	+3.52	32.00	-2.75	92		
Western Division	16.70	13.62	-3.08	18.97	+2.27	17.69	+0.99	17.40	+0.70	18.22	+1.52	10.19	-6.51	17.13	+0.43	12.83	-3.87	77		
Wyoming	57.33	36.02	-21.31	67.87	+10.54	62.98	+5.65	58.75	+1.42	52.08	-5.25	44.01	-13.32	69.87	+12.64	59.74	+2.41	104		
Florida	14.01	12.93	-1.08	13.58	-0.43	9.81	-4.20	16.35	+2.32	10.46	-3.55	15.06	+1.05	10.88	-3.13	10.27	-3.74	73		
	52.73	50.69	-2.04	52.65	-0.08	51.53	-1.40	48.37	-4.36	57.50	+4.77	59.19	+6.46	52.94	+0.21	54.54	+1.81	103		

¹Departure from normal.

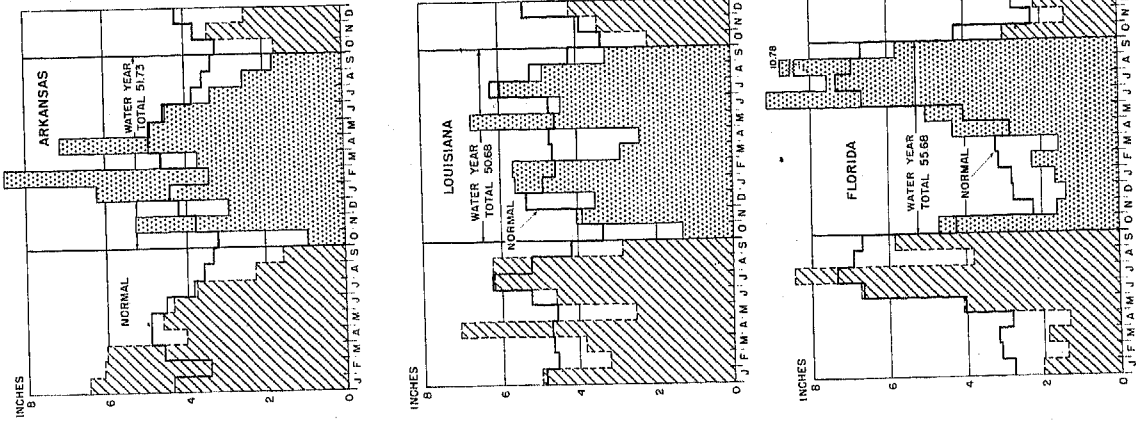
TABLE 2.—MONTHLY AND ANNUAL PRECIPITATION WITH ANNUAL DEPARTURE FOR CALENDAR YEARS, 1938 AND 1939; AND MONTHLY AND TOTAL PRECIPITATION WITH DEPARTURE FOR PERIOD FOR WATER YEAR, OCTOBER 1938 THROUGH SEPTEMBER 1939
(For the 17 western States, Arkansas, Louisiana, and Florida)

STATE	PRECIPITATION																			
	1938										1939									
	Water Year										Water Year									
	Jan.-Mar.	Apr.-June	July-Sept.	Oct.	Nov.	Dec.	Annual	Annual	Annual	Annual	Jan.-Mar.	Apr.-June	July-Sept.	Oct.	Nov.	Dec.	Annual	Annual	Annual	Annual
Arizona	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches
Arkansas	4.58	1.29	4.56	0.10	0.07	2.20	12.80	-1.09	1.12	1.20	0.66	0.58	0.04	0.04	1.16	2.36	3.79	13.30	-0.59	1.95
California	18.58	12.99	7.55	0.94	5.26	2.93	48.25	0.00	6.21	8.56	3.71	7.13	4.85	4.50	3.34	2.53	1.77	51.73	+8.48	7.56
Colorado	21.31	2.59	0.60	1.61	1.17	2.78	30.06	+6.34	3.23	2.25	2.90	0.52	0.97	0.12	0.08	0.07	1.70	17.40	-6.32	3.98
Idaho	3.98	6.23	6.45	0.87	0.88	0.89	19.35	+2.97	1.30	1.09	1.14	0.81	1.03	0.82	0.90	1.08	1.10	12.06	-4.32	1.31
Kansas	7.02	4.40	2.19	2.58	1.91	1.46	19.56	+1.60	1.69	2.01	1.29	0.68	0.81	1.29	0.69	0.16	0.97	15.54	-2.42	4.14
Louisiana	3.67	14.05	7.62	0.33	1.40	0.20	27.27	+0.84	0.78	1.22	1.72	1.98	2.35	4.59	1.40	3.50	0.32	19.77	-6.66	2.24
Montana	11.99	14.16	15.23	1.32	4.03	3.53	50.26	-5.19	5.82	5.89	2.89	2.40	6.72	4.42	5.97	4.86	3.23	50.68	-4.77	9.71
Nebraska	2.54	6.98	3.66	1.75	0.89	0.56	16.60	+1.37	0.70	0.61	0.72	0.78	1.89	3.52	0.68	0.62	0.94	13.86	-1.37	2.17
Nevada	2.41	10.65	8.09	0.18	0.72	0.18	22.23	-0.33	0.70	0.87	1.21	1.40	2.53	3.84	1.85	2.04	0.44	15.94	-6.82	1.42
New Mexico	4.67	3.52	1.34	1.32	0.52	0.42	11.79	+2.57	0.96	0.78	0.95	0.79	0.73	0.19	0.60	0.34	1.34	8.94	-0.28	1.80
North Dakota	2.38	3.46	6.63	1.10	0.27	0.78	14.62	+0.19	1.39	0.61	0.76	0.88	0.72	0.64	2.45	1.78	1.83	13.17	-1.26	2.18
Oklahoma	1.75	6.37	5.47	0.55	0.87	0.32	15.35	-1.54	0.47	0.63	0.39	0.87	1.55	4.59	1.81	2.10	0.68	14.83	-2.04	1.06
Oregon	10.15	13.20	6.51	0.52	2.21	0.62	33.21	+0.94	2.79	1.67	1.82	2.44	3.78	5.35	1.65	2.66	0.35	25.82	-6.45	4.24
Eastern Division	13.33	3.60	1.49	2.06	3.55	2.48	26.31	+0.21	2.90	3.53	2.23	0.44	1.07	1.05	0.49	0.35	0.64	20.59	-5.51	8.07
Western Division	6.70	2.87	1.30	1.29	1.71	1.02	14.89	+1.08	1.09	1.68	1.22	0.22	0.78	0.61	0.35	0.12	0.55	10.62	-3.19	3.90
South Dakota	28.05	5.25	1.93	3.80	7.04	5.76	51.83	-2.00	6.97	7.70	4.51	0.93	1.75	2.03	0.79	0.68	0.86	43.02	-10.81	17.42
Texas	2.35	8.67	5.49	0.16	0.57	0.26	17.50	-1.37	0.95	0.69	0.35	1.03	2.32	4.15	1.85	1.92	1.02	15.27	-3.60	1.43
Utah	7.12	9.65	6.39	0.87	1.50	1.72	27.18	-5.45	3.10	1.66	1.04	1.47	3.16	5.05	2.60	2.21	1.12	23.70	-6.93	5.08
Washington	5.24	5.60	2.52	1.70	1.16	0.97	15.19	+2.24	1.37	1.29	0.94	0.78	0.88	0.85	0.54	0.66	2.61	13.53	+0.59	1.79
Eastern Division	11.40	4.23	1.54	3.55	4.01	4.54	29.27	-5.48	5.79	4.44	2.45	0.91	1.52	1.64	0.84	0.43	0.84	30.96	-5.78	13.14
Western Division	6.30	2.07	0.91	1.64	1.70	1.17	13.79	-2.91	1.97	1.99	1.12	0.45	0.60	0.85	0.18	0.13	0.34	12.12	-4.68	5.22
Wyoming	19.05	7.52	2.68	6.40	7.46	8.69	52.70	-4.63	11.51	8.12	4.45	1.64	2.90	2.83	1.84	0.87	1.59	59.20	+1.87	23.99
Florida	2.61	5.75	4.04	1.17	1.01	0.68	15.26	+1.25	0.78	0.85	0.68	0.96	1.87	1.70	0.81	0.78	0.92	11.91	-2.10	1.22
Florida	5.28	12.14	18.10	4.70	1.60	1.35	43.17	-9.56	1.82	2.25	1.54	4.32	5.01	9.13	7.59	10.78	5.79	65.68	+2.95	6.51

¹Departure from normal.

CHART I - ARKANSAS, LOUISIANA, AND FLORIDA

AVERAGE MONTHLY PRECIPITATION
1938 AND 1939



AVERAGE ANNUAL PRECIPITATION AND DEPARTURE FROM NORMAL 1888-1939

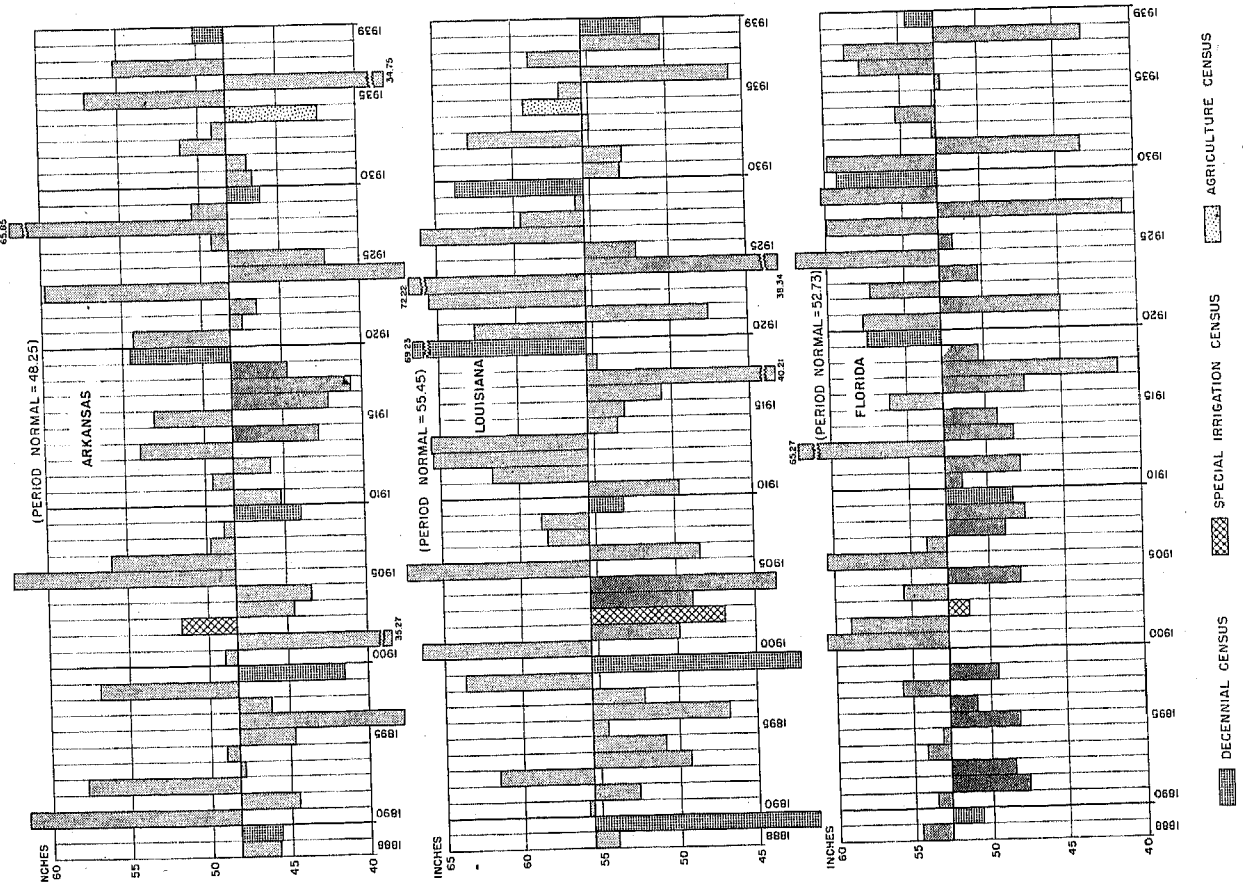
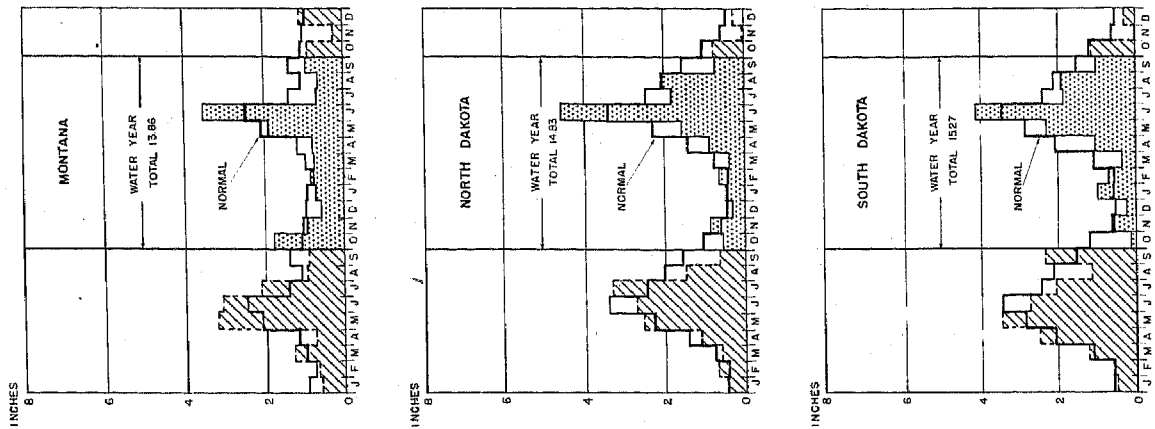


CHART II - MONTANA, NORTH DAKOTA, AND SOUTH DAKOTA

AVERAGE MONTHLY PRECIPITATION
1938 AND 1939



AVERAGE ANNUAL PRECIPITATION AND DEPARTURE FROM NORMAL 1888-1939

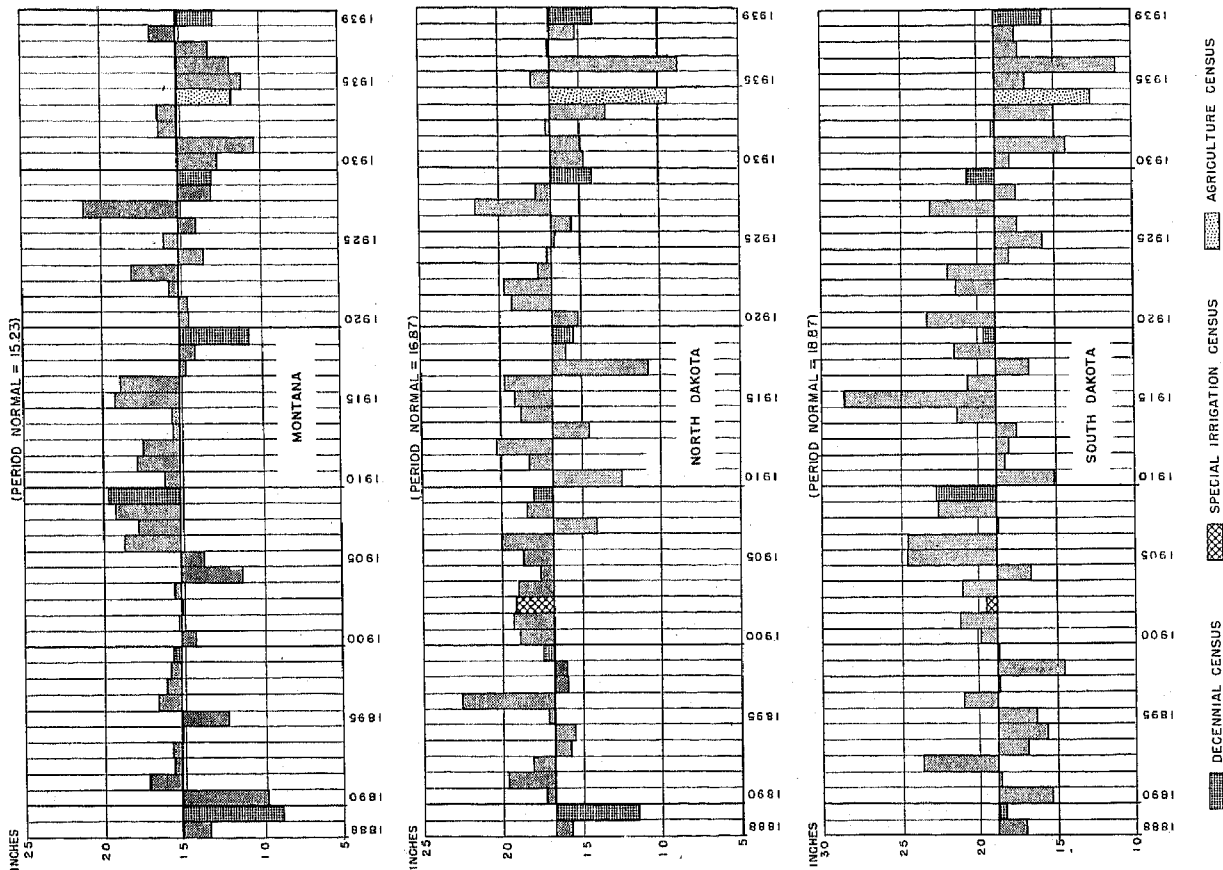
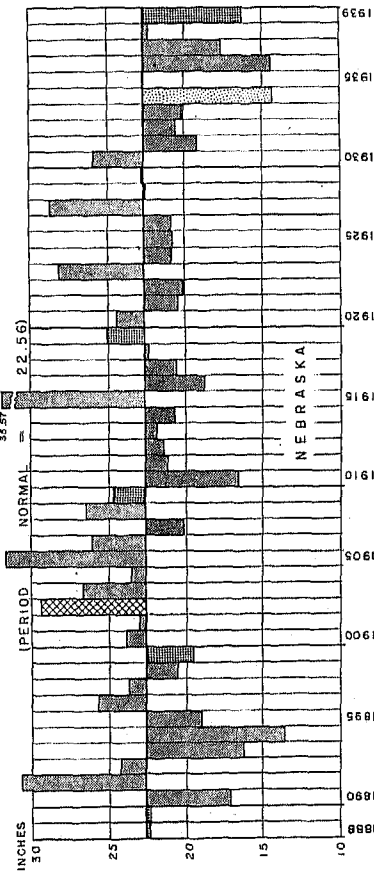
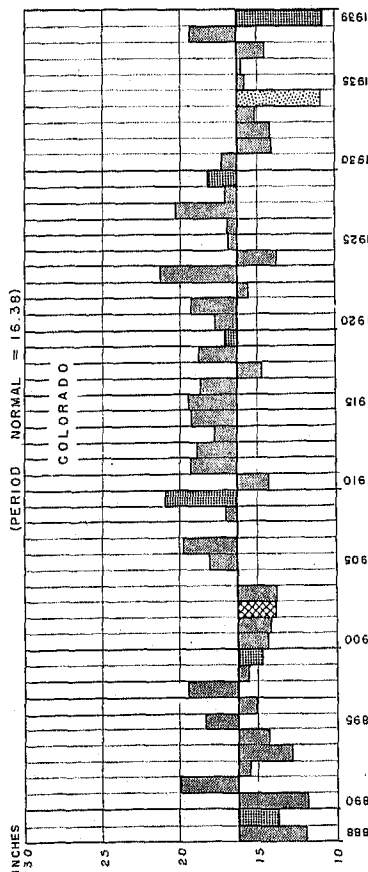
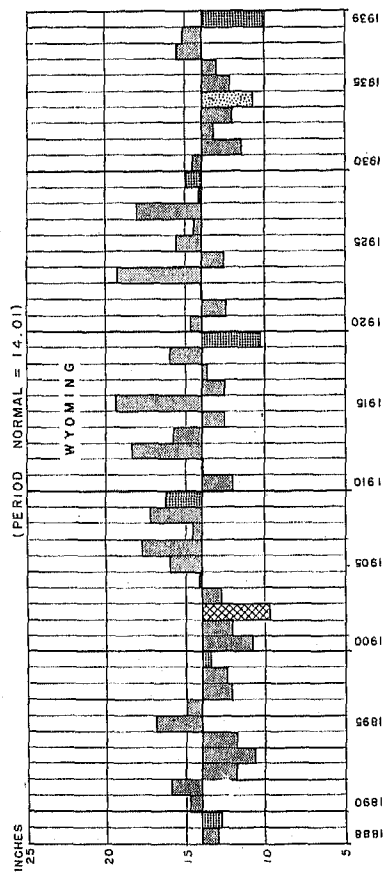


CHART III - WYOMING, COLORADO, AND NEBRASKA

AVERAGE ANNUAL PRECIPITATION AND DEPARTURE FROM NORMAL 1888-1939



DECENNIAL CENSUS SPECIAL IRRIGATION CENSUS AGRICULTURE CENSUS

GENERAL DISCUSSION

AVERAGE MONTHLY PRECIPITATION 1938 AND 1939

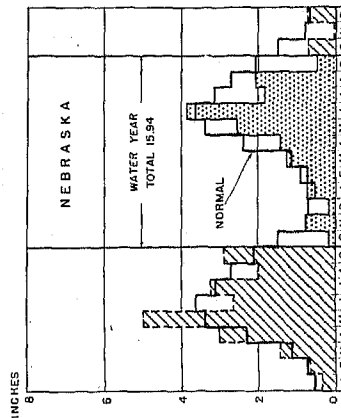
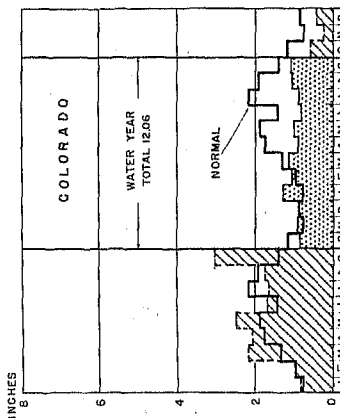
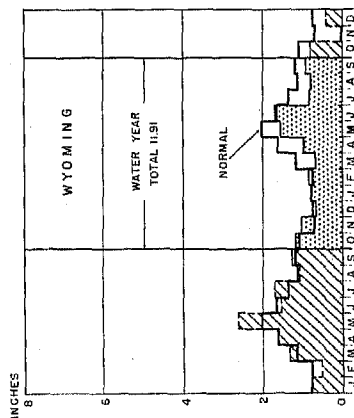


CHART IV - KANSAS, OKLAHOMA, AND TEXAS

AVERAGE ANNUAL PRECIPITATION AND DEPARTURE FROM NORMAL 1888-1939

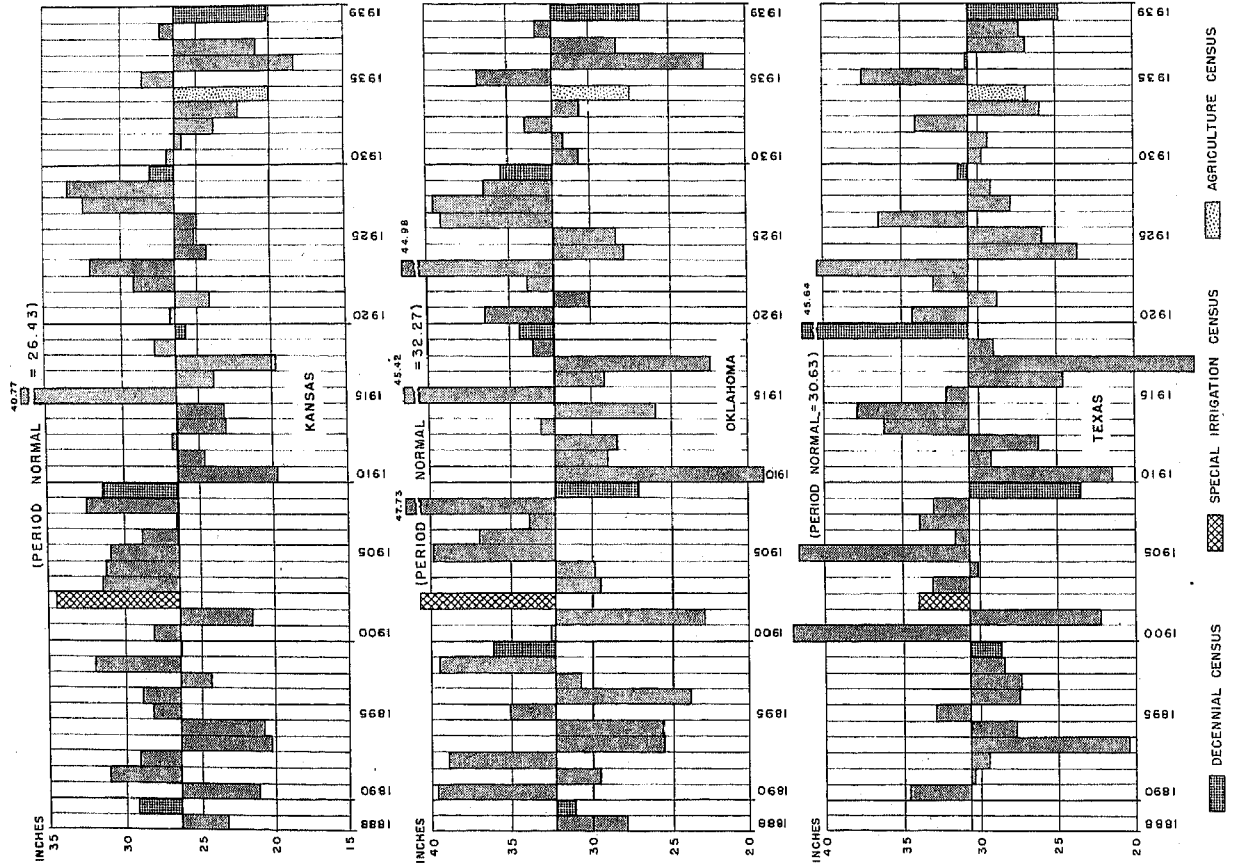
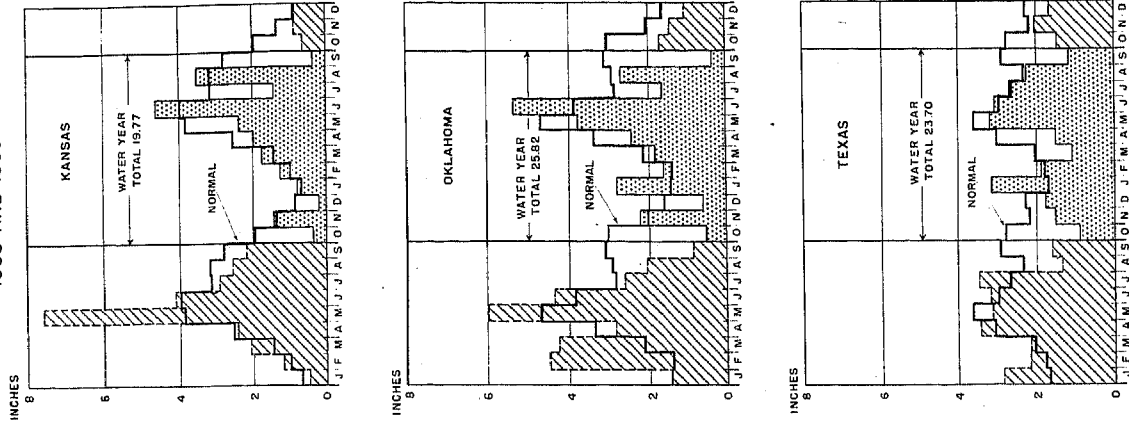
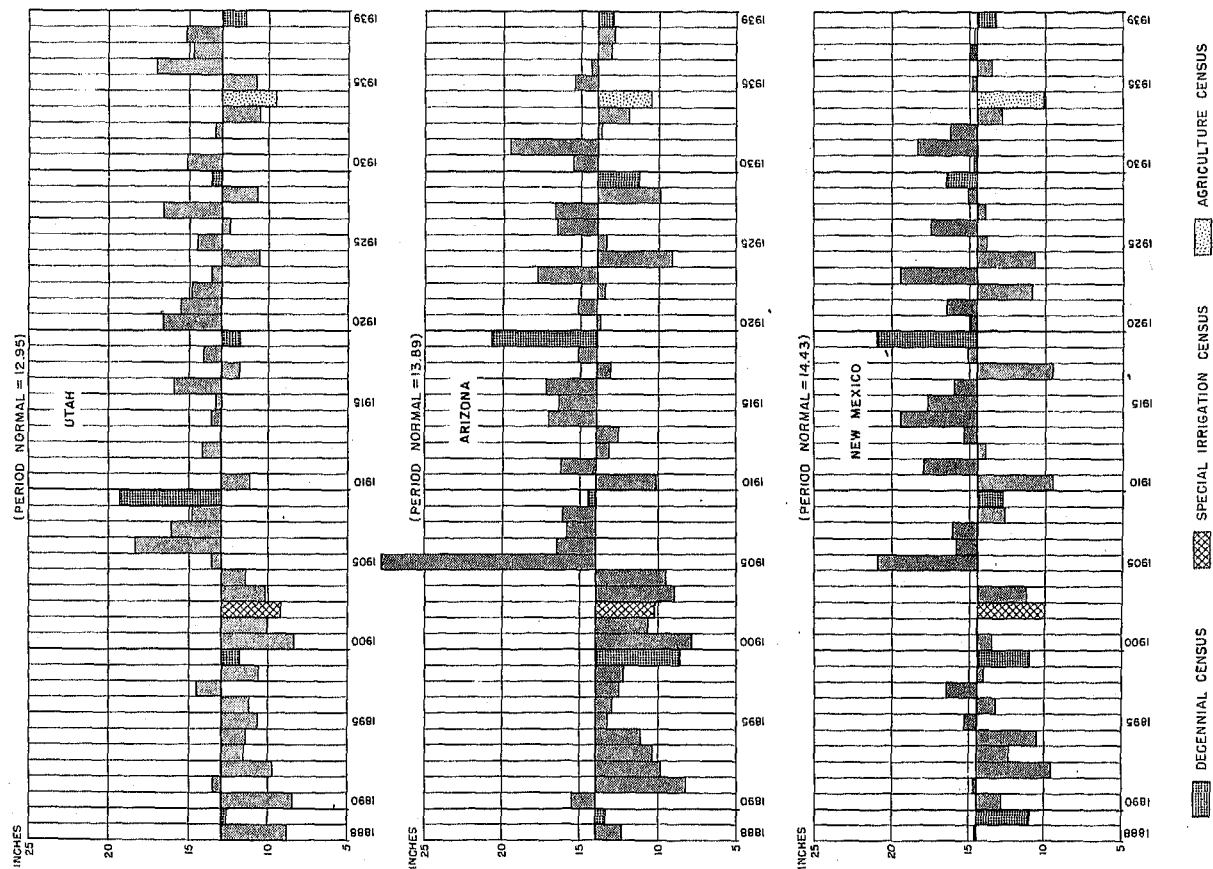
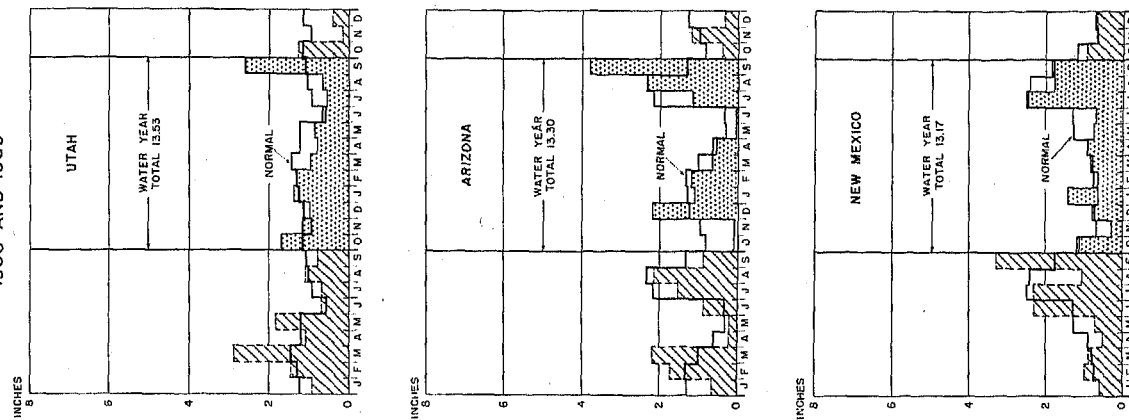
AVERAGE MONTHLY PRECIPITATION
1938 AND 1939

CHART V- UTAH, ARIZONA, AND NEW MEXICO

AVERAGE ANNUAL PRECIPITATION AND DEPARTURE FROM NORMAL 1888-1939

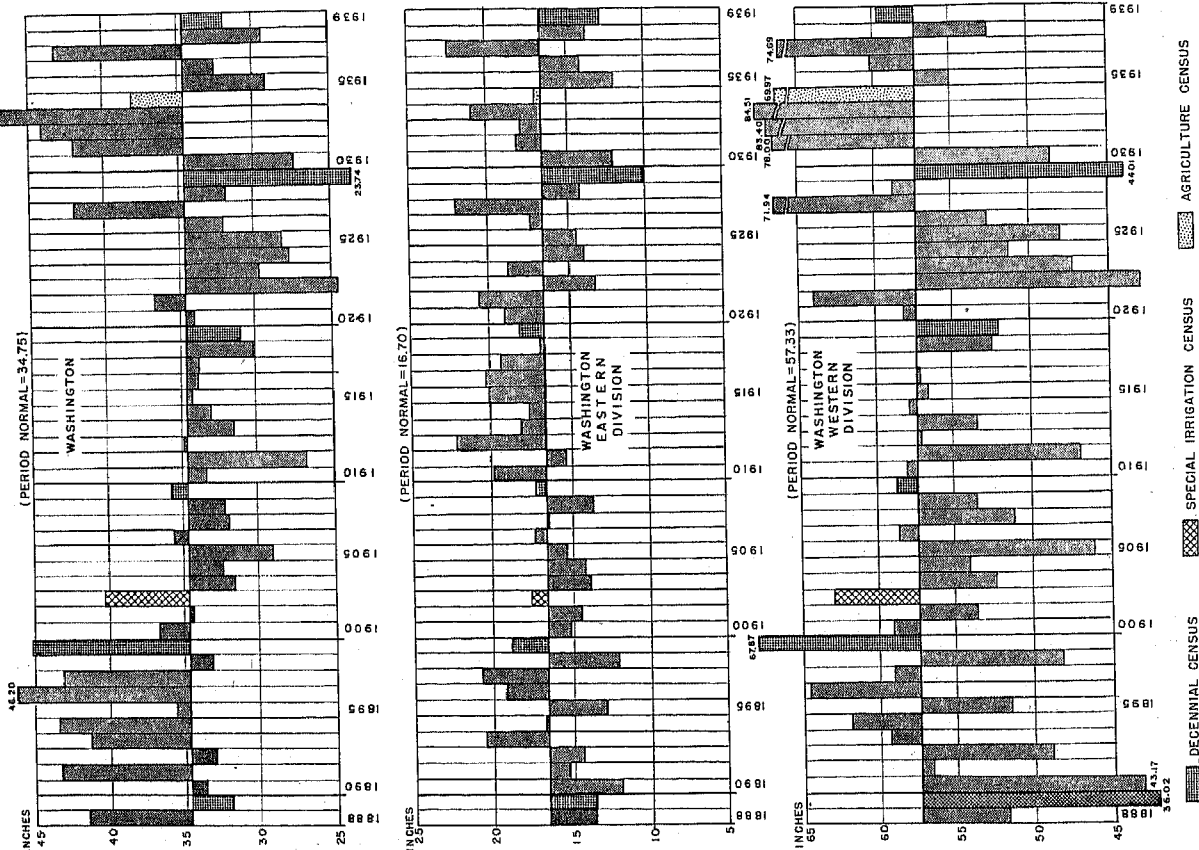


AVERAGE MONTHLY PRECIPITATION
1938 AND 1939



GENERAL DISCUSSION

..... AVERAGE ANNUAL PRECIPITATION AND DEPARTURE FROM NORMAL 1888 - 1939



AVERAGE MONTHLY PRECIPITATION
1938 AND 1939

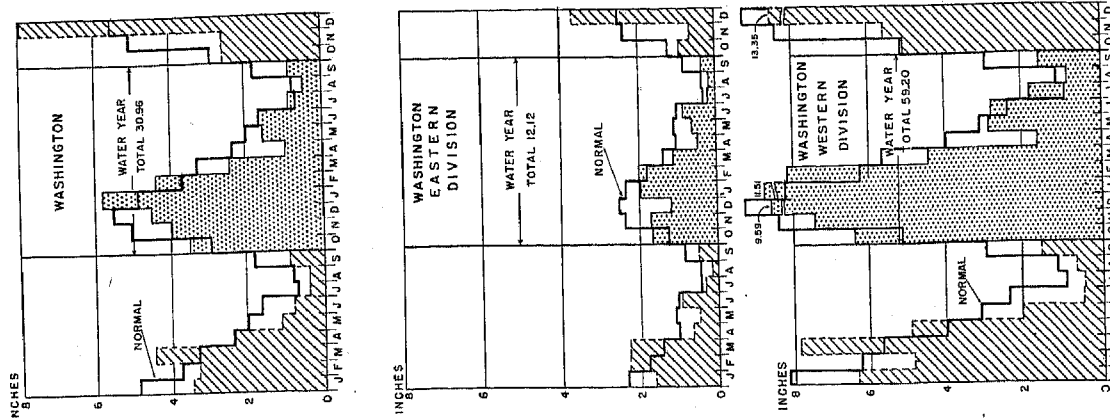
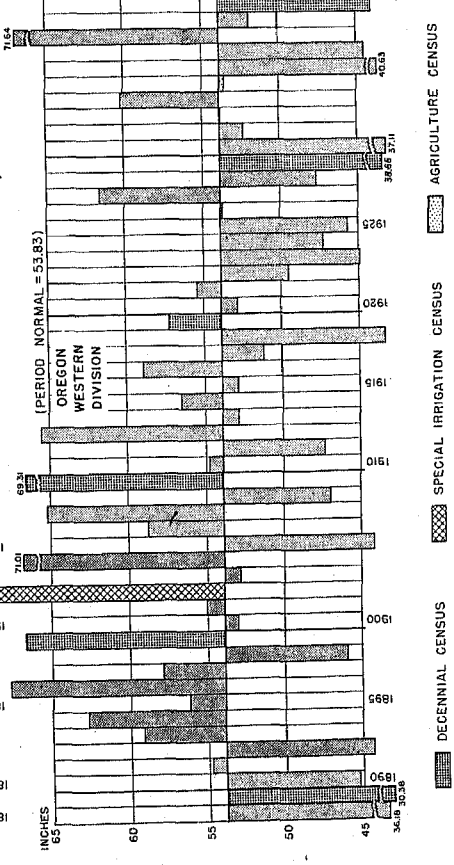
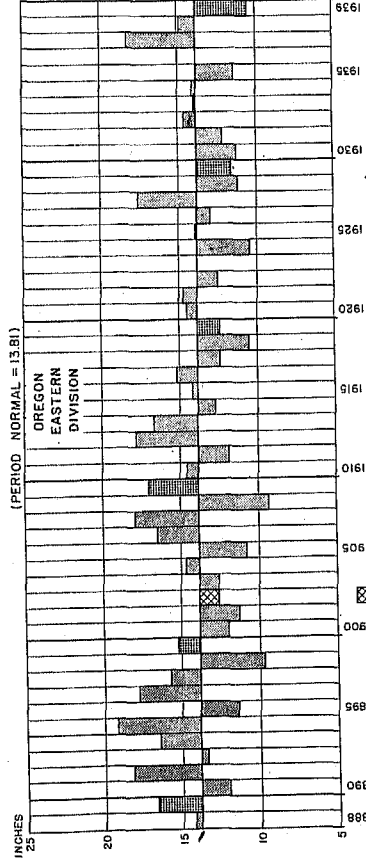
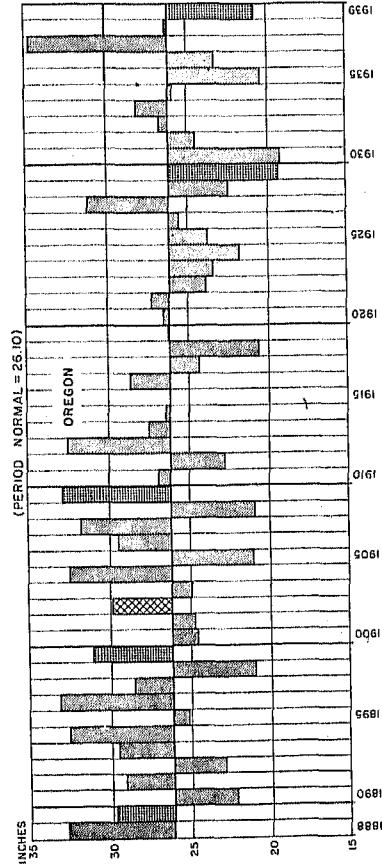


CHART VII - OREGON

AVERAGE ANNUAL PRECIPITATION AND DEPARTURE FROM NORMAL 1888-1939



GENERAL DISCUSSION

AVERAGE MONTHLY PRECIPITATION 1938 AND 1939

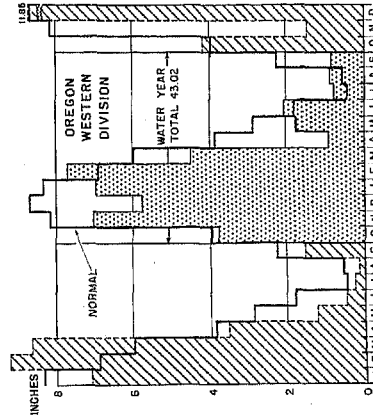
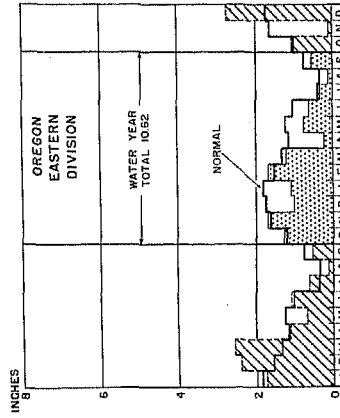
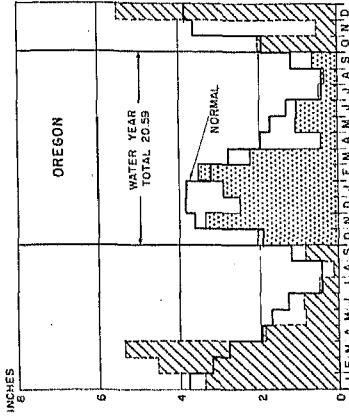
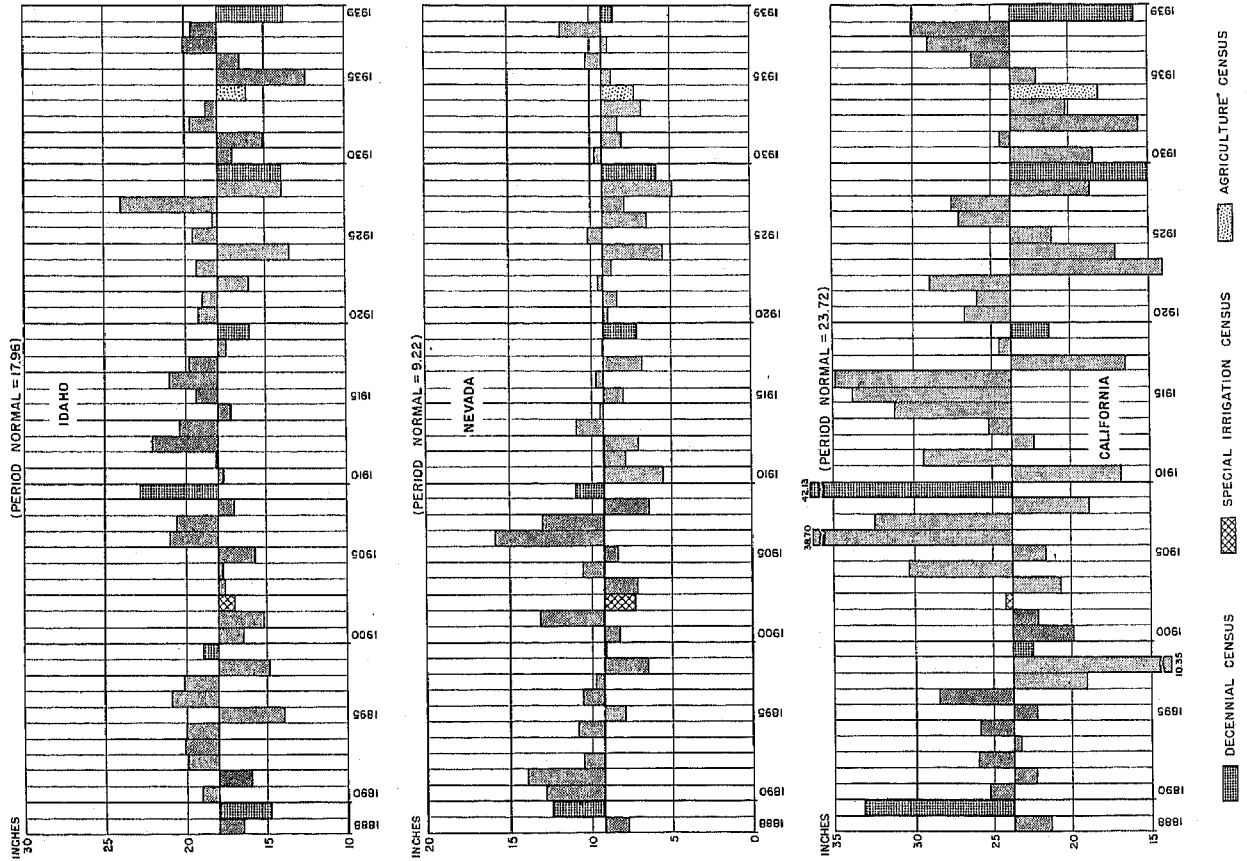
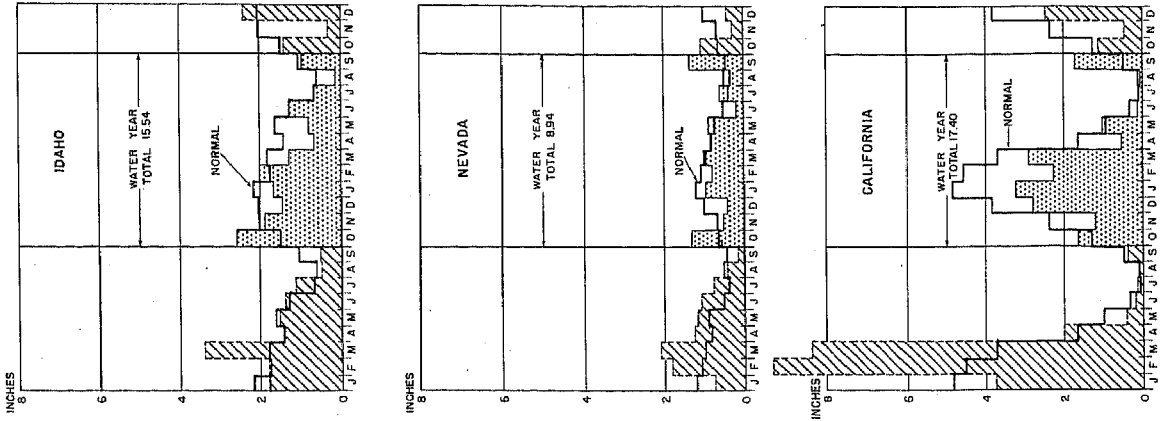


CHART VIII - IDAHO, NEVADA, AND CALIFORNIA

AVERAGE ANNUAL PRECIPITATION AND DEPARTURE FROM NORMAL 1888-1939



AVERAGE MONTHLY PRECIPITATION
1938 AND 1939



Areas Irrigated

The total area irrigated in 1939 in the 17 western States and Arkansas and Louisiana, reported by the Census of Irrigation (table 3), was 21,003,739 acres, an increase of 1,456,195 acres, or 7.4 percent since 1929. This is a greater rate of increase than the 1.9 percent increase during the preceding decade, yet much less than that for the decade 1909-1919 when an increase of 33.0 percent was shown. In the 1929-1939 period, increases were shown in 15 States, and decreases were recorded for Colorado of 5.1 percent, Louisiana of 0.8 percent, South Dakota of 10.3 percent, and Utah of 11.2 percent. The 1939 irrigated areas by principal drainage basins show increases in all basins, with the exception of the Rio Grande which shows a decrease of 2.8 percent, since 1929.

The distribution of 1939 irrigated areas by type of irrigation enterprise (table 4) shows increases for all types with the exception of "Commercial," -17.3 percent; and "All other," -2.4 percent. The transferring, during the past decade, of "Commercial" and "All other" (miscellaneous) types of enterprises into water-user organizations such as "Cooperatives," "Irrigation districts," and "Government projects" probably accounts for most of these area changes by type of organization. The greatest decade increases of area irrigated, by type of enterprise, were reported by Individual and partnership, 903,571 acres, Cooperatives, 381,154 acres, and Bureau of Reclamation, 338,976.

Charts IX and X show graphically the historic trends of areas by type of enterprise related to investment. For the Census of 1940, the areas and investment involved in developments for supplemental water are graphically presented with the supplemental investment shown in a side column; this is also added to the top of the primary investment column. Investment columns for earlier census years represent total expenditures for primary and supplemental projects unsegregated. Therefore, the total investment column (primary plus supplemental) in 1940 is comparable with the investment columns of previous years. Likewise, the average investment per acre is based on totals for all years except 1940 when separate averages for primary and supplemental enterprises are shown. In the graph for "All Types" an average based on totals for 1940 is also shown because the total investment applies to the total primary acreage. In the graphs for the individual type of enterprise an average investment per acre based on total investment is not shown because the supplemental investment usually applies to areas administered under one or more types other than the one credited with the investment.

Areas irrigated in 1939 in the 29 humid States (exclusive of Arkansas and Louisiana) are shown in table 5. These States are arranged in order of number of farms irrigated in 1939. All historic irrigation statistics (obtained by the Bureau of the Census) for the period of 1899 to 1939, inclusive, are shown. It is noted that the area irrigated in Florida in 1939 exceeded the area irrigated in the individual semihumid States of Oklahoma, North Dakota, South Dakota, or Kansas; and, also, the irrigated area in New Jersey, New York, or Ohio was greater than that irrigated in Oklahoma.

Capital Invested

The total investment of \$1,052,049,201 in irrigation works and water rights reported by enterprises in the 1940 Irrigation Census for the 17 western States and Arkansas and Louisiana (table 3) continued the upward trend from \$892,755,790 in

1930 an increase of \$159,293,411, or 17.8 percent. The change in investment per acre, based on the area irrigation works were capable of supplying with water, was from \$34.20 in 1930 to \$37.50 in 1940, indicating that the costs of additional irrigation works and betterments per unit irrigated also continued to increase, as has been true from the beginning of Census Records. Likewise, the estimated cost to complete the irrigation works in existing enterprises based on the irrigable lands in these projects changed from \$33.17 per acre in 1930, to \$35.99 per acre in 1940, an increase of \$2.82 per irrigable acre in the projects. Charts IX and X show graphically the historic trends of capital invested, related to project areas.

California ranks first in the 19 Irrigation States in capital invested in irrigation enterprises with \$318,889,218, or 30.3 percent of the total, the decade increase being 2.5 percent; Colorado second with \$106,849,343, or 10.2 percent of the total, with a decade increase of 22.0 percent; and Idaho third with \$102,585,798, or 9.8 percent of the total, a decade increase of 21.4 percent. Investment increases for the decade were reported in each of the 17 western States. However, the States of Arkansas and Louisiana, where irrigation is principally pumping water for rice, showed capital decreases of 15.6 percent and 26.5 percent, respectively, although the irrigated areas increased in Arkansas 6.5 percent and the number of irrigation enterprises increased in both States. Some of the factors causing these decreases are revealed by the statistics showing losses and gains in capital invested by counties and parishes in Arkansas and Louisiana, respectively, which indicate considerable shifts of location of irrigation practice within these States since 1930. Such shifts require the abandonment of old wells and pumping plants, many of which were installed prior to 1920 at high costs, and the installation of new wells and/or pumping equipment. Irrigation statistics of the Census of 1940 compared with 1930 also indicate a change from steam and internal-combustion engines to more efficient electric motors at less cost per horsepower. There are indications that new engines and wells installed during the decade 1930-40 cost less than those they have replaced which were of the earlier installations.

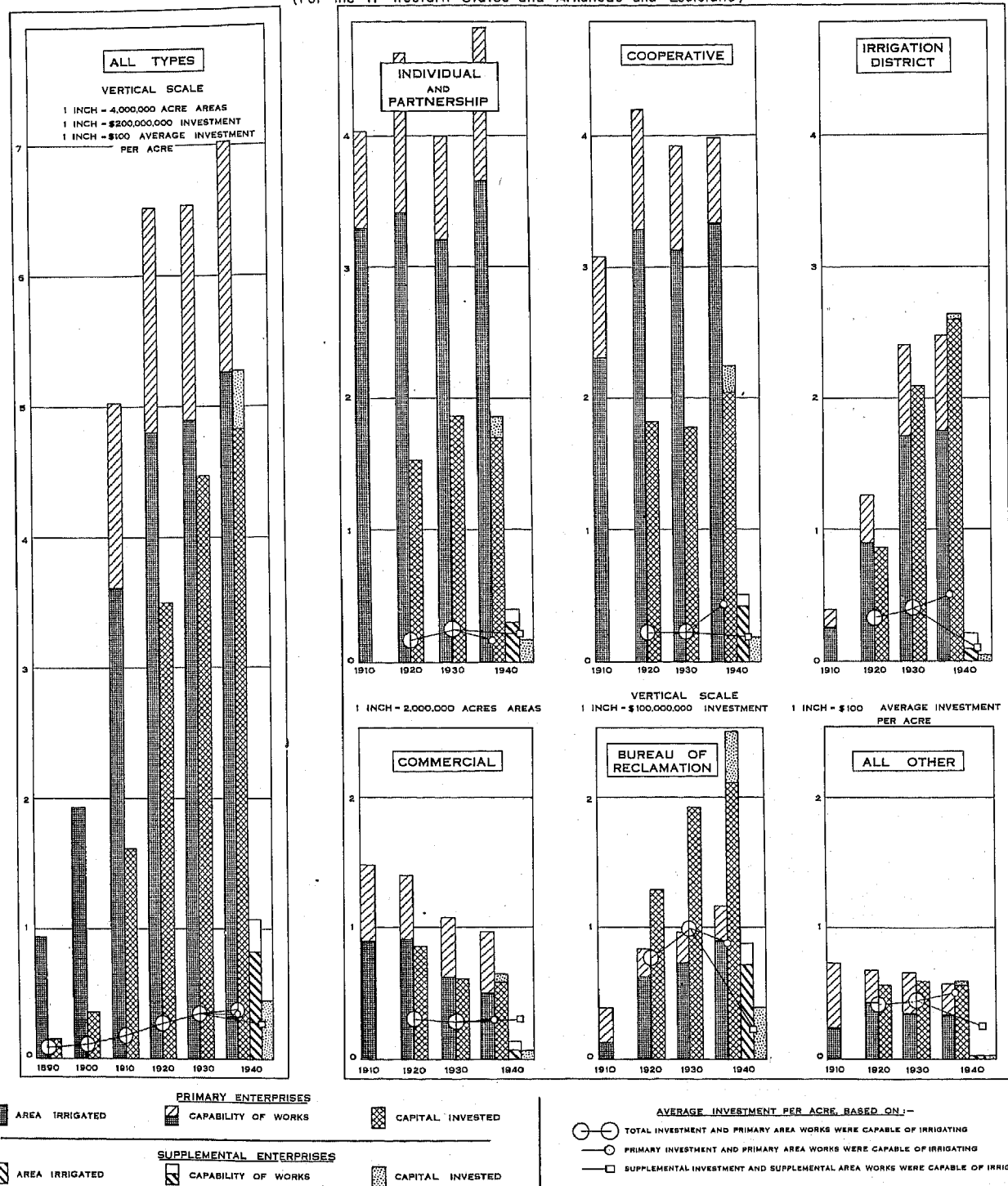
The Columbia River Drainage Basin ranks first in the 12 principal drainage basins in capital invested in irrigation enterprises (\$206,523,302 or 19.6 percent of the total) and also reported the greatest decade increase (\$49,168,188 or 31.2 percent). The Missouri River Drainage Basin ranks second (\$179,750,238 invested or 17.1 percent of the total, with a decade increase of \$43,243,517 or 31.7 percent), and the Sacramento-San Joaquin Delta and tributaries third (\$171,004,939 or 16.2 percent of the total, with a decade increase of \$6,376,846 or 3.9 percent).

Irrigation districts continue to lead in total investment by type of organization with \$265,737,810, or 25.3 percent of the total, an increase within the decade of 26.1 percent (charts IX and X). The United States Bureau of Reclamation ranks second with \$250,245,359, or 23.8 percent of the total, a decade increase of 29.0 percent; and cooperatives rank third with \$224,140,876, or 21.3 percent of the total, a decade increase of 25.0 percent. State enterprises (summary table 7, section C) lead in percentage increase of investment with 57.7 percent; the United States Office of Indian Affairs second, 53.3 percent; and the United States Bureau of Reclamation third, 29.0 percent. Decreases in investment are shown by City and/or sewage enterprises, with 63.7 percent, and Individual and partnership, 0.3 percent.

CENSUS OF IRRIGATION: 1940

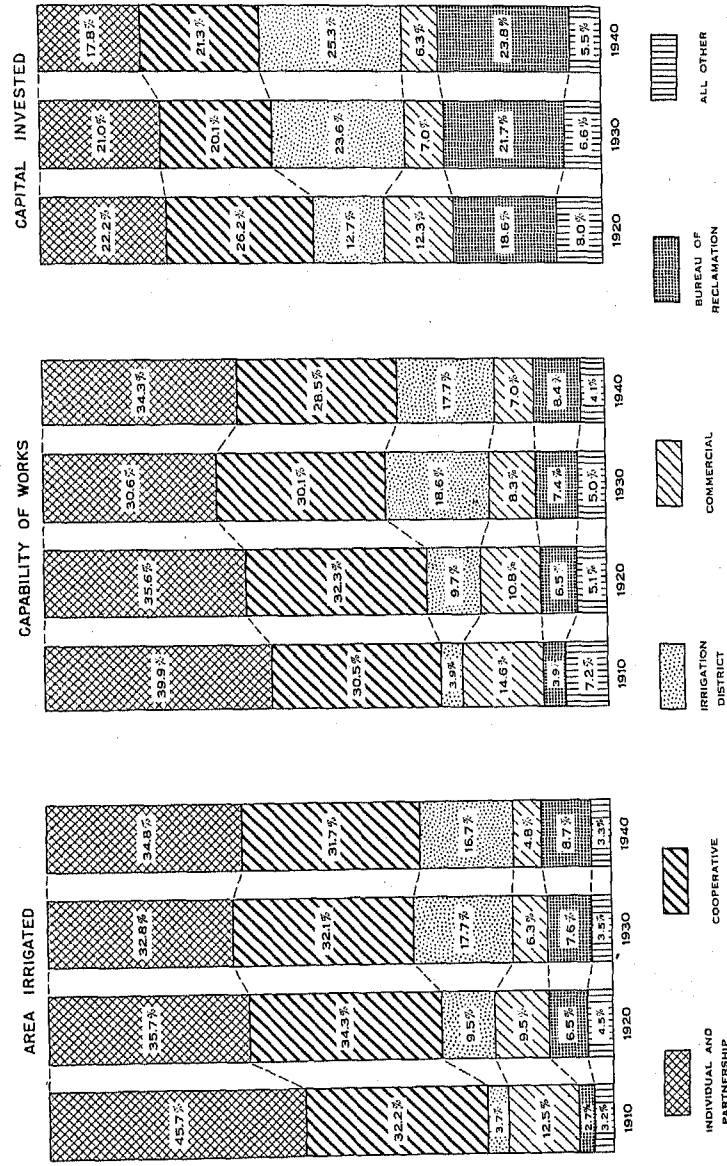
CHART IX-- AREAS, CAPITAL INVESTED, AND AVERAGE INVESTMENT PER ACRE, 1890-1940;
AND BY TYPE OF IRRIGATION ENTERPRISE, 1910-1940

(For the 17 Western States and Arkansas and Louisiana)



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CHART X — PROPORTION OF TOTAL—AREA IRRIGATED AND AREA WORKS WERE CAPABLE OF SUPPLYING WATER, 1910-1940;
AND CAPITAL INVESTED, 1920-1940; BY TYPE OF IRRIGATION ENTERPRISE
(For the 17 Western States and Arkansas and Louisiana)



CENSUS OF IRRIGATION: 1940

TABLE 3.—AREA IRRIGATED, 1939, 1929, AND 1919; AREA IRRIGATION WORKS WERE CAPABLE OF SUPPLYING WITH WATER, 1940 AND 1930; CAPITAL INVESTED, 1940, 1930, AND 1920; AND AVERAGE INVESTMENT PER ACRE, 1940 AND 1930; BY STATES AND BY PRINCIPAL DRAINAGE BASINS

(For the 17 western States and Arkansas and Louisiana)

ITEM	AREA IRRIGATED					AREA WORKS WERE CAPABLE OF SUPPLYING WITH WATER		CAPITAL INVESTED							
	1939 ¹		1929	1919	Increase or decrease (-) 1929-1939	1940 ¹	1930	1940 ¹		1930	1920	Increase or decrease (-) 1930-1940	Average per acre works were capable of supplying water		Increase or decrease (-) per acre 1930-1940
	Area	Proportion of total						Total	Proportion of total				1940 ²	1930 ²	
			Acres	Percent	Acres	Acres	Percent			Acres	Acres	Dollars			Percent
Total (19 States)	21,003,739	100.0	19,547,544	19,181,716	7.4	26,055,248	23,101,990	1,052,049,201	100.0	982,755,790	697,657,328	17.8	37.50	34.20	3.30
STATE	BY STATES														
Arizona	655,265	3.1	575,590	467,565	13.5	844,212	824,152	65,528,608	7.9	75,328,197	53,498,094	13.9	98.94	88.97	9.97
Arkansas	161,601	0.8	151,787	145,946	6.5	287,765	209,942	5,766,895	0.5	8,856,648	7,183,522	-15.6	20.04	32.55	-12.52
California	5,069,568	24.3	4,746,652	4,219,040	6.8	7,398,578	6,815,250	518,889,216	30.5	510,967,979	194,886,888	2.5	43.10	45.65	-2.55
Colorado	3,220,685	15.3	5,395,619	5,348,385	-5.1	3,913,542	4,078,712	106,849,343	10.2	87,605,240	86,302,442	22.0	27.30	21.48	5.82
Idaho	2,277,857	10.8	2,181,250	2,488,806	4.4	2,593,534	2,617,021	102,585,798	9.8	84,500,354	91,501,009	21.4	39.55	32.29	7.26
Kansas	99,980	0.5	71,290	47,312	40.2	142,409	85,583	2,153,886	0.2	1,685,652	2,067,381	27.8	15.12	20.17	-5.05
Louisiana	447,095	2.1	450,901	454,882	-0.8	759,915	765,165	11,565,513	1.1	15,744,745	14,063,181	-26.5	15.22	19.80	-4.58
Montana	1,711,409	8.1	1,594,912	1,681,729	7.3	2,344,380	2,276,000	67,552,505	6.4	50,319,204	52,143,563	35.9	28.73	22.11	6.62
Nebraska	610,379	2.9	532,617	442,680	14.6	992,957	705,841	39,056,207	3.7	21,586,519	15,909,185	82.6	39.53	30.39	8.94
Nevada	739,863	3.5	486,648	561,447	52.0	841,504	736,249	16,906,790	1.6	15,457,981	14,754,280	9.4	20.10	21.00	-0.90
New Mexico	554,039	2.6	527,053	538,377	5.1	731,990	656,669	32,735,997	3.1	19,854,380	18,210,412	65.0	44.72	30.20	14.52
North Dakota	21,615	0.1	9,592	12,072	130.1	35,522	24,006	1,755,489	0.2	1,267,514	1,857,118	38.5	48.07	52.79	-4.72
Oklahoma	4,160	(*)	1,575	2,969	164.5	8,624	7,351	272,166	(*)	160,099	151,325	70.0	31.56	21.84	9.72
Oregon	1,049,178	5.0	898,713	986,162	18.7	1,261,081	1,159,210	50,961,251	4.8	38,754,548	28,929,151	31.5	40.41	33.46	6.95
South Dakota	60,198	0.3	67,107	100,682	-10.3	121,847	109,550	5,395,610	0.5	4,502,117	5,465,248	19.8	44.28	41.10	3.18
Texas	1,045,224	5.0	798,917	586,120	30.8	1,775,812	1,177,415	66,441,376	6.3	49,022,164	55,072,739	35.5	37.46	41.64	-4.18
Utah	1,176,116	5.6	1,324,125	1,371,651	-11.2	1,357,714	1,542,475	41,696,532	4.0	35,669,819	32,037,351	17.5	30.66	23.13	7.73
Washington	615,013	2.9	499,283	529,898	23.2	731,527	631,511	56,415,196	5.4	40,561,895	29,299,011	39.1	77.12	64.25	12.69
Wyoming	1,486,498	7.1	1,236,155	1,207,882	20.3	1,913,527	1,655,006	41,522,601	3.9	35,153,187	34,326,828	18.1	21.70	21.24	0.46
DRAINAGE BASIN	BY PRINCIPAL DRAINAGE BASINS														
Red River (of the North)	4,495	(*)	2,099	-----	114.1	7,980	2,099	130,566	(*)	20,925	-----	524.0	16.36	9.97	6.39
Missouri River	4,410,865	21.0	4,185,180	4,147,278	5.4	5,942,958	5,472,012	179,750,238	17.1	136,506,721	131,553,106	31.7	30.25	24.95	5.30
Mississippi River, exclusive of Missouri River	927,594	4.4	902,560	958,493	2.8	1,350,911	1,170,585	37,101,932	3.5	31,831,673	35,183,789	16.6	27.46	27.19	0.27
Gulf of Mexico streams other than Mississippi River and Rio Grande	902,392	4.3	662,958	698,077	56.1	1,520,796	1,221,997	30,498,361	2.9	28,576,195	29,439,808	6.7	20.05	23.39	-3.34
Rio Grande	1,521,578	7.2	1,584,725	1,312,855	-2.8	2,177,705	1,914,781	80,563,998	7.6	53,748,608	34,824,111	49.9	36.99	28.07	8.92
Colorado River	2,658,120	12.6	2,537,124	2,326,690	4.0	3,587,744	3,335,914	155,800,882	14.8	132,350,247	86,939,884	17.7	46.28	39.67	6.59
Whitewater Draw and Vamori Wash ³	8,498	(*)	3,301	5,871	157.4	13,462	4,755	226,627	(*)	230,606	299,368	-1.7	16.65	48.52	-31.69
Great Basin	2,075,727	9.9	2,056,033	2,277,651	1.9	2,381,171	2,536,482	59,698,865	5.7	37,579,074	62,207,175	-11.7	25.07	26.64	-1.57
Columbia River	3,619,759	18.2	3,395,640	3,673,245	12.6	4,426,387	4,241,244	206,525,502	19.7	157,355,114	145,672,582	31.2	46.66	37.10	9.56
Klamath River	271,058	1.3	187,991	153,105	44.2	310,560	264,949	10,430,941	1.0	9,430,566	5,502,890	10.8	33.59	35.59	-2.00
Sacramento-San Joaquin Delta and tributary streams	3,595,882	16.2	3,157,132	2,744,644	7.5	5,132,597	4,795,856	171,004,959	16.2	164,628,095	100,527,759	3.9	33.32	34.33	-1.01
Pacific Ocean streams, excl. of Gulf of California streams, Columbia and Klamath Rivers, and Sacramento-San Joaquin Delta and tributary streams	1,032,294	4.9	914,801	695,607	12.8	1,422,997	1,141,230	120,318,550	11.4	110,495,970	65,507,056	8.9	84.55	96.82	-12.27

¹Data for primary and supplemental enterprises in table 4.²Based on primary acreage and total capital invested.³Revised.⁴Less than one-tenth of 1 percent.⁵Data for Censuses of 1930 and 1920 are for Whitewater Draw and unidentified tributaries, and do not include the independent basin, Vamori, Wash.

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TABLE 4.—AREAS, CAPITAL INVESTED, AVERAGE INVESTMENT PER ACRE, AND PROPORTIONS OF TOTALS, BY TYPE OF ENTERPRISE: 1890 TO 1940

(Statistics for charts numbers IX and X covering the 17 western States and Arkansas and Louisiana)

TYPE OF ENTERPRISE (For definitions and explanations, see text)	CENSUS OF—												
	1890 ¹	1900 ¹	1910		1920		1930		1940				
	All enter- prises	All enter- prises	All enter- prises	Proportion of total	All enter- prises	Proportion of total	All enter- prises	Proportion of total	All enter- prises	Proportion of total	Increase or decrease (-) 1930- 1940	Primary enter- prises ²	Supple- mental enter- prises
AREA IRRIGATED													
Total	Acres 3,715,945	Acres 7,744,492	Acres 14,435,285	Percent 100.0	Acres 19,191,716	Percent 100.0	Acres 19,547,544	Percent 100.0	Acres 21,003,739	Percent 100.0	Percent 7.4	Acres 21,003,739	Acres 3,287,210
Individual and partnership	(3)	(3)	6,584,614	45.7	6,848,807	35.7	6,410,581	32.8	7,314,152	34.8	14.1	7,314,152	596,171
Cooperatives	(3)	(3)	4,843,539	32.2	6,581,400	34.3	6,271,334	32.1	6,652,488	31.7	6.1	6,652,488	858,398
Irrigation district	(3)	(3)	528,642	3.7	1,822,887	9.5	3,452,275	17.7	3,514,702	16.7	1.8	3,514,702	211,470
Commercial	(3)	(3)	1,809,379	12.5	1,822,001	9.5	1,230,763	6.3	1,017,781	4.8	-17.3	1,017,781	128,238
U. S. Bureau of Reclamation	(3)	(3)	385,646	2.7	1,254,569	6.5	1,485,028	7.6	1,824,004	8.7	22.8	1,824,004	1,460,470
All other ⁴	(3)	(3)	461,465	3.2	862,052	4.5	697,583	3.5	680,612	3.3	-2.4	680,612	32,473
AREA WORKS WERE CAPABLE OF SUPPLYING WITH WATER													
Total	Acres (3)	Acres (3)	Acres 20,265,403	Percent 100.0	Acres 26,020,477	Percent 100.0	Acres 26,101,890	Percent 100.0	Acres 28,055,248	Percent 100.0	Percent 7.5	Acres 28,055,248	Acres 4,268,394
Individual and partnership	(3)	(3)	8,086,766	39.9	9,255,756	35.6	7,982,142	30.6	9,633,198	34.3	20.7	9,633,198	798,308
Cooperatives	(3)	(3)	6,191,677	30.5	8,403,298	32.3	7,861,081	30.1	7,986,236	28.5	1.7	7,986,236	980,411
Irrigation district	(3)	(3)	800,451	3.9	2,531,425	9.7	4,846,095	18.6	4,969,595	17.7	2.5	4,969,595	461,877
Commercial	(3)	(3)	2,954,166	14.6	2,799,583	10.8	2,160,950	8.3	1,961,202	7.0	-9.2	1,961,202	252,804
U. S. Bureau of Reclamation	(3)	(3)	786,190	3.9	1,680,643	6.5	1,944,825	7.4	2,349,967	8.4	20.8	2,349,967	1,765,721
All other ⁴	(3)	(3)	1,466,253	7.2	1,349,792	5.1	1,306,797	5.0	1,145,250	4.1	-12.4	1,145,250	32,473
CAPITAL INVESTED													
Total	Dollars 29,533,921	Dollars 70,010,594	Dollars 321,454,008	Percent 100.0	Dollars 897,657,328	Percent 100.0	Dollars 992,755,790	Percent 100.0	Dollars 1,062,048,201	Percent 100.0	Percent 17.8	Dollars 963,888,263	Dollars 88,160,938
Individual and partnership	(3)	(3)	(3)	(3)	154,654,169	22.2	187,887,180	21.0	187,582,730	17.8	-0.3	170,368,731	17,013,999
Cooperatives	(3)	(3)	(3)	(3)	186,041,500	20.7	179,329,962	20.1	224,140,876	21.3	25.0	205,082,550	19,058,325
Irrigation district	(3)	(3)	(3)	(3)	88,573,614	12.7	210,755,476	25.6	285,737,810	25.3	26.1	260,701,900	5,035,910
Commercial	(3)	(3)	(3)	(3)	85,735,470	12.3	62,351,734	7.0	65,245,823	6.3	6.2	59,250,005	6,993,820
U. S. Bureau of Reclamation	(3)	(3)	(3)	(3)	129,609,819	18.6	195,999,576	21.7	250,245,359	23.8	29.0	211,046,135	39,199,226
All other ⁴	(3)	(3)	(3)	(3)	56,162,656	8.0	56,465,862	6.8	56,298,603	5.5	-0.3	57,438,946	859,657
AVERAGE INVESTMENT PER ACRE WORKS WERE CAPABLE OF SUPPLYING WITH WATER													
Total	Dollars \$7.95	Dollars \$9.04	Dollars 15.85	xxx	Dollars 26.81	xxx	Dollars \$34.20	xxx	Dollars 37.50	xxx	Percent 9.1	Dollars 34.36	Dollars 20.65
Individual and partnership	(3)	(3)	(3)	xxx	16.71	xxx	\$25.54	xxx	xxx	xxx	xxx	17.99	21.51
Cooperatives	(3)	(3)	(3)	xxx	21.78	xxx	22.81	xxx	xxx	xxx	xxx	25.65	19.24
Irrigation district	(3)	(3)	(3)	xxx	34.99	xxx	45.49	xxx	xxx	xxx	xxx	52.46	11.15
Commercial	(3)	(3)	(3)	xxx	30.82	xxx	28.85	xxx	xxx	xxx	xxx	30.21	30.04
U. S. Bureau of Reclamation	(3)	(3)	(3)	xxx	77.06	xxx	99.75	xxx	xxx	xxx	xxx	89.61	22.24
All other ⁴	(3)	(3)	(3)	xxx	41.61	xxx	44.75	xxx	xxx	xxx	xxx	50.15	26.47

¹ Census of Agriculture. ² Areas shown under "Supplemental sources" are parts of areas shown under "Primary sources" and therefore are not added again into the totals (see text). ³ Data not separated by type of enterprise. ⁴ Includes Reclamation District Office of Indian Affairs, State, City and/or sewage, and other. ⁵ Revised.

TABLE 5.—IRRIGATION OF AGRICULTURAL LANDS IN THE HUMID STATES EXCLUSIVE OF ARKANSAS AND LOUISIANA—NUMBER OF FARMS REPORTING IRRIGATION AND AREA IRRIGATED, 1939, 1934, 1902, AND 1899; AND CONSTRUCTION COSTS OF SYSTEMS, 1902 AND 1899; BY STATES

STATE (Order based on number of farms reporting ir- rigation for 1939)	FARMS REPORTING IRRIGATION				AREA IRRIGATED										CONSTRUCTION COSTS OF SYSTEMS			
	1939 ¹	1934 ¹	1902	1899	1939 ¹			1934 ¹	1902	1899	Average per farm				1902	1899	Average per ir- rigated acre	
					Total	Cropland harvested	Pas- ture				1939 ²	1934 ²	1902	1899			1902	1899
Number	Number	Number	Number	Acres	Acres	Acres	Acres	Acres	Acres	Acres	Acres	Acres	Acres	Dollars	Dollars	Dollars	Dollars	
Total (29 humid States)--	7,949	5,410	1,875	1,426	166,053	162,771	3,282	95,795	56,011	44,113	20.9	14.9	29.0	30.9	2,319,857	1,511,200	41.42	34.26
Florida ²	5,947	2,751	405	180	128,191	128,682	2,509	65,832	3,772	1,538	32.0	23.9	9.3	8.5	512,659	232,588	135.96	151.10
Ohio	858	655	—	—	4,536	4,536	—	4,598	—	—	6.9	7.0	—	—	—	—	—	—
New Jersey	580	899	9	8	7,956	7,795	161	7,902	48	73	13.7	11.3	5.3	9.1	3,256	2,651	67.42	58.78
New York	587	498	14	10	5,948	5,850	98	3,221	159	68	10.5	8.6	11.4	6.8	4,780	1,872	30.06	27.53
Michigan	462	718	—	—	2,960	2,735	225	5,587	—	—	6.4	7.8	—	—	—	—	—	—
Pennsylvania	299	185	147	134	3,356	3,328	28	1,047	906	814	11.2	5.4	6.2	6.1	17,214	15,627	19.00	19.20
Massachusetts	251	22	30	28	2,049	2,031	18	322	283	154	8.9	14.6	9.4	4.8	24,850	14,680	87.81	109.55
Minnesota	216	61	—	—	2,968	2,918	50	498	—	—	13.7	8.0	—	—	—	—	—	—
Wisconsin	163	78	—	—	2,345	2,345	—	1,438	—	—	14.4	18.4	—	—	—	—	—	—
Missouri	140	143	—	—	960	960	—	981	—	—	6.9	6.9	—	—	—	—	—	—
Indiana	136	102	—	—	685	685	—	532	—	—	5.0	5.2	—	—	—	—	—	—
Iowa	68	107	—	—	2,258	2,193	65	1,461	—	—	25.7	13.7	—	—	—	—	—	—
Illinois	72	42	—	—	307	307	—	193	—	—	4.3	4.6	—	—	—	—	—	—
Connecticut	57	11	48	56	520	520	—	115	379	471	9.1	10.5	7.0	6.4	11,572	16,113	30.55	34.21
Virginia	53	26	—	—	687	687	—	387	—	—	13.0	10.8	—	—	—	—	—	—
Kentucky	46	37	—	—	205	205	—	234	—	—	4.5	6.3	—	—	—	—	—	—
Alabama	37	45	7	7	281	281	—	193	95	89	7.6	4.0	13.6	12.7	3,180	5,200	33.47	58.43
North Carolina ³	37	51	104	101	246	239	7	125	3,422	3,285	6.8	4.0	32.9	32.5	112,905	112,771	32.99	34.55
Maine	35	6	11	11	143	94	48	25	17	17	4.3	3.8	1.5	1.5	2,267	2,170	133.35	127.65
Georgia ³	26	72	260	238	158	158	—	401	8,581	7,956	6.1	5.6	33.0	33.0	274,990	250,214	52.05	31.85
West Virginia	25	11	—	—	270	268	2	47	—	—	11.7	4.5	—	—	—	—	—	—
Tennessee	21	4	—	—	311	246	65	57	—	—	14.8	14.2	—	—	—	—	—	—
Maryland	17	9	—	—	67	62	5	79	—	—	3.9	8.8	—	—	—	—	—	—
South Carolina ³	14	65	831	648	411	411	—	414	38,220	29,690	29.4	6.4	46.0	45.8	1,545,104	851,509	55.14	28.68
Rhode Island	10	5	2	2	109	109	—	88	15	40	10.9	17.6	7.5	20.0	2,500	3,000	166.67	75.00
Mississippi	7	6	7	5	94	94	—	21	114	40	13.4	3.5	16.3	15.3	6,400	2,625	56.14	70.82
New Hampshire	7	6	—	—	25	25	—	17	—	—	3.6	2.8	—	—	—	—	—	—
Delaware	2	3	—	—	7	7	—	2	—	—	3.5	2.7	—	—	—	—	—	—
Vermont	—	1	—	—	—	—	—	—	—	—	2.0	—	—	—	—	—	—	—

were used in 1940. Additional data for Florida shown in other tables.

XXX

CENSUS OF IRRIGATION: 1940

TABLE 6.—COST OF MAINTENANCE AND OPERATION, 1929 AND 1929; AND PAY ROLL AND NUMBER OF EMPLOYEES, 1939; BY STATES

(For the 17 western States and Arkansas and Louisiana)

STATE	COST OF MAINTENANCE AND OPERATION									PAY ROLL AND EMPLOYEES, 1939 ¹				
	Irrigated area in enterprises reporting maintenance and operation						Reported cost, 1939		Average per acre irrigated			Enter-prises reporting pay roll ²	Wages and salaries paid and payable	Em-ploy-ees dur-ing week ending Apr. 29
	1939		1929	Primary	Supple-mental	1939		1929						
	Primary	Supple-mental				Primary	Supple-mental							
Acres	Acres	Acres	Dollars	Dollars	Dollars	Dollars	Dollars	Number	Dollars	Number				
Total (19 States)-----	20,193,761	2,983,963	18,690,184	43,172,525	2,828,094	2.14	0.95	2.77	4,034	16,071,522	24,006			
Arizona-----	630,942	14,463	561,605	3,101,467	50,715	4.92	3.51	4.57	67	1,444,641	1,548			
Arkansas-----	153,346	231	147,921	835,691	1,201	5.45	5.20	7.03	6	12,823	44			
California-----	4,821,580	439,235	4,338,579	21,229,685	1,620,218	4.39	3.69	8.10	851	4,901,590	4,425			
Colorado-----	3,128,787	808,498	3,235,829	2,035,680	498,440	0.65	0.82	0.85	700	1,167,624	3,088			
Idaho-----	2,219,466	889,254	2,109,087	2,256,788	202,690	1.02	0.23	1.44	404	1,318,975	2,275			
Kansas-----	99,033	13,628	84,983	227,076	29,869	2.29	2.18	1.53	9	16,235	75			
Louisiana-----	438,921	2,434	431,337	1,589,007	3,883	3.64	1.51	4.09	91	502,320	602			
Montana-----	1,650,373	168,762	1,476,854	1,180,189	20,908	0.72	0.12	0.87	248	1,501,148	1,804			
Nebraska-----	602,562	171,448	524,260	839,682	119,770	1.39	0.70	1.64	56	308,746	686			
Nevada-----	688,722	84,722	474,422	293,659	39,705	0.43	0.46	0.91	65	160,642	275			
New Mexico-----	518,918	5,083	493,229	1,082,768	10,142	2.09	2.00	2.15	205	718,210	1,773			
North Dakota-----	21,290	8,773	8,773	30,072	---	1.41	---	1.97	6	14,611	21			
Oklahoma-----	3,869	---	335	12,973	---	3.35	---	7.62	---	---	---			
Oregon-----	982,940	97,643	883,685	1,157,018	71,049	1.18	0.73	1.41	195	621,247	1,094			
South Dakota-----	58,428	---	85,783	71,966	---	1.28	---	1.33	17	60,964	114			
Texas-----	1,002,202	51,197	772,160	3,865,224	32,866	3.86	0.64	4.74	82	1,628,198	1,698			
Utah-----	1,144,100	322,055	1,301,098	881,814	84,681	0.77	0.26	1.00	686	518,607	2,688			
Washington-----	602,414	22,296	467,977	1,673,992	11,514	2.78	0.51	4.14	201	784,904	937			
Wyoming-----	1,421,852	96,014	1,131,867	807,345	31,923	0.57	0.34	0.84	175	392,047	578			

¹ Only for enterprises serving 5 or more units.² Includes interstate enterprises.TABLE 7.—INDEBTEDNESS, 1939; ARREARAGE, 1939 AND 1938; AND ANNUAL CHARGES, 1939 AND 1929; BY STATES ¹

(For the 17 western States and Arkansas and Louisiana)

STATE	INDEBTEDNESS REPORTED DEC. 31, 1939					ARREARAGE REPORTED ²				ANNUAL CHARGES REPORTED			
	Total	Average per acre				Total		Average per acre assessed, 1939		Total 1939	Average per acre assessed		
		Assessed		Works were capable of supplying with water		Dec. 31, 1939	Dec. 31, 1938	Primary	Supplemental		1939		1929
Primary	Supplemental	Primary	Supplemental					Primary	Supplemental				
Dollars	Dollars	Dollars	Dollars	Dollars	Dollars	Dollars	Dollars	Dollars	Dollars	Dollars	Dollars	Dollars	
Total (19 States)-----	386,040,274	32.90	11.63	29.94	10.01	31,080,285	29,352,985	11.29	0.93	34,284,667	1.98	0.54	3.42
Arizona-----	42,592,133	70.03	(3)	69.67	(3)	990,222	923,519	43.87	-----	2,826,685	4.31	1.80	4.82
Arkansas-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	34,409	7.05	-----	-----
California-----	95,694,893	32.40	27.25	30.45	22.57	19,651,711	18,668,245	16.53	16.78	13,041,784	3.04	2.61	5.42
Colorado-----	22,810,607	13.12	6.31	12.98	5.60	1,699,096	1,637,538	5.61	3.73	2,491,161	0.86	0.46	1.82
Idaho-----	26,418,138	18.94	3.36	18.13	2.91	1,259,945	1,263,975	8.95	-----	2,646,004	1.15	0.21	1.95
Kansas-----	43,775	1.10	-----	1.08	-----	(3)	(3)	(3)	-----	43,168	0.76	-----	0.81
Louisiana-----	2,748,768	18.87	-----	12.11	-----	1,137,646	1,078,511	18.85	-----	1,259,711	5.12	-----	7.87
Montana-----	44,542,281	52.72	15.98	39.97	12.13	1,820,069	1,853,066	5.84	1.33	1,180,790	0.99	0.53	1.79
Nebraska-----	21,727,368	52.08	22.42	31.46	7.24	178,738	57,871	2.44	-----	770,745	1.29	0.83	1.76
Nevada-----	3,934,315	14.79	16.73	14.12	22.63	-----	-----	-----	-----	391,703	1.39	0.86	1.57
New Mexico-----	16,715,813	48.66	-----	45.60	-----	560,392	520,087	30.40	-----	966,787	2.00	-----	3.97
North Dakota-----	1,337,648	57.35	-----	41.96	-----	23,854	13,187	1.58	-----	18,909	0.81	-----	1.50
Oklahoma-----	15,850	106.79	-----	396.25	-----	-----	-----	-----	-----	530	0.74	-----	-----
Oregon-----	14,329,768	36.06	34.82	33.43	31.72	1,800,973	1,588,681	22.64	-----	994,245	1.57	0.73	3.51
South Dakota-----	4,800,023	88.82	-----	83.21	-----	66,992	57,507	1.27	-----	131,490	1.80	-----	1.54
Texas-----	36,041,388	34.02	8.32	33.98	11.26	730,703	847,425	2.45	(3)	4,068,704	3.55	1.39	5.83
Utah-----	13,768,417	7.53	35.33	9.73	35.70	466,221	476,898	23.34	0.85	1,221,591	0.96	0.40	1.26
Washington-----	22,621,604	43.52	1.96	41.69	4.20	605,398	494,978	2.73	-----	1,545,582	2.69	0.35	6.17
Wyoming-----	16,699,485	41.01	3.47	31.64	10.85	87,800	69,898	1.93	0.46	662,711	0.74	0.38	1.31

¹ Only for enterprises serving 5 or more units.² In payment of principal, interest, and/or other funded obligations.³ Data are included only in total because less than 3 enterprises reported in the 1940 Census.

GENERAL DISCUSSION

XXXI

Sources of Water Supply

The Irrigation Census of 1940 grouped the various sources of water supply into (a) primary sources, i.e., sources from which the principal part or all of the water is obtained for irrigation of the land involved, and (b) supplemental sources, i.e., sources from which a part of the supply of water is obtained to supplement an inadequate "primary" supply. These two groups are, in turn, segregated into the various surface and underground sources.

Water diverted from streams by gravity and/or pumped, and used alone or in connection with water from wells, continues to be the major supply of irrigation water. For detailed breakdown of sources of water supply related to areas, costs, etc., see tables 8 to 11.

The total area reported entirely irrigated from streams was 16,054,903 acres in 1939, comparable to 14,952,049 acres in 1929, or an increase of 7.4 percent. The area reported as irrigated entirely from wells, either pumped or flowing, was 2,570,392 acres in 1939, comparable to 2,117,012 acres in 1929, or an increase of 21.4 percent. However, areas irrigated entirely from flowing wells decreased 14.4 percent, and that from wells, pumped and flowing increased 24.0 percent, indicating additional wells originally flowing are being pumped. This transition is particularly apparent in the States of Utah, New Mexico, and Louisiana. The area reported as irrigated from all sources other than entirely from streams or entirely from wells was 2,378,444 acres in 1939, comparable to 2,478,483 acres in 1929, or a decrease of 4.0 percent.

Areas irrigated entirely from stream diversions increased from 1929 to 1939 in 13 States, and decreased in 6 States. The greatest increases were reported in Wyoming, 267,163 acres, or 22.6 percent; Oregon, 223,880 acres, or 30.3 percent; California, 208,597 acres, or 9.3 percent; Nevada, 186,359 acres, or 47.2 percent; and Montana, 169,747 acres, or 11.4 percent.

The greatest decreases were reported in Colorado, 130,362 acres, or 4.1 percent; and Arizona, 51,053, or 29.9 percent. Areas irrigated entirely from wells, increased in 15 States and decreased in 4 States. The greatest increases were reported in Texas, 204,240 acres, or 326.1 percent; Nebraska, 57,582 acres, or 245.5 percent; and California, 54,342 acres, or 3.7 percent. The greatest decreases were reported in Louisiana, 39,009 acres, or 22.2 percent; and Utah, 3,717 acres, or 18.9 percent.

Areas irrigated entirely from streams, gravity and wells, pumped, 1,252,329 acres in 1939, increased in 14 States and decreased in Idaho, 32,859 acres, or 45.0 percent; and Montana, 1,198 acres, or 44.5 percent. In 1939, the States of North Dakota, Oklahoma, and South Dakota reported no lands irrigated from this source. The net increase for 16 States reporting was 87,980 acres, or 7.6 percent; areas irrigated entirely from springs, 210,373 acres in 1939, decreased 3.2 percent in the 10 years. Of the total acreage irrigated from springs in 1939, Nevada irrigated 54,945 acres; Utah, 35,898 acres; and California, 28,538 acres; representing changes of -11.4 percent, -27.6 percent, and +18.9 percent, respectively.

The 1940 Census of Irrigation segregated the statistics of all enterprises delivering supplemental water to primary enterprises and related the areas served to sources of water supply, i.e., from streams, pumped; wells, pumped or flowing; and streams, gravity or storage, a summary of which is shown in table 3, section C, of this volume.

The 1930 Census of Irrigation segregated statistics only for those enterprises delivering supplemental water from pumped streams, pumped wells, and flowing wells. Therefore, since the major portion of supplemental water is supplied from streams, gravity and storage facilities which were not included in the 1930 Census, the figures shown in table 11 under supplemental water should not be considered comparable between the two Census periods.

TABLE 8.—AREA RECEIVING ENTIRE WATER SUPPLY FROM STREAMS, BY TYPE OF DIVERSION, BY STATES: 1939, 1929, AND 1919
(For the 17 western States and Arkansas and Louisiana)

STATE	TOTAL				STREAMS, GRAVITY				STREAMS, PUMPED				STREAMS, GRAVITY AND PUMPED			
	1939	1929	1919	In-crease or de-crease 1929-1939	1939	1929	1919	In-crease or de-crease 1929-1939	1939	1929	1919	In-crease or de-crease 1929-1939	1939	1929	1919	In-crease or de-crease 1929-1939
	Acres	Acres	Acres	Percent	Acres	Acres	Acres	Percent	Acres	Acres	Acres	Percent	Acres	Acres	Acres	Percent
Total (19 States)	16,054,903	14,952,049	15,953,165	7.4	13,063,955	12,980,575	14,527,080	0.6	1,724,800	1,713,380	1,226,510	0.7	1,266,148	258,064	199,595	380.6
Arizona	119,744	170,797	196,453	-29.9	71,075	162,821	189,782	-56.3	1,055	8,123	6,671	-87.0	47,614	53	-----	(1)
Arkansas	6,960	1,502	6,129	363.4	-----	-----	120	-----	8,733	1,502	6,009	348.3	227	-----	-----	-----
California	2,463,309	2,254,712	2,920,396	9.5	1,741,575	1,699,599	2,554,445	2.5	470,558	469,944	295,673	0.1	251,196	85,169	60,278	194.9
Colorado	3,039,197	3,169,559	3,050,964	-4.1	3,010,172	3,138,966	3,028,787	-4.1	4,691	27,765	12,747	-83.1	24,334	2,828	9,430	760.5
Idaho	2,097,857	2,029,016	2,384,010	3.4	1,628,863	1,848,780	2,274,959	-11.9	294,402	103,362	107,181	184.8	174,792	76,894	1,870	127.3
Kansas	49,194	58,412	32,137	-12.6	40,808	53,198	30,807	-23.1	8,279	3,216	730	157.4	13	-----	800	-----
Louisiana	249,514	259,001	271,152	-3.7	494	1,611	10,226	-69.3	247,190	257,360	248,306	-4.0	1,630	-----	12,820	-----
Montana	1,657,498	1,487,751	1,550,827	11.4	1,475,894	1,592,161	1,515,212	6.0	35,925	38,620	15,743	-7.0	145,679	56,970	19,872	155.7
Nebraska	511,489	505,653	437,552	1.6	488,499	501,195	435,587	-2.5	10,176	2,459	1,115	314.0	12,614	-----	860	-----
Nevada	581,595	395,235	470,179	47.2	578,163	394,415	466,612	46.6	652	821	2,847	-20.6	2,780	-----	720	-----
New Mexico	417,700	436,955	434,368	-4.4	343,684	430,099	432,478	-20.1	3,887	6,855	1,890	-43.3	70,129	-----	-----	-----
North Dakota	21,432	8,253	11,499	159.7	18,573	6,584	9,080	182.1	2,359	1,669	2,469	41.3	500	-----	-----	-----
Oklahoma	2,794	875	2,710	313.9	1,631	555	2,522	359.4	1,163	320	188	263.4	-----	-----	-----	-----
Oregon	963,449	739,569	851,183	30.3	788,059	674,396	796,354	16.8	45,008	50,537	64,576	-10.9	132,382	14,636	253	804.5
South Dakota	57,081	65,916	93,360	-13.4	20,445	65,855	92,491	-69.0	1,723	61	869	(1)	34,913	-----	-----	-----
Texas	728,878	899,146	495,870	4.2	191,124	168,246	73,982	13.6	525,547	527,700	421,538	-0.4	12,007	3,800	350	275.2
Utah	1,071,609	1,040,577	1,116,130	3.0	906,958	962,568	1,106,691	-5.8	13,445	63,809	10,389	-78.9	151,806	14,800	50	964.8
Washington	565,588	450,067	471,145	25.6	329,397	306,185	352,199	7.6	44,187	139,738	28,244	-68.4	191,824	4,144	92,702	(1)
Wyoming	1,450,415	1,183,252	1,187,121	22.6	1,430,647	1,173,763	1,155,596	21.9	7,860	9,489	1,525	-17.2	11,908	-----	-----	-----

¹Percent not shown when more than 1,000.

CENSUS OF IRRIGATION: 1940

TABLE 9.—AREA RECEIVING ENTIRE WATER SUPPLY FROM WELLS, BY TYPE OF DIVERSION, BY STATES: 1939, 1929, AND 1919
(For the 17 western States and Arkansas and Louisiana)

STATE	TOTAL				WELLS, PUMPED				WELLS, FLOWING				WELLS, PUMPED AND FLOWING			
	1939	1929	1919	Increase or decrease(-) 1929-1939	1939	1929	1919	Increase or decrease(-) 1929-1939	1939	1929	1919	Increase or decrease(-) 1929-1939	1939	1929	1919	Increase or decrease(-) 1929-1939
	Acres	Acres	Acres	Percent	Acres	Acres	Acres	Percent	Acres	Acres	Acres	Percent	Acres	Acres	Acres	Percent
Total (19 States)	2,570,392	2,117,012	1,364,639	21.4	2,508,078	2,051,735	1,263,098	22.2	41,481	48,479	65,656	-14.4	20,835	16,798	35,685	24.0
Arizona-----	146,496	106,002	41,610	38.2	144,175	104,837	39,694	37.8	1,947	1,107	1,558	75.9	374	258	558	45.0
Arkansas-----	149,915	142,978	135,260	4.9	149,915	142,978	135,260	4.9	1,638	1,927	17,653	-15.1	5,877	9,761	23,561	-39.8
California-----	1,519,302	1,464,960	888,060	3.7	1,511,789	1,455,272	826,846	4.0	8,256	3,766	4,191	65.2	482	85	85	728.0
Colorado-----	63,506	15,929	14,390	298.7	56,771	12,143	10,114	367.5	6,256	1,973	1,131	7.1	414	50	50	728.0
Idaho-----	8,395	5,569	1,545	50.7	5,865	3,546	414	286.1	26	3	5	766.7	80	50	50	728.0
Kansas-----	45,058	11,651	13,285	296.7	44,972	11,648	15,235	-21.7	1,372	2,896	198	-52.6	214	198	1,075	9.2
Louisiana-----	136,778	175,787	155,675	-22.2	135,192	172,695	154,504	-24.5	666	821	212	-15.0	---	---	---	---
Montana-----	1,542	1,064	351	44.9	844	245	139	247.5	381	---	---	---	---	---	---	---
Nebraska-----	81,034	23,452	546	245.5	80,878	23,452	546	244.0	381	---	---	---	---	---	---	---
Nevada-----	3,409	3,426	1,171	-0.5	588	2,117	295	-73.2	2,604	1,132	811	130.0	237	177	65	33.9
New Mexico-----	98,818	58,118	52,295	70.0	75,556	30,425	15,709	148.3	11,533	21,838	30,030	-47.2	11,728	5,855	6,556	100.3
North Dakota-----	792	63	125	(1)	792	63	107	(1)	---	---	18	---	---	---	---	---
Oklahoma-----	8,329	3,891	2,405	114.0	8,173	3,804	1,995	114.9	155	87	72	78.2	---	---	340	---
Oregon-----	701	528	130	32.8	108	---	---	---	593	528	130	12.3	---	---	---	---
South Dakota-----	266,684	62,624	44,466	326.1	262,724	60,793	39,485	332.2	2,949	1,651	3,256	61.1	1,141	---	1,727	---
Texas-----	15,938	19,855	12,394	-18.9	8,925	10,285	7,308	-15.2	6,706	8,974	4,908	-25.3	307	398	1,778	-22.9
Utah-----	19,999	20,995	20,665	-4.7	17,926	19,456	17,504	-7.9	2,073	1,436	1,871	44.4	---	103	1,490	---
Washington-----	3,497	320	---	985.4	3,008	180	147	(1)	459	140	19	227.9	---	---	---	---
Wyoming-----	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---

1 Percent not shown when more than 1,000.

TABLE 10.—AREA RECEIVING ENTIRE WATER SUPPLY FROM MIXED SOURCES, BY TYPE OF DIVERSION, BY STATES: 1939, 1929 AND 1919
(For the 17 western States and Arkansas and Louisiana)

STATE	TOTAL				STREAMS, GRAVITY AND WELLS, PUMPED				STREAMS, GRAVITY AND WELLS, FLOWING				OTHER MIXED			
	1939	1929	1919	Increase or decrease(-) 1929-1939	1939	1929	1919	Increase or decrease(-) 1929-1939	1939	1929	1919	Increase or decrease(-) 1929-1939	1939	1929	1919	Increase or decrease(-) 1929-1939
	Acres	Acres	Acres	Percent	Acres	Acres	Acres	Percent	Acres	Acres	Acres	Percent	Acres	Acres	Acres	Percent
Total (19 States)	1,983,407	2,052,075	1,423,999	-2.9	1,252,329	1,164,349	544,713	7.8	71,571	21,292	82,665	256.1	669,587	868,434	996,621	-22.7
Arizona-----	383,144	294,808	226,014	30.1	368,375	292,681	217,799	25.9	3,447	40	525	(1)	11,322	1,687	7,690	500.0
Arkansas-----	4,432	6,750	2,087	-34.3	479	---	250	---	3,953	6,750	1,817	-41.4	---	---	---	---
California-----	1,008,356	969,640	320,576	4.0	786,466	780,960	87,897	0.7	4,363	2,222	4,255	98.4	217,527	186,456	228,424	16.7
Colorado-----	88,518	176,195	249,983	-49.8	15,046	8,956	18,258	69.0	38,094	6,700	87,880	349.4	34,378	158,539	165,625	-78.3
Idaho-----	137,904	107,465	58,885	28.3	40,100	72,959	357	-45.0	2,702	1,708	1,927	58.2	95,102	52,798	54,601	190.0
Kansas-----	5,221	458	1,890	(1)	2,443	405	1,540	503.2	---	---	---	---	2,778	53	350	(1)
Louisiana-----	19,722	11,695	17,880	88.6	3,775	---	10,045	---	---	---	---	---	15,947	11,695	7,835	36.4
Montana-----	31,393	79,428	95,293	-60.5	1,496	2,694	155	-44.5	55	---	6,088	---	29,842	76,732	89,070	-61.1
Nebraska-----	10,345	2,329	1,235	344.2	5,019	70	115	(1)	---	---	---	---	5,328	2,259	1,120	135.8
Nevada-----	99,640	25,686	50,215	287.9	9,837	2,280	4,957	335.3	2,502	2,274	82	10.0	87,301	21,152	45,178	312.7
New Mexico-----	32,871	20,516	31,813	60.2	2,564	655	1,541	291.5	1	360	685	-99.7	30,306	19,501	29,787	55.4
North Dakota-----	---	---	65	---	---	---	---	---	---	---	---	---	---	---	65	---
Oklahoma-----	179	40	125	347.5	---	---	---	---	---	---	---	---	179	40	125	347.5
Oregon-----	50,203	127,324	111,442	-60.6	4,416	994	105	344.3	6,585	2,328	200	182.9	39,202	124,002	111,137	-68.4
South Dakota-----	799	180	4,364	399.4	---	---	500	---	390	160	20	145.7	409	---	3,864	---
Texas-----	30,329	20,097	24,669	50.9	1,956	850	454	130.1	915	---	45	---	27,458	19,247	24,170	42.7
Utah-----	48,061	154,191	174,157	-68.8	8,271	20	125	(1)	10,017	3,500	537	186.2	29,763	150,671	173,495	-80.2
Washington-----	18,605	16,863	21,885	10.3	916	708	2,415	29.4	20	---	441	---	17,669	16,155	19,027	9.4
Wyoming-----	23,765	38,634	35,443	-38.5	1,170	137	400	754.0	1,480	---	---	---	21,105	38,497	35,043	-45.2

1 Percent not shown when more than 1,000.

TABLE 11.—AREA RECEIVING ENTIRE WATER SUPPLY FROM MISCELLANEOUS SOURCES, 1939, 1929, AND 1919; AND AREA RECEIVING SUPPLEMENTAL WATER FROM STREAMS, STORAGE, AND WELLS, 1939 AND 1929; BY STATES
(For the 17 western States and Arkansas and Louisiana)

STATE	TOTAL				SPRINGS				ALL OTHER				SUPPLEMENTAL SOURCES (STREAMS, STORAGE, AND WELLS) ¹	
	1939	1929	1919	Increase or decrease(-) 1929-1939	1939	1929	1919	Increase or decrease(-) 1929-1939	1939	1929	1919	Increase or decrease(-) 1929-1939	1939	1929
	Acres	Acres	Acres	Percent	Acres	Acres	Acres	Percent	Acres	Acres	Acres	Percent	Acres	Acres
Total (19 States)	384,977	426,408	449,913	-9.7	210,373	217,246	196,009	-3.2	174,604	209,162	251,905	-16.5	3,287,210	318,045
Arizona-----	3,879	4,183	3,288	-7.3	3,081	3,058	2,578	0.2	618	1,127	710	-27.4	73,806	1,725
Arkansas-----	294	587	490	-47.2	---	---	---	---	294	557	490	-47.2	341	---
California-----	78,601	57,320	110,008	37.1	25,538	23,999	27,698	18.9	50,063	33,521	82,310	50.2	455,342	289,589
Colorado-----	29,461	31,936	33,068	-7.7	12,826	10,806	10,858	20.9	16,635	21,330	22,212	-22.0	628,015	1,870
Idaho-----	33,701	39,202	46,366	-14.0	20,819	24,233	35,537	-14.1	12,882	14,969	13,029	-15.9	910,002	9,047
Kansas-----	507	2,789	---	-81.7	263	155	---	69.7	244	2,614	---	-90.7	13,668	1,050
Louisiana-----	41,081	4,418	10,275	829.9	---	---	---	---	41,081	4,418	10,275	829.9	2,579	280
Montana-----	20,976	28,671	35,258	-21.4	10,215	10,947	14,945	-6.7	10,781	15,724	20,313	-31.6	168,863	---
Nebraska-----	7,511	3,183	3,377	136.0	2,113	414	2,050	410.4	5,398	2,769	1,327	94.9	171,633	---
Nevada-----	55,219	62,300	39,882	-11.4	54,945	61,987	21,987	-11.4	274	315	17,995	-12.5	64,722	---
New Mexico-----	4,650	11,444	19,901	-59.4	3,136	5,595	10,791	-43.9	1,514	5,849	9,110	-74.1	5,123	20
North Dakota-----	136	1,139	508	-98.1	21	8	---	512.5	87	1,131	508	-92.5	---	---
Oklahoma-----	395	795	9	-50.3	49	5	6	320.0	374	790	3	-52.7	---	---
Oregon-----	27,196	27,929	21,132	-2.6	15,274	6,973	9,584	118.0	11,922	20,956	11,546	-45.1	104,970	8,499
South Dakota-----	1,617	503	2,808	221.5	757	25	328	(2)	830	478	2,482	84.1	---	---
Texas-----	19,353	17,050	21,115	15.5	9,715	9,323	8,696	4.1	9,638	7,722	12,429	24.8	66,909	254
Utah-----	40,518	109,702	69,970	-68.1	35,696	49,593	41,510	-27.6	4,620	60,109	27,650	-82.5	322,594	972
Washington-----	11,021	11,358	16,208	-3.0	5,752	4,033	7,669	42.6	5,289	7,525	6,537	-29.1	164,664	4,759
Wyoming-----	8,861	13,949	---	-36.5	7,011	8,269	5,985	11.5	1,850	7,660	11,667	-75.8	95,581	---

1 Data for 1939 includes streams pumped; wells, pumped or flowing; streams, gravity or storage. Data for 1929 do not include streams, gravity or storage.

2 Percent not shown when more than 1,000.

GENERAL DISCUSSION

XXXIII

Irrigation Works

Tables 12 to 15 present an inventory of irrigation works, by States, and principal drainage basins for the Censuses of 1940, 1930, and 1920. The marked increase in the number of practically all physical structures during the last decade indicates the installations of betterments and increased efforts to conserve water and develop additional water supplies. Storage dams increased from 2,949 in 1930 to 4,607 in 1940, or 56.2 percent. The number of storage reservoirs increased from 5,122 in 1930 to 7,709 in 1940, or 50.5 percent. The total storage capacity of reservoirs increased from 24,508,590 acre-feet in 1930 to 33,787,382 acre-feet in 1940, or 37.9 percent. Although the number of reservoirs reported decreased in a few States, each irrigation State, except Kansas, shows increased storage capacity. The statistics presented on storage dams and reservoirs for the Census of 1920 include some developments installed for other purposes besides irrigation. Therefore,

in several States, the data are not comparable with those of later censuses when only structures installed primarily for irrigation purposes were included.

Judging from increases in storage capacity, the most important developments in the conservation of water by storage in the decade 1930 to 1940 took place in the States of Arizona, Nebraska, and Utah and in the principal drainage basins of the Missouri, Colorado, and Columbia Rivers and in the Great Basin.

The lengths and capacities of canals show only slight increases, while the lengths of reported pipe lines of all kinds increased from 17,363.1 miles in 1930 to 28,584.9 miles in 1940, or 64.6 percent. The major portion of this increase was concrete pipe lines installed in California, Arizona, and Texas.

The number of flowing wells decreased from 4,811 in 1930 to 4,641 in 1940 and their capacities decreased from 809,367 gallons per minute to 555,073 gallons per minute, or 8.9 percent.

TABLE 12.—NUMBER OF DIVERSION AND STORAGE DAMS, 1940, 1930, AND 1920, BY MATERIALS, 1940; AND NUMBER OF RESERVOIRS WITH CAPACITY, 1940, 1930, AND 1920; BY STATES AND BY PRINCIPAL DRAINAGE BASINS

(For the 17 western States and Arkansas and Louisiana)

ITEM	DIVERSION DAMS							STORAGE DAMS						RESERVOIRS					
	Total			Materials, 1940				Total			Materials, 1940			Total			Capacity		
	1940	1930	1920	Con-crete or ma-sonry	Tim-ber	Earth and rock	All other ¹	1940	1930	1920	Con-crete or ma-sonry	Earth and rock	All other ¹	1940	1930	1920	1940	1930	1920
	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	Acre-ft.	Acre-ft.	Acre-ft.
Total (19 States)-----	34,544	21,947	23,894	3,666	4,595	18,032	8,251	4,607	2,949	3,931	409	3,795	403	7,709	5,122	7,538	33,787,382	24,508,590	21,246,436
STATE	BY STATES																		
Arizona-----	602	267	248	84	5	321	192	199	78	99	17	167	15	333	378	340	4,860,898	3,410,975	1,510,856
Arkansas-----	6	1	63	-----	1	4	1	27	6	17	-----	21	6	24	10	16	31,992	7,342	20
California-----	2,714	1,654	2,070	527	477	1,111	599	709	421	455	126	531	52	2,652	1,769	3,030	3,581,621	3,225,675	1,091,394
Colorado-----	4,792	3,672	3,647	367	427	2,838	1,160	1,015	706	803	19	951	45	1,071	765	979	2,071,522	1,924,962	2,408,372
Idaho-----	3,209	2,305	2,872	356	290	1,984	619	260	152	288	44	185	31	290	155	249	3,795,272	3,645,373	3,493,511
Kansas-----	102	27	10	16	4	65	17	40	7	13	8	22	10	80	19	36	32,584	86,233	391
Louisiana-----	105	36	419	3	15	45	42	114	81	63	1	91	22	75	85	74	34,199	13,909	7,632
Montana-----	6,136	2,856	3,545	254	1,067	3,217	1,598	468	326	523	19	385	64	517	282	468	1,301,422	857,067	1,571,720
Nebraska-----	351	185	260	76	24	165	86	156	28	73	4	148	6	164	40	59	2,306,159	199,185	197,890
Nevada-----	1,896	1,640	1,523	95	84	1,077	640	122	118	82	8	110	4	200	209	134	696,005	529,369	504,428
New Mexico-----	1,072	665	1,423	121	102	475	374	141	69	153	7	124	10	502	240	328	3,280,550	2,945,220	2,980,718
North Dakota-----	19	9	26	-----	1	14	4	14	10	11	-----	14	-----	14	8	9	3,946	1,468	1,110
Oklahoma-----	8	4	7	1	-----	6	1	21	3	3	2	18	1	20	7	8	900	293	52
Oregon-----	5,097	3,806	3,285	663	877	2,220	1,337	247	167	309	33	156	58	257	120	266	2,212,315	1,698,428	1,905,037
South Dakota-----	258	91	207	13	19	198	28	74	10	182	2	69	3	82	5	119	209,785	203,124	212,264
Texas-----	244	107	165	76	4	136	28	194	168	134	47	134	13	542	325	368	1,405,024	935,085	392,999
Utah-----	1,973	1,717	1,479	611	217	778	367	362	287	307	39	313	10	438	413	476	3,417,704	1,093,252	1,600,505
Washington-----	1,755	499	579	166	453	725	411	125	100	115	21	61	23	114	78	205	1,165,527	699,807	477,769
Wyoming-----	4,205	2,406	2,086	257	528	2,673	747	319	212	301	12	277	30	334	214	374	3,379,957	3,051,745	2,911,748
DRAINAGE BASIN	BY PRINCIPAL DRAINAGE BASINS																		
Red River (of the North)-----	5	-----	-----	-----	-----	5	-----	2	-----	-----	-----	2	-----	2	-----	-----	720	-----	-----
Missouri River-----	8,897	5,006	5,973	673	1,046	5,351	1,827	1,237	734	1,246	33	1,119	85	1,332	743	1,220	6,715,271	4,043,135	4,860,616
Mississippi River, exclu-sive of Missouri River-----	959	814	1,704	88	58	472	341	360	180	259	17	300	43	425	209	381	1,608,164	1,523,856	1,163,306
Gulf of Mexico streams, other than Mississippi River and Rio Grande-----	196	99	148	42	11	85	58	204	195	162	43	140	21	436	321	360	334,176	296,264	305,415
Rio Grande-----	1,450	922	1,639	198	158	670	424	182	99	125	14	137	11	567	306	351	3,864,857	3,120,623	3,233,164
Colorado River-----	4,391	3,155	2,468	318	489	2,614	970	840	494	565	25	772	43	1,030	734	839	5,717,080	3,748,284	1,676,036
Whitewater Draw and Vamori Wash-----	158	7	6	1	-----	67	90	6	4	51	-----	6	-----	18	90	76	74	140	85,071
Great Basin-----	4,263	3,806	3,234	756	441	1,933	1,133	462	409	449	53	395	14	766	787	800	3,781,538	1,922,757	2,269,641
Columbia River-----	11,208	6,247	6,494	1,066	1,748	5,698	2,696	590	414	803	85	388	117	614	353	646	7,517,123	6,316,670	5,711,783
Klamath River-----	670	472	505	29	155	292	194	52	20	41	5	40	7	60	32	90	1,165,143	1,110,362	1,022,365
Sacramento-San Joaquin Delta and tributary streams-----	1,497	781	1,128	335	313	478	371	358	218	285	47	287	24	1,310	949	1,639	2,681,435	2,100,255	677,957
Pacific Ocean streams, excl. of Gulf of California streams, Columbia and Klamath Rivers, and Sacramento-San Joaquin Delta and tributary streams-----	850	638	595	160	176	367	147	334	182	145	87	209	38	1,149	598	1,136	401,801	326,244	221,060

¹Other and mixed, and not reported. Other and mixed are principally temporary dams, replaced annually.

²Data for Censuses of 1930 and 1920 are for Whitewater Draw and unidentified tributaries, and do not include the independent basin, Vamori Wash.

CENSUS OF IRRIGATION: 1940

TABLE 13.—LENGTH OF CANALS WITH CAPACITY AT MAIN HEADING, LENGTH OF PIPE LINES, AND NUMBER OF FLOWING WELLS, WITH CAPACITY, 1940, 1930, AND 1920; AND PIPE LINES BY KIND OF MATERIAL, 1940; BY STATES AND BY PRINCIPAL DRAINAGE BASINS

(For the 17 western States and Arkansas and Louisiana)

ITEM	CANALS						PIPE LINES ¹								WELLS, FLOWING					
	Length			Capacity ²			Length			Materials, 1940					Total			Capacity		
	1940	1930	1920	1940	1930	1920	1940	1930	1920	Con- crete	Metal	Wood- stave	Clay and other	1940	1930	1920	1940	1930	1920	
	Miles	Miles	Miles	Sec.-ft.	Sec.-ft.	Sec.-ft.	Miles	Miles	Miles	Miles	Miles	Miles	Miles	No.	No.	No.	G.p.m.	G.p.m.	G.p.m.	
Total (19 States)	127,533.7	126,802	159,884	812,021	547,314	651,079	28,584.9	17,363.1	8,878.3	18,692.2	8,027.5	1,238.5	828.7	4,641	4,811	4,608	555,075	609,387	935,057	
STATE	BY STATES																			
Arizona	4,178.2	3,974	3,368	13,258	13,897	11,707	344.3	189.3	104.5	265.8	65.7	3.0	9.8	288	215	310	22,878	13,772	14,547	
Arkansas	77.9	51	88	270	1,845	1,205	13.0	1.0	0.4	-----	3.4	-----	9.8	-----	-----	-----	-----	-----	-----	
California	19,799.1	18,602	27,384	91,776	84,944	115,237	22,690.2	14,883.0	6,885.9	18,745.0	5,414.1	249.8	281.5	458	449	1,415	34,787	85,768	287,187	
Colorado	19,864.0	21,381	27,593	139,780	123,652	119,558	245.1	131.9	217.3	86.7	93.5	23.7	41.2	868	621	476	54,859	39,644	20,139	
Idaho	13,802.1	14,544	17,298	71,510	76,763	86,273	299.9	263.4	180.6	96.0	58.5	121.0	24.4	375	220	142	40,165	30,108	15,133	
Kansas	292.5	285	418	3,347	2,079	1,667	24.1	16.1	2.8	1.1	21.7	-----	1.3	24	1	6	1,453	75	500	
Louisiana	2,421.0	2,226	3,243	10,355	11,366	11,889	63.6	15.1	50.1	15.4	40.7	5.9	1.6	502	807	9	12,695	31,961	6,255	
Montana	15,702.5	15,957	22,498	66,745	53,253	94,429	148.1	64.9	48.0	14.5	78.7	28.1	28.8	44	40	41	9,834	4,106	4,608	
Nebraska	3,331.3	3,465	3,325	14,258	13,108	11,685	126.1	27.5	3.8	21.2	83.2	12.5	9.2	19	-----	-----	370	-----	-----	
Nevada	2,897.2	4,155	4,368	22,930	16,986	10,554	104.7	90.6	33.0	8.7	77.7	12.1	8.2	322	274	123	39,835	19,131	21,942	
New Mexico	4,847.9	4,466	5,932	16,821	17,479	23,432	36.5	15.2	80.8	8.7	21.4	3.4	3.0	288	340	558	181,076	223,257	378,222	
North Dakota	159.2	87	151	616	1,072	836	3.8	1.2	0.3	0.3	3.4	-----	0.1	-----	-----	-----	-----	-----	-----	
Oklahoma	42.2	24	57	277	77	344	24.4	0.7	4.3	0.6	23.6	0.1	0.1	-----	-----	1	-----	-----	100	
Oregon	8,518.0	8,197	9,071	37,290	25,806	28,697	665.2	225.3	159.6	97.8	489.2	87.7	10.5	78	59	65	3,396	6,535	11,988	
South Dakota	1,049.3	1,082	1,258	1,948	1,995	5,427	17.3	8.9	7.2	5.7	11.0	0.5	0.1	19	13	4	5,377	4,825	2,750	
Texas	5,936.1	4,879	4,473	24,813	21,626	23,261	923.1	319.0	157.1	655.4	204.0	22.2	41.5	100	61	135	39,508	38,020	62,584	
Utah	9,004.5	9,237	11,677	34,579	30,648	29,447	172.5	159.0	154.7	40.6	60.7	21.2	50.0	1,218	1,665	1,258	85,838	104,670	96,371	
Washington	4,248.6	3,635	5,615	15,104	14,987	16,242	2,612.7	1,136.9	790.0	814.9	1,239.0	654.3	104.5	50	42	60	21,192	27,290	14,925	
Wyoming	11,762.1	10,775	12,051	46,366	35,811	39,009	70.5	14.1	17.9	13.8	36.0	13.0	5.5	36	6	7	5,830	2,205	46	
DRAINAGE BASIN	BY PRINCIPAL DRAINAGE BASINS																			
Red River (of the North)	23.9	1	-----	365	2	-----	1.9	1.2	-----	0.1	1.8	-----	-----	-----	-----	-----	-----	-----	-----	
Missouri River	31,131.1	30,612	39,599	148,255	130,173	167,891	400.6	101.1	89.5	71.8	227.6	37.8	63.4	79	21	41	9,915	7,218	4,271	
Mississippi River, exclusive of Missouri River	4,838.6	5,518	6,266	49,858	49,701	41,974	174.5	114.9	148.3	61.9	78.8	14.5	19.3	47	7	27	4,263	993	6,240	
Gulf of Mexico streams, other than Mississippi River and Rio Grande	4,569.8	3,792	4,886	18,860	18,608	20,931	221.0	46.5	159.9	30.5	173.9	7.5	9.1	578	856	127	43,504	52,933	57,009	
Rio Grande	8,702.9	9,381	9,732	43,851	38,609	40,424	774.3	287.9	90.3	648.4	68.5	21.4	36.0	1,136	965	1,018	240,308	276,671	401,156	
Colorado River	20,894.1	20,185	22,566	81,033	68,322	66,308	919.0	216.6	246.0	684.8	181.2	16.3	36.7	463	224	812	48,584	16,803	70,917	
Whitewater Draw and Vamori Wash ³	26.0	7	128	484	10	553	4.9	4.1	5.1	-----	4.9	-----	-----	6	11	10	765	430	503	
Great Basin	10,757.6	12,753	17,665	57,949	50,743	57,409	984.7	1,112.3	723.0	706.1	186.5	35.8	56.3	1,898	2,175	1,610	118,499	153,800	128,522	
Columbia River	27,535.0	26,919	32,799	121,457	115,083	134,536	3,181.4	1,616.2	1,125.2	794.9	1,427.7	821.7	137.1	374	293	176	65,579	62,451	27,135	
Klamath River	1,904.3	1,698	1,728	9,179	5,900	8,878	52.8	21.1	22.1	4.6	43.8	3.4	1.0	3	28	4	42	241	35	
Sacramento-San Joaquin Delta and tributary streams	15,202.8	13,314	19,428	72,735	64,374	79,142	7,437.1	4,819.4	1,757.8	6,487.8	766.8	131.0	51.7	47	72	181	3,403	14,400	51,785	
Pacific Ocean streams, excl. of Gulf of California streams, Columbia and Klamath Rivers, and Sacramento-San Joaquin Delta and tributary streams	1,947.6	2,622	3,049	7,995	5,789	13,036	14,432.7	9,021.8	4,512.1	9,201.3	4,866.2	147.1	218.1	212	159	802	20,211	23,427	187,494	

¹ Includes siphons and farm pipe lines reported.² Total capacity (not necessarily capacities of canals) of heading structures (including pumping plants) for diverting water from natural surface sources.³ Data for Censuses of 1930 and 1920 are for Whitewater Draw and unidentified tributaries, and do not include the independent basin, Vamori Wash.

GENERAL DISCUSSION

XXXV

Number and Yield of Pumped Wells

Table 14 shows the number and yield of wells pumped for irrigation, by States and by principal drainage basins. The total of 68,279 pumped wells reported in 1940 represents a net increase of 11,550 (20.4 percent) for the 19 irrigation States during the decade compared to an increase of 24,635 wells (76.8 percent) during the decade 1920 to 1930.

Yields of pumped wells also increased at the net rate of 33.5 percent in the last decade compared to 98.0 percent increase during the previous decade. The average yield per well was 835 gallons per minute in 1940 as compared to 572 gallons per minute in 1930, which indicates that larger wells are being developed with the more modern drilling and pumping equipment available.

Each of the 19 irrigation States, excepting Utah, shows an increase for 1940 contrasted with 1930 in number of wells

pumped while the reported yields decreased in Louisiana (22.1 percent), Nevada (6.0 percent), and Washington (6.3 percent). The greatest increases in number of pumped wells were reported for Texas (2,294), Colorado (2,224), Nebraska (1,875), and California (1,831). The greatest increases in yields, gallons per minute, were in California with 4,031,802; Colorado with 1,891,895; Nebraska with 1,625,126; and Texas with 1,598,835. These yields raised the average per well in these States as follows: California, from 519 gallons per minute to 583; Colorado, from 364 gallons per minute to 670; Nebraska, from 797 gallons per minute to 851; and Texas, from 558 gallons per minute to 652.

The number of pumped wells increased (1930-40) in all principal drainage basins, excluding Red River of the North, N. Dak.; Whitewater Draw, and Vamori Wash, Ariz.; and the Great Basin which shows a decrease of 1,401 wells, or 51.8 percent, representing a decrease of 50.6 percent in total yield.

TABLE 14.—NUMBER AND YIELD OF PUMPED WELLS, BY STATES AND BY PRINCIPAL DRAINAGE BASINS: 1940, 1930, AND 1920
(For the 17 western States and Arkansas and Louisiana)

ITEM	PUMPED WELLS													
	Number							Yield						
	1940	1930	1920	Increase or decrease (-)				1940	1930	1920	Increase or decrease (-)			
				1930-1940		1920-1930					1930-1940		1920-1930	
				Number	Percent	Number	Percent				G.p.m.	Percent	G.p.m.	Percent
Total (19 States)	68,279	56,729	32,094	11,550	20.4	24,635	76.8	43,355,271	32,467,120	16,896,549	10,888,151	33.5	16,070,571	98.0
STATE	BY STATES													
Arizona	1,858	1,398	999	460	32.9	399	39.9	2,508,337	1,832,352	1,042,590	675,965	36.9	789,762	75.8
Arkansas	1,534	1,190	1,089	344	28.9	101	9.5	1,812,647	1,641,448	1,470,147	171,199	10.4	171,301	11.7
California	48,568	46,737	25,401	1,831	3.9	21,556	84.0	28,297,969	24,266,167	10,608,476	4,081,802	16.6	13,657,691	128.8
Colorado	2,878	854	527	2,224	340.1	127	24.1	1,929,798	237,903	210,094	1,691,895	711.2	27,809	18.2
Idaho	309	121	53	188	155.4	68	128.5	225,164	34,601	17,749	190,565	550.7	16,862	94.9
Kansas	1,638	772	710	866	112.2	62	8.7	863,663	323,500	266,797	540,163	167.0	56,703	21.3
Louisiana	1,504	1,589	812	115	8.3	577	71.1	1,528,615	1,958,811	1,607,637	-432,198	-22.1	351,174	21.8
Montana	102	49	22	53	108.2	27	122.7	33,883	18,653	11,085	15,250	81.6	7,568	98.3
Nebraska	2,412	637	34	1,875	349.2	503	(1)	2,053,184	428,068	24,701	1,625,126	379.7	403,357	(1)
Nevada	167	147	129	20	13.6	18	14.0	50,938	54,162	6,798	-3,224	-6.0	47,364	696.7
New Mexico	1,467	680	461	807	118.7	219	47.5	1,143,276	461,898	265,618	661,378	137.2	216,280	81.4
North Dakota	11	11	11	11	100.0	11	100.0	378	378	378	378	100.0	378	100.0
Oklahoma	77	18	19	59	327.8	-1	-5.3	15,486	2,715	3,843	12,771	470.4	-928	-25.5
Oregon	901	558	208	545	61.5	550	168.3	209,299	136,669	47,026	72,620	53.1	89,643	180.6
South Dakota	16	1	1	15	(1)	1	6.3	1,039	375	800	259	24.5	259	100.0
Texas	3,396	1,102	901	2,294	208.2	201	22.3	2,213,250	614,395	538,565	1,598,835	260.2	75,850	14.1
Utah	285	346	192	-60	-21.3	154	80.2	122,528	120,333	39,059	2,195	1.8	81,274	208.1
Washington	1,041	1,019	520	22	2.2	499	96.0	287,327	306,800	227,744	-19,475	-6.3	79,056	34.7
Wyoming	94	11	16	83	754.5	-5	-31.3	60,522	8,280	8,020	52,242	830.9	260	5.2
DRAINAGE BASIN	BY PRINCIPAL DRAINAGE BASINS													
Missouri River	4,760	1,071	385	3,689	344.4	686	178.2	3,633,499	613,350	171,464	3,020,149	492.4	441,886	257.7
Mississippi River, exclusive of Missouri River	4,428	2,216	2,085	2,212	99.8	131	6.3	3,493,620	2,104,316	1,878,840	1,369,504	66.0	227,476	12.1
Gulf of Mexico streams, other than Mississippi River and Rio Grande	4,158	2,363	1,615	1,795	76.0	748	46.3	3,210,793	2,493,111	2,072,580	717,672	28.8	420,531	20.3
Rio Grande	1,712	731	503	991	134.2	228	45.3	1,291,071	498,631	286,143	792,440	158.9	212,468	74.5
Colorado River	2,395	1,196	1,128	1,199	100.3	68	6.0	2,758,983	1,772,612	1,095,724	966,171	55.6	677,088	61.8
Whitewater Draw and Vamori Wash ²	142	210	209	-68	-32.4	1	0.5	45,537	62,457	72,787	-16,920	-27.1	-10,330	-14.2
Great Basin	1,306	2,707	870	-1,401	-51.8	1,637	211.1	685,078	1,321,596	275,094	-668,118	-60.6	1,048,302	335.9
Columbia River	1,972	1,665	752	309	18.6	811	121.1	687,659	484,026	277,555	223,615	48.2	186,471	87.2
Klamath River	56	14	16	42	300.0	-2	-12.5	29,509	21,442	5,975	8,067	37.6	15,467	258.9
Sacramento-San Joaquin Delta and tributary streams-1	52,418	31,744	14,657	674	2.1	17,087	116.6	20,042,293	16,750,569	6,384,682	3,311,924	19.8	10,345,487	182.0
Pacific Ocean streams, excl. of Gulf of California streams, Columbia and Klamath Rivers, and Sacramento-San Joaquin Delta and tributary streams	14,932	12,814	9,874	2,118	16.5	2,940	29.8	7,509,059	6,385,210	3,879,505	1,123,849	17.6	2,505,705	64.6

¹ Percent not shown when more than 1,000.

² Data for Censuses of 1930 and 1920 are for Whitewater Draw and unidentified tributaries, and do not include the independent basin, Vamori Wash.

Pumping Equipment

Table 15 presents comparable statistics on pumping equipment for the Censuses of 1940, 1930, and 1920, by kind of power, kind of pump, and capacities by States and principal drainage basins. The average pumping lift is also shown.

The total installed horsepower for pumping water for irrigation in the 19 States increased from 1,283,419 horsepower to 1,762,687 horsepower, or 37.3 percent during the decade 1930 to 1940. Likewise, the pumps installed increased 27.8 percent

in number and 32.4 percent in capacity. The average pumping lift reported for all pumping plants remains static for the decade at 51 feet.

Since 1930 the use of electric power increased by 241,858 installed horsepower and represents 63.4 percent of the total in 1940. The installed horsepower of internal-combustion engines increased 322,387 horsepower and represents 83.4 percent of the total.

A marked increase (13,370 to 38,204 or 185.7 percent) took place in the installation of turbine pumps during the decade.

Since this type of pump is used almost exclusively for the pumping of water from wells and there was no substantial reduction in the use of other types of pumps, it can be reasoned that the trend is toward turbine pumps and the increased number of turbine pumps is indicative of new developments since 1930 involving pumped wells. Although turbine pumps lead in total number and require 51.1 percent of the total installed motive power, centrifugal pumps exceed in capacity with 55.4 percent of the total. The average lift for centrifugal pumps is 29 feet compared with 70 feet for the turbines. This higher lift largely accounts for the greater horsepower required by the turbine installations. It is notable that the total number of centrifugal pumps decreased slightly. However, the total capacity increased 10.1 percent and the installed horsepower decreased 17.8 percent, indicating replacements of machinery of higher efficiency.

All States show a marked decade increase in the installation of pumping equipment, with the exception of Utah (-11.1 percent). California, with 52,016 pumps or 66.1 percent of the total installations ranks first, followed in order by Texas, 6.1 percent, and Colorado and Nebraska, each with 3.6 percent of the total. Marked increases in reported average lifts are shown in Arizona and Texas.

Pumping plant installations in the principal drainage basins, exclusive of Red River and Whitewater Draw and Vamori Wash, increased, with the exception of the Great Basin (-48.1 percent). The Sacramento-San Joaquin Delta and tributary basins contain 44.3 percent of the total irrigation pumps in the 19 States. Other Pacific Ocean basins exclusive of the Colorado, Columbia, and Klamath Basins, rank second, with 21.1 percent, and the Missouri River Basin ranks third, with 7.6 percent of the total number of pumps installed. However, the Gulf of Mexico streams other than the Mississippi and Rio Grande rank third in installed horsepower and second in capacity of pumps.

TABLE 15.—PUMPING EQUIPMENT—BY KIND OF POWER, BY KIND OF PUMP, BY STATES, AND BY PRINCIPAL DRAINAGE BASINS: 1940, 1930, AND 1920

(For the 17 western States and Arkansas and Louisiana)

ITEM (For definitions and explanations, see text)	CAPACITY OF PRIME MOVERS						PUMPS												Average pumping lift		
	1940	1930	1920	Pro- portion of total, 1940	In- crease or de- crease (-) 1930- 1940	Percent	Total					Capacity					1940	1930	1920		
							Number	Number	Number	Percent	Percent	G.p.m.	G.p.m.	G.p.m.	Percent	Percent					
1940	1930	1920	Pro- portion of total, 1940	In- crease or de- crease (-) 1930- 1940	Percent	Number	Number	Number	Percent	Percent	G.p.m.	G.p.m.	G.p.m.	Percent	Percent	Feet	Feet	Feet			
Total (19 States)	1,762,687	1,283,419	748,971	100.0	37.3		78,528	61,445	33,804	100.0	27.8	75,802,998	57,244,869	38,275,005	100.0	32.4	51	51	41		
BY KIND OF POWER																					
Electric motor	1,118,024	876,186	289,018	63.4	27.6		50,597	44,165	12,745	64.5	14.6	43,527,320	37,565,179	13,311,435	57.4	16.5	55	57	50		
Internal-combustion engine	588,123	265,756	259,613	33.4	121.3		21,533	15,012	15,691	27.4	65.5	20,532,240	10,891,865	10,461,857	27.1	88.5	42	37	35		
Other	66,540	50,345	125,429	3.2	12.3		1,213	874	2,315	1.5	58.8	1,842,277	5,245,151	7,986,226	2.4	-43.2	63	40	87		
Mixed	(1)	91,174	74,911				5,185	5,594	3,055	6.6	52.8	9,901,161	5,742,674	4,515,487	13.1	72.4	50	45	46		
BY KIND OF PUMP																					
Centrifugal	597,067	726,301	581,274	33.9	-17.8		34,447	34,803	28,019	43.9	-1.0	42,036,592	53,193,371	29,250,062	55.4	10.1	29	38	33		
Turbine	901,137	302,294	24,390	51.1	198.1		38,204	15,370	877	48.6	185.7	30,746,028	8,655,509	525,728	40.6	255.2	70	75	84		
Plunger	17,558	17,603	(*)	1.0	0.3		4,887	2,687	(*)	6.2	70.5	299,420	272,174	(*)	0.4	10.0	80	101	(*)		
Other and mixed	246,930	237,321	214,307	14.0	121.5		990	10,405	7,108	1.3	-79.6	2,721,159	10,123,905	8,499,215	3.6	-55.8	40	65	288		
BY STATES																					
Arizona	102,733	57,635	22,014	5.8	78.3		1,969	1,364	1,001	2.5	44.4	2,992,988	2,125,293	1,049,030	3.9	40.8	60	46	44		
Arkansas	78,048	66,980	59,332	4.3	13.5		1,633	1,206	1,121	2.1	35.4	2,013,897	1,775,788	1,654,097	2.7	13.4	61	68	50		
California	969,551	820,787	386,200	54.9	18.0		62,016	47,994	24,134	66.1	8.4	39,147,470	33,240,589	16,773,692	51.7	17.8	55	53	41		
Colorado	49,157	11,204	8,635	2.8	338.7		2,818	540	435	3.6	421.9	2,263,375	437,250	299,728	3.0	417.6	32	25	23		
Idaho	44,597	33,754	28,364	2.5	51.9		675	465	232	0.9	45.2	2,719,905	2,115,513	1,397,681	3.8	28.7	26	32	29		
Kansas	26,798	6,221	6,946	1.5	350.7		1,259	312	298	1.6	303.5	1,231,482	393,526	297,975	1.6	212.9	35	26	30		
Louisiana	85,574	86,413	85,622	4.9	-1.0		2,403	2,000	1,941	3.1	20.2	5,453,487	5,914,799	4,986,898	8.5	9.1	32	37	32		
Montana	29,110	9,095	10,341	1.7	220.1		680	233	299	0.9	191.8	1,309,014	523,494	453,231	1.7	150.1	21	22	20		
Nebraska	53,572	10,991	959	3.0	387.4		2,848	656	54	3.6	347.8	2,528,669	556,752	75,688	3.3	371.1	32	29	24		
Nevada	2,262	2,671	409	0.1	-15.3		198	173	72	0.2	13.3	141,085	115,648	35,268	0.2	22.0	51	31	22		
New Mexico	40,110	14,483	8,468	2.3	176.9		1,559	738	491	2.0	111.2	1,309,005	555,083	304,789	1.7	135.8	44	40	40		
North Dakota	1,253	216	2,068	0.1	480.1		83	13	10	0.1	588.5	104,158	24,900	51,250	0.1	318.3	17	24	38		
Oklahoma	1,037	229	184	0.1	352.8		118	30	26	0.1	286.7	59,280	8,855	7,888	0.1	569.5	36	33	59		
Oregon	29,527	21,257	13,769	1.7	38.9		2,285	1,167	614	2.9	95.8	1,510,958	1,022,213	600,045	2.0	47.8	27	27	28		
South Dakota	2,060	92	498	0.1	(*)		127	8	25	0.2	(*)	103,050	4,027	23,320	0.1	(*)	20	27	21		
Texas	195,061	95,933	80,511	11.1	103.3		4,754	2,028	1,641	6.1	134.4	9,918,225	6,494,999	6,825,998	13.1	52.7	69	55	45		
Utah	14,216	11,381	11,392	0.8	24.9		409	460	291	0.5	-11.1	855,662	877,942	783,588	1.1	-4.8	35	36	25		
Washington	37,131	33,187	22,929	2.1	11.9		2,488	2,023	1,059	3.2	23.0	953,751	993,503	636,552	1.3	-4.0	47	59	60		
Wyoming	4,152	912	1,304	0.2	355.3		230	85	70	0.3	253.8	209,559	86,905	59,725	0.3	141.1	30	21	31		
BY PRINCIPAL DRAINAGE BASINS																					
Red River (of the North)	274	153	-----	(*)	79.1		16	8	-----	(*)	100.0	26,045	20,400	-----	(*)	27.7	21	13	-----		
Missouri River	117,173	25,788	18,329	6.6	354.4		5,994	1,279	889	7.6	388.6	5,733,010	1,543,545	800,218	7.6	326.7	32	28	22		
Mississippi River, exclu- sive of Missouri River	145,750	78,378	73,739	8.3	88.0		4,190	1,804	1,715	5.3	132.3	4,275,330	2,418,238	2,237,441	5.6	76.8	57	54	45		
Gulf of Mexico streams, other than Mississippi River and Rio Grande	208,930	140,298	138,953	11.9	48.9		5,697	3,525	3,208	7.3	61.6	11,646,141	9,929,951	9,202,748	15.4	30.4	50	46	37		
Rio Grande	78,569	52,910	30,941	4.3	44.7		2,353	1,099	709	3.0	114.1	5,488,952	3,881,586	2,718,936	7.2	41.4	42	41	42		
Colorado River	117,403	62,050	27,406	6.7	89.2		2,640	1,220	1,128	3.4	116.4	3,618,220	2,367,101	1,195,680	4.8	52.8	54	44	42		
Whitewater Draw and Vamori Wash*	2,070	2,025	2,403	0.1	2.2		144	215	209	0.2	-33.0	65,344	59,507	73,987	0.1	6.4	57	48	44		
Great Basin	39,973	62,344	20,803	2.3	-35.9		1,448	2,788	820	1.8	-48.1	1,514,746	3,205,814	1,033,984	2.0	-52.8	71	87	41		
Columbia River	105,911	77,271	62,451	6.0	37.1		4,439	3,434	1,745	5.7	29.3	4,609,862	3,593,854	2,522,910	6.1	28.3	39	47	50		
Klamath River	6,854	6,522	3,996	0.4	5.1		224	123	85	0.3	82.1	508,460	508,985	174,184	0.7	-0.5	26	33	25		
Sacramento-San Joaquin Delta and tributary streams	552,163	466,661	201,074	31.3	17.8		34,831	33,129	14,849	44.3	5.1	29,694,592	23,556,244	11,584,371	39.1	24.5	42	42	32		
Pacific Ocean streams, excl. of Gulf of Cali- fornia streams, Columbia and Klamath Rivers, and Sacramento-San Joaquin Delta and tributary streams	389,587	307,019	171,076	22.1	26.9		16,552	12,821	8,649	21.1	29.1	8,630,296	7,059,634	4,732,586	11.4	22.2	80	79	58		

1 For 1940 mixed types of motors were segregated and assigned to the proper types. 1930 and 1920 data include "Not reported." 2 Data for "Plunger" pumps included with horsepower for 1920. 3 Percent not shown when more than 1,000. 4 Less than one-tenth of 1 percent. 5 Data for Censuses of 1930 and 1920 are for

GENERAL DISCUSSION

XXXVII

Capability of Irrigation Works

Table 16 shows the areas which installed irrigation works were reported capable of supplying with water and irrigable areas reported, together with the excess of these areas over areas irrigated. The expansion possibilities from the standpoint of capacity of irrigation works are thus indicated. Of the 10,302,210 acres of irrigable land now in irrigation projects which were not irrigated in 1939, statistics indicate that 7,051,509 acres could be irrigated with the present systems, leaving 3,250,701 acres of irrigable land in operating enterprises for which works have not been constructed. Cali-

fornia with constructed irrigation works capable of supplying water to 2,329,008 acres more than were irrigated in 1939, Texas with 728,588 acres, Colorado with 692,857 acres, and Montana with 632,981 acres, are the States with the greatest acreages under works but not irrigated. Similarly, the Sacramento and San Joaquin Valleys of California with works capable of supplying water to 1,738,715 acres more than were irrigated in 1939, the Missouri River with 1,532,673 acres, the Colorado River with 729,624 acres, and the Rio Grande with 656,129 acres, indicate the locations of largest areas by drainage basins under irrigation works but not irrigated in 1939.

TABLE 16.—AREA IRRIGATION WORKS WERE CAPABLE OF SUPPLYING WITH WATER, AND IRRIGABLE AREA, 1940, 1930, AND 1920; AND THE EXCESS OF THESE AREAS OVER AREAS IRRIGATED, 1939, 1929, AND 1919; BY STATES AND BY PRINCIPAL DRAINAGE BASINS

(For the 17 western States and Arkansas and Louisiana)

ITEM	AREA WORKS WERE CAPABLE OF SUPPLYING WITH WATER							IRRIGABLE AREA						
	1940		1930		1920		Increase or decrease (-) of excess over area irrigated 1930-1940	1940		1930		1920		Increase or decrease (-) of excess over area irrigated 1930-1940
	Area	Excess over area irrigated in 1939	Area	Excess over area irrigated in 1929	Area	Excess over area irrigated in 1919		Area	Excess over area irrigated in 1939	Area	Excess over area irrigated in 1929	Area	Excess over area irrigated in 1919	
Acres	Acres	Acres	Acres	Acres	Acres	Percent	Acres	Acres	Acres	Acres	Acres	Acres	Percent	
Total (19 States)	28,055,248	7,051,509	28,101,890	6,554,346	26,020,477	6,828,761	7.6	31,305,949	10,302,210	30,599,470	11,051,926	35,890,821	18,699,105	-8.8
STATE	BY STATES													
Arizona	844,212	190,949	824,152	248,562	627,305	159,738	-23.2	1,104,645	451,382	1,085,627	510,037	813,153	345,588	-11.5
Arkansas	287,785	126,164	209,942	58,155	179,013	35,087	116.9	314,929	153,328	225,992	74,205	246,480	102,534	106.6
California	7,398,576	2,329,008	6,815,250	2,068,618	5,894,466	1,675,426	12.6	8,039,175	2,969,607	8,075,895	3,329,263	7,605,207	3,586,187	-10.8
Colorado	3,913,542	692,857	4,078,712	665,093	3,855,348	506,963	1.1	4,283,250	1,062,565	4,528,251	1,134,632	5,220,588	1,872,203	-6.4
Idaho	2,598,534	315,677	2,617,021	435,771	3,062,810	604,004	-27.6	2,870,023	592,168	2,814,048	632,798	3,780,048	1,291,242	-8.4
Kansas	142,409	42,429	83,583	12,293	87,853	20,541	245.1	147,226	47,246	95,719	24,429	102,562	55,250	93.4
Louisiana	759,915	312,820	795,165	344,284	728,742	273,860	-9.1	793,674	346,579	850,401	399,500	651,211	396,329	-13.2
Montana	2,544,390	632,981	2,276,000	661,088	2,753,498	1,071,769	-7.1	2,588,214	876,805	2,622,423	1,027,511	4,329,148	2,647,419	-14.7
Nebraska	992,957	382,578	703,641	171,024	562,468	119,778	123.7	1,095,567	485,188	763,039	230,422	766,768	324,078	110.6
Nevada	841,304	101,441	736,249	249,601	704,708	145,261	-59.4	915,889	175,826	983,717	497,069	1,382,036	820,589	-64.6
New Mexico	731,990	177,951	656,689	129,636	696,119	157,742	37.3	807,656	253,617	741,245	214,212	961,879	423,502	18.4
North Dakota	36,522	14,907	24,006	14,614	34,235	22,163	0.2	39,558	17,943	24,860	15,468	57,476	45,404	16.0
Oklahoma	8,624	4,464	7,331	5,758	9,672	8,703	-22.5	13,494	9,334	7,344	5,771	11,742	8,773	61.7
Oregon	1,261,081	211,905	1,158,210	259,497	1,344,046	357,884	-18.3	1,441,417	392,241	1,478,128	579,415	1,925,997	939,825	-32.3
South Dakota	121,847	61,649	109,550	42,445	150,914	50,232	45.3	123,961	63,765	122,510	55,403	188,582	87,700	15.1
Texas	1,775,812	728,588	1,177,415	378,498	1,160,542	564,422	92.5	2,180,796	1,135,572	1,566,876	787,959	1,687,447	1,101,327	47.9
Utah	1,557,714	181,598	1,542,475	218,350	1,700,550	328,699	-16.8	1,432,533	256,417	1,739,869	415,744	2,359,244	987,593	-38.3
Washington	731,527	116,514	631,511	132,228	637,151	107,252	-11.9	837,096	222,063	915,379	418,066	836,795	306,898	-46.6
Wyoming	1,913,527	427,029	1,655,008	418,853	1,831,039	623,057	2.0	2,277,046	790,548	1,958,147	721,992	2,584,668	1,356,686	9.5
DRAINAGE BASIN	BY PRINCIPAL DRAINAGE BASINS													
Red River (of the North)	7,980	3,487	2,099					8,100	3,607	2,409	310			(1)
Missouri River	5,942,958	1,532,573	5,472,012	1,286,832	5,905,630	1,658,352	19.1	6,542,576	2,132,191	6,231,873	2,046,693	8,463,171	4,335,893	4.2
Mississippi River, exclusive of Missouri River	1,350,911	423,317	1,170,583	268,023	1,162,261	193,768	57.9	1,458,502	530,908	1,290,730	378,170	1,543,064	584,571	40.4
Gulf of Mexico streams, other than Mississippi River and Rio Grande	1,520,796	618,404	1,221,997	559,039	1,157,529	459,452	10.6	1,874,654	972,282	1,558,404	873,446	1,802,169	904,092	11.3
Rio Grande	2,177,705	656,127	1,914,781	350,056	1,914,285	601,430	87.4	2,378,065	656,485	2,177,664	612,939	2,628,153	1,315,298	39.7
Colorado River	3,367,744	729,624	3,355,914	799,790	3,009,219	682,529	-8.7	4,017,757	1,379,637	4,435,529	1,898,405	4,102,096	1,775,406	-27.3
Whitewater Draw and Vamori Wash	13,482	4,984	4,753	1,452	9,950	4,079	241.9	14,261	5,763	5,570	2,269	16,623	10,752	154.0
Great Basin	2,381,171	307,444	2,538,492	500,459	2,825,313	547,882	-39.6	2,504,611	430,884	3,004,651	968,618	4,165,450	1,887,799	-55.5
Columbia River	4,428,367	606,629	4,241,244	847,604	4,968,518	1,095,273	-28.4	5,001,483	1,181,745	4,992,131	1,598,491	6,336,801	2,463,556	-28.1
Klamath River	310,580	39,522	264,949	78,958	206,374	52,269	-48.6	384,003	112,965	316,239	128,248	362,793	209,686	-11.9
Sacramento-San Joaquin Delta and tributary streams	5,132,597	1,738,715	4,795,836	1,638,704	4,113,524	1,368,880	6.1	5,860,337	2,266,455	5,393,866	2,236,534	5,499,755	2,755,091	1.3
Pacific Ocean streams, excl. of Gulf of California streams, Columbia and Klamath Rivers, and Sacramento-San Joaquin Delta and tributary streams	1,422,997	390,703	1,141,230	226,429	858,874	185,067	72.5	1,461,502	429,308	1,222,604	307,803	1,150,766	456,959	39.5

1 Percent not shown when more than 1,000.

* Data for Censuses of 1930 and 1920 are for Whitewater Draw and unidentified tributaries, and do not include the independent basin, Vamori Wash.

TABLE 17.—DRAINAGE WITHIN IRRIGATION ENTERPRISES WHICH REPORTED LANDS DRAINED OR NEEDING DRAINAGE—AREA IRRIGATED, AREA IRRIGABLE, AREA FOR WHICH DRAINS HAVE BEEN INSTALLED, AND ADDITIONAL AREA NEEDING DRAINAGE IN THESE ENTERPRISES, BY STATES, 1940, 1930, AND 1920; AND BY PRINCIPAL DRAINAGE BASINS, 1940

(For the 17 western States and Arkansas and Louisiana)

ITEM	AREA IRRIGATED	AREA IRRIGABLE				AREA FOR WHICH DRAINS HAVE BEEN INSTALLED				ADDITIONAL AREA NEEDING DRAINAGE				
	1939	1940	1930	1920 ¹	1940	1930	1920	Increase or decrease (-)		1940	1930	1920	Increase or decrease (-)	
	1930-1940	1920-1930	1920-1930	1920-1930	1920-1930	1920-1930	1920-1930	1920-1930	1920-1930	1920-1930	1920-1930	1920-1930	1920-1930	1920-1930
	Acres	Acres	Acres	Acres	Acres	Acres	Acres	Acres	Acres	Acres	Acres	Acres	Acres	Acres
Total (19 States) ²	8,224,568	9,553,069	10,811,415	8,860,760	3,861,305	3,707,354	1,519,853	153,951	2,187,501	897,912	1,078,566	1,476,771	-180,654	-398,205
STATE	BY STATES													
Arizona-----	271,680	418,539	588,254	382,928	93,803	123,013	25,173	-29,210	97,840	107,651	47,155	71,357	60,496	-24,202
Arkansas-----	14,700	34,894	124,799	37,574	26,078	107,801	27,350	-61,523	80,251	2,016	1,873	2,821	143	-946
California-----	1,711,027	2,596,196	3,105,549	1,823,330	1,509,852	1,522,338	319,573	-12,506	1,202,765	384,963	235,990	409,933	158,973	-173,943
Colorado-----	466,804	887,246	1,018,260	1,526,311	119,286	215,600	113,899	-96,314	101,701	35,792	148,693	220,711	-112,901	-72,018
Idaho-----	731,717	943,910	920,314	734,405	238,907	202,575	81,187	36,332	121,388	29,042	48,995	94,934	-19,953	-45,939
Kansas-----	2,093	3,507	851	3,610	2,552	336	250	2,216	88	240	157	1,320	83	-1,163
Louisiana-----	101,321	214,408	226,510	283,476	174,848	169,577	167,138	5,271	2,439	12,379	18,832	21,202	-6,453	-2,370
Montana-----	473,604	822,140	840,007	751,274	147,151	85,189	82,872	61,962	22,317	52,071	59,995	50,901	-7,924	9,094
Nebraska-----	284,858	336,461	434,969	376,518	47,960	122,101	10,793	-74,141	111,308	10,305	51,505	26,606	-41,200	24,899
Nevada-----	160,044	244,084	353,238	537,417	97,576	126,249	34,175	-28,873	92,074	21,153	26,348	98,249	-5,195	-71,801
New Mexico-----	231,795	331,233	225,730	212,353	240,614	80,907	74,783	179,707	-15,876	8,732	49,572	60,277	-40,840	-10,705
North Dakota-----	15,277	26,826	20,559	49,581	11,552	3,040	1,613	8,512	1,427	242	2,000	659	-1,758	1,341
Oklahoma-----	342	836	189	1,960	429	95	334	95	106	50	1,820	56	-1,770	1,341
Oregon-----	265,771	338,991	436,425	347,750	126,688	230,413	93,799	-103,715	156,814	18,786	94,866	46,115	-76,080	48,751
South Dakota-----	36,072	74,640	79,729	106,129	25,906	4,559	2,109	21,553	2,244	5,509	8,100	4,714	-591	1,386
Texas-----	597,227	657,141	614,635	650,622	553,850	345,926	272,437	207,824	75,489	106,637	135,936	154,532	-29,099	-18,586
Utah-----	285,514	524,771	586,697	503,212	90,657	66,656	85,448	22,001	-16,792	26,418	68,338	91,976	-59,920	-3,638
Washington-----	300,562	446,702	460,861	216,763	178,212	172,059	79,166	6,173	92,671	16,673	28,084	43,461	-9,411	-15,377
Wyoming-----	456,780	645,642	592,041	513,347	175,394	147,346	68,086	28,048	79,260	44,997	34,077	75,185	10,920	-41,106
DRAINAGE BASIN	BY PRINCIPAL DRAINAGE BASINS ²													
Missouri River-----	1,266,478	1,968,532	-----	-----	431,045	-----	-----	-----	-----	108,165	-----	-----	-----	-----
Mississippi River, exclusive of Missouri River-----	116,659	164,985	-----	-----	50,820	-----	-----	-----	-----	6,772	-----	-----	-----	-----
Gulf of Mexico streams, other than Mississippi River and Rio Grande-----	160,158	413,034	-----	-----	286,975	-----	-----	-----	-----	52,261	-----	-----	-----	-----
Rio Grande-----	639,928	1,121,694	-----	-----	721,017	-----	-----	-----	-----	86,260	-----	-----	-----	-----
Colorado River-----	939,690	1,422,474	-----	-----	341,508	-----	-----	-----	-----	458,141	-----	-----	-----	-----
Great Basin-----	471,434	562,861	-----	-----	188,450	-----	-----	-----	-----	53,514	-----	-----	-----	-----
Columbia River-----	1,240,294	1,705,259	-----	-----	467,652	-----	-----	-----	-----	54,828	-----	-----	-----	-----
Klamath River-----	119,455	159,493	-----	-----	111,485	-----	-----	-----	-----	8,292	-----	-----	-----	-----
Sacramento-San Joaquin Delta and tributary streams-----	1,181,659	1,697,316	-----	-----	1,213,566	-----	-----	-----	-----	60,237	-----	-----	-----	-----
Pacific Ocean streams, excl. of Gulf of California streams, Columbia and Klamath Rivers, and Sacramento-San Joaquin Delta and tributary streams-----	88,813	116,621	-----	-----	48,767	-----	-----	-----	-----	9,442	-----	-----	-----	-----

¹For 1920 relates to total area in enterprises. Irrigable area was not reported and irrigated area in enterprises reporting drainage was not reported separately for the 1920 Census.²Data by drainage basins available only for 1940.

GENERAL DISCUSSION

XXXIX

TABLE 18.—WATER USED PER ACRE IRRIGATED FROM SURFACE SOURCES, 1939 AND 1929; AND FROM UNDERGROUND SOURCES, 1939; BY PRIMARY AND SUPPLEMENTAL ENTERPRISES, AND BY STATES
(For the 17 western States and Arkansas and Louisiana)

STATE	QUANTITY OF WATER ENTERING CANALS PER ACRE IRRIGATED			QUANTITY OF WATER DELIVERED TO IRRIGATORS PER ACRE IRRIGATED				
	1939		1929 ¹	1939			1929 ¹	
	Primary enterprises	Supplemental enterprises	Primary enterprises	Primary enterprises		Supplemental enterprises	Primary enterprises	
	Surface sources	Surface sources	Surface sources	Surface sources	Underground sources	Surface sources	Underground sources	Surface sources
	Acre-feet	Acre-feet	Acre-feet	Acre-feet	Acre-feet	Acre-feet	Acre-feet	Acre-feet
TOTAL								
Average (19 States)-----	4.5	1.7	4.1	2.8	2.5	1.3	1.9	2.8
Arizona-----	7.6	-----	5.8	3.2	3.4	1.0	1.6	3.1
Arkansas-----	2.0	-----	(2)	2.6	2.8	0.7	2.8	(2)
California-----	4.3	1.4	4.0	2.6	2.7	1.5	1.9	2.8
Colorado-----	2.5	0.8	2.8	2.4	2.2	0.6	1.8	1.8
Idaho-----	7.9	2.6	5.9	4.1	2.9	1.2	1.8	4.1
Kansas-----	1.4	-----	(2)	1.3	1.6	0.2	2.0	(2)
Louisiana-----	3.4	-----	2.8	2.7	2.1	1.6	0.8	1.6
Montana-----	5.4	2.1	4.8	2.1	2.1	1.3	3.0	1.7
Nebraska-----	5.8	4.9	4.1	2.0	1.5	0.5	0.8	3.0
Nevada-----	5.1	3.5	4.0	3.0	4.6	3.5	1.8	3.1
New Mexico-----	6.4	-----	5.8	3.2	2.6	1.1	1.5	2.1
North Dakota-----	4.5	-----	6.1	1.8	0.4	-----	-----	1.6
Oklahoma-----	0.8	-----	(2)	1.2	2.0	-----	-----	(2)
Oregon-----	5.3	1.2	4.8	3.3	2.0	2.1	5.6	3.1
South Dakota-----	2.1	-----	3.8	1.1	0.4	-----	-----	1.3
Texas-----	5.2	4.8	3.3	2.7	1.4	1.4	1.4	1.7
Utah-----	2.9	1.2	3.5	2.5	3.5	1.1	2.0	2.4
Washington-----	5.7	2.0	5.4	4.3	4.2	3.8	2.7	3.6
Wyoming-----	4.4	1.1	3.2	2.1	1.9	0.8	0.2	2.5
MEASURED ¹								
Average (19 States)-----	4.5	1.6	4.0	2.8	2.4	2.0	1.3	2.8
Arizona-----	7.9	-----	5.7	3.2	3.0	-----	-----	2.9
Arkansas-----	-----	-----	(2)	-----	-----	-----	-----	(2)
California-----	4.4	2.0	4.0	2.4	1.9	1.8	1.2	2.7
Colorado-----	2.4	0.7	2.4	1.6	1.3	0.7	-----	1.8
Idaho-----	7.4	2.6	5.5	5.1	3.2	6.1	2.2	4.1
Kansas-----	1.2	-----	(2)	1.3	-----	-----	-----	(2)
Louisiana-----	-----	-----	(2)	-----	-----	-----	-----	(2)
Montana-----	3.3	2.1	3.2	1.9	-----	1.3	-----	1.6
Nebraska-----	3.4	4.9	4.2	1.9	-----	0.5	-----	3.1
Nevada-----	5.2	5.4	4.0	4.2	-----	3.3	-----	3.1
New Mexico-----	6.2	-----	6.2	2.8	2.4	-----	-----	2.1
North Dakota-----	5.3	-----	6.1	-----	-----	-----	-----	1.6
Oklahoma-----	0.8	-----	(2)	-----	0.5	-----	-----	(2)
Oregon-----	5.3	1.3	5.2	4.2	0.4	0.7	-----	3.2
South Dakota-----	2.2	-----	3.6	1.0	-----	-----	-----	(2)
Texas-----	5.6	-----	4.8	2.9	1.8	0.9	-----	2.6
Utah-----	3.0	1.1	2.7	2.4	4.3	1.1	-----	2.4
Washington-----	5.6	0.7	5.3	4.1	4.6	1.5	-----	3.6
Wyoming-----	5.4	1.1	2.8	3.6	-----	0.9	-----	2.0
NOT MEASURED								
Average (19 States)-----	4.4	2.0	4.4	2.7	2.6	0.9	1.9	2.6
Arizona-----	5.5	-----	7.8	3.4	4.0	1.0	1.6	5.3
Arkansas-----	2.0	-----	(2)	2.6	2.8	0.7	2.8	(2)
California-----	3.7	1.0	5.6	2.9	2.8	1.1	1.9	3.2
Colorado-----	2.9	0.9	3.8	4.2	2.2	0.6	1.8	2.1
Idaho-----	12.0	2.4	7.2	2.3	2.6	0.2	1.7	4.9
Kansas-----	1.6	-----	(2)	1.2	1.6	0.2	2.0	(2)
Louisiana-----	3.4	-----	2.8	2.7	2.1	1.6	0.8	1.6
Montana-----	3.5	1.8	5.2	2.2	2.1	1.1	3.0	1.8
Nebraska-----	6.0	-----	1.8	2.1	1.5	0.5	0.8	1.8
Nevada-----	4.9	3.1	4.6	2.6	4.6	4.3	1.8	3.2
New Mexico-----	6.5	-----	5.3	3.4	2.6	1.1	1.5	1.4
North Dakota-----	1.9	-----	(2)	1.8	0.4	-----	-----	(2)
Oklahoma-----	-----	-----	(2)	1.2	2.1	-----	-----	(2)
Oregon-----	5.3	0.9	4.1	2.9	2.1	2.2	5.6	2.3
South Dakota-----	1.5	-----	5.9	1.6	0.4	-----	-----	1.3
Texas-----	4.7	4.8	2.5	2.7	1.4	2.1	1.1	1.5
Utah-----	2.6	1.4	4.5	2.8	3.4	1.1	2.0	2.6
Washington-----	5.9	6.7	5.9	4.5	4.1	4.0	2.7	5.5
Wyoming-----	3.4	1.0	3.5	1.7	1.9	0.8	0.2	3.4

¹ Data only for enterprises serving 5 or more units. Water and area for surface and underground sources and water and area for primary and supplemental enterprises were not segregated in 1929.
² Not reported.

Areas by Types of Water Rights

Table 19 (p. XLV) presents a proportional table by States based on the areas irrigated by enterprises reporting different types of water rights. The indicated decrease in the proportion of acreages reporting water rights adjudicated by court in 1939 is probably due largely to the fact that a direct question calling for a report on adjudicated rights was not placed on the questionnaire presented to the enterprises. Therefore, in many instances, appropriated, underground, or other rights,

were not specified by the enterprise reporting as rights having been also adjudicated by court decree.

The considerable increase in water rights reported as underground, in the States of Arizona, Kansas, Nebraska, and Texas, harmonizes substantially with the increases of areas irrigated from wells in these States as set forth in table 9. Lands irrigated from wells show a decade increase in Arizona of 40,494 acres; Kansas, 33,407 acres; Nebraska, 57,582 acres; and Texas, 204,240 acres. A further discussion of water rights and laws pertaining to water rights by States is presented on page XL.

Water may be diverted from a natural source of supply for irrigation or other useful purposes only by virtue of a right of use, called a water right. Water rights of various types are defined or recognized by legislation and court decisions in all of the 17 Western States, all of which are included in the irrigation census, and the States have assumed greater or less control over the acquisition and exercise of rights of certain types. In the 3 other States included in the irrigation census of 1940—Arkansas, Florida, and Louisiana—there is as yet no water-right legislation, and rights to the use of water have not yet been defined clearly even by the courts.

Surface sources.—The two types of water right that apply to the use of water of surface streams are the appropriative right and the riparian right. Under the appropriation doctrine, the first user of water acquires a right to continue the use, which right is prior to the right of every subsequent user from the same source of supply, and each one who begins use thereafter is junior in right to all those who preceded him and is senior to all those whose rights are acquired later. Under the riparian doctrine, the owner of land that is contiguous to a stream has certain rights in the flow of water for use on his riparian land, solely by virtue of such land ownership, and no priority over other riparian owners is acquired by the first user.

Appropriation doctrine.—All of the 17 western States have adopted the doctrine of appropriation and have provided by statute for the appropriation of water from specified sources, such as watercourses and springs, under designated procedures. The current procedure in most States includes an application to a State official, and approval thereof, which becomes a permit to make the appropriation, followed by steps that result in perfecting the right upon making proof that the water has been put to beneficial use. The date of filing the application in the State office is the date of priority of the appropriation, provided all subsequent steps are taken in full compliance with the statute and regulations for administering the statute. The value of the priority lies in the fact that the requirements of the appropriator for water covered by his appropriation must be satisfied fully from the available supply before the holder of any subsequent priority is entitled to divert water from the same source.

Prior to the enactment of the present water codes, the usual procedure under the then existing statute of a State or Territory was to post a notice at the proposed point of diversion of water, and to file a copy in the county records. The priority of such an appropriation dated from the initial step, provided that the construction work was completed and the water applied to the land with reasonable diligence, but if the appropriator was not diligent, the priority dated from the completion of the appropriation.

Appropriations now in effect are equally valid, whether made before or after the enactment of the present water codes, provided they were completed in accordance with whatever statute was in effect at the time of the appropriation, and provided that they have not since been abandoned or otherwise lost by prescription or by forfeiture through failure to exercise the right for a definite number of years prescribed by statute.

Riparian doctrine.—Some of the western States recognize the riparian doctrine concurrently with the doctrine of appropriation. The riparian right is inherent in the ownership of riparian land and therefore is not acquired by applying to the State for a permit to make use of the water. Nor is the right lost by failure to use the water, but it can be lost by adverse use on the part of others upstream for a period of years prescribed by the statute of limitations.

The riparian doctrine has been repudiated wholly in Arizona, Colorado, Idaho, Montana, Nevada, New Mexico, Utah, and Wyoming; hence (with minor exceptions in Nevada, as noted below), water rights applicable to surface streams in those States are subject entirely to the appropriation doctrine. In Oregon the riparian doctrine has been so restricted by statute and court decisions as to amount to practical abrogation. In Oklahoma it is assumed that the riparian doctrine is in effect in some degree, but its status is uncertain. In the remaining 7 western States (California, Kansas, Nebraska, North Dakota, South Dakota, Texas, and Washington) the riparian and appropriation doctrines are recognized concurrently, but the limitations upon the riparian right vary considerably from State to State.

Underground sources.—Ground waters commonly are considered by the courts as falling into two classes: (1) water in definite underground streams, and (2) percolating water, which comprises all water in the ground other than that flowing in defined subterranean channels.

Definite underground streams.—Water in definite underground channels or streams is subject to the same rules of law as water in surface watercourses. Hence in each western State the appropriation doctrine applies equally to definite watercourses whether upon or under the surface, and the riparian doctrine in a given State applies to subterranean streams to whatever extent it is applicable to surface streams.

Percolating water.—Percolating waters have been subjected to appropriation by the statutes of some States, as noted in the ensuing discussion of the separate State water-right doctrines. In the other western States percolating waters are considered to belong to the owner of the land in which they are found, subject in some States to an unlimited right of use by the owner of overlying land, and in other States to some measure of reasonableness in the use of the water.

Summaries of State Water-Right Doctrines

Arizona

Surface sources.—The doctrine of appropriation governs rights to the use of water in watercourses, to the exclusion of the riparian doctrine. The Territorial legislature in 1891 repudiated the common-law doctrine of riparian water rights, and the State constitution contains a similar provision (art. XVII, sec. 1). The courts, furthermore, have held specifically that the riparian doctrine has been repudiated (*Clough v. King*, 2 Ariz. 371, 17 Pac. 453 (1888); *Pima Farms Co. v. Proctor*, 30 Ariz. 98, 245 Pac. 369 (1926)).

The water code provides that the water of all sources, flowing in streams, canyons, ravines, or other natural channels, or in definite underground channels, whether perennial

¹ Wells A. Hutchins, Senior Irrigation Economist, Division of Irrigation, Soil Conservation Service, U. S. Department of Agriculture.

or intermittent, flood, waste, or surplus water, and of lakes, ponds, and springs on the surface, belongs to the public and is subject to appropriation. An application to appropriate water must be made to the State Water Commissioner, whose approval constitutes a permit, and on completion of the appropriation the permittee receives a certificate. Determinations of water rights may be made by the State Water Commissioner, and filed in court as the basis of a civil action, or if an action to adjudicate water rights has been brought by private parties, the court may transfer the action to the commissioner for similar determination. Control over the distribution of water, excepting that reserved to water commissioners appointed by courts under existing decrees, is vested in an organization headed by the State Water Commissioner; the commissioner being authorized to create water districts and appoint water superintendents when necessary.

Underground sources.—Water flowing in definite underground channels is subject to appropriation under the water code. However, the existence of a subterranean stream must be proved by clear and convincing evidence, for ground water is presumed to be percolating (Maricopa County Municipal Water Conservation Dist. No. 1 v. Southwest Cotton Co., 39 Ariz. 65, 4 Pac. (2d) 369 (1931)). Percolating water is not subject to appropriation, but belongs to the owner of the land in which it is found (Howard v. Perrin, 8 Ariz. 347, 76 Pac. 460 (1904); Campbell v. Willard, 45 Ariz. 221, 42 Pac. (2d) 403 (1935)).

California

Surface sources.—The appropriation and riparian doctrines are in effect concurrently in California. The appropriation doctrine, as it is now recognized throughout the West originated in this State in the customs of miners on the public domain, and was later extended to irrigation and other uses.

Under the present statute waters flowing in any river, stream, canyon, ravine, or other natural channel, excepting waters needed for use upon riparian lands or otherwise appropriated, are public waters and subject to appropriation. The statute also applies to return flow that has reentered a stream, lake, or other body of water, and to water in subterranean streams flowing through known and definite channels. The statutory procedure involves an application to the State Division of Water Resources, a permit therefrom, and a license from the division upon completion of the appropriation. The division, upon the petition of one or more claimants, may make a determination of both appropriative and riparian rights upon a stream system, which is filed in court, and is heard in the form of a civil action. Any suit for the determination of water rights may be referred, in the discretion of the court, to the division as referee, and the division may accept a reference from a Federal court. The division may create water-master districts and appoint watermasters for the distribution of water.

The riparian doctrine is of outstanding importance in California water law. It was considered fully in an early case (Lux v. Haggin, 89 Calif. 255, 10 Pac. 674 (1886)) and has been reaffirmed in many subsequent decisions. A constitutional amendment in 1928 (art. XIV, sec. 3), which limited riparian and other water rights to reasonable beneficial use under reasonable methods of diversion, has been upheld by the supreme court (Peabody v. Vallejo, 2 Calif. (2d) 351, 40 Pac. (2d) 486 (1935)). The right of a riparian owner to make use of water under such limitation is safeguarded by the amendment, and the excess above his reasonable needs is public water subject to appropriation.

Underground sources.—Water in definite underground streams is subject to appropriation under the present statute. It is likewise subject to riparian rights (Verdugo Canyon Water Co. v. Verdugo, 152 Calif. 655, 93 Pac. 1021 (1908)).

Percolating water is subject to the reasonable use of owners of overlying land under the rule of correlative rights (Katz v. Walkinshaw, 141 Calif. 118, 70 Pac. 663 (1902), 74 Pac. 766 (1903)). Each landowner is entitled, in time of shortage, to a reasonable proportion of the common supply of water that underlies a group of land ownerships. If there is an excess in the common supply, above the reasonable requirements

of overlying lands, such excess may be appropriated for distant use. (Burr v. Maclay Rancho Water Co., 154 Calif. 428, 98 Pac. 260 (1908).) The statutory procedure for appropriating water, however, does not apply to percolating water; one simply takes the water and, if attacked, defends his action in court. Ground water that feeds a surface stream, that which percolates away from a stream, and the water in the stream itself, all are considered one common supply under the rule of reasonable beneficial use (Hudson v. Bailey, 156 Calif. 617, 105 Pac. 748 (1909); Lodi v. East Bay Municipal Utility Dist., 7 Calif. (2d) 316, 60 Pac. (2d) 439 (1936)).

Colorado

Surface sources.—Appropriation is the sole means of acquiring a right to use water from a watercourse in Colorado. The riparian doctrine never has been recognized in this State (Coffin v. Left Hand Ditch Co., 6 Colo. 443 (1882); Wyoming v. Colorado, 259 U. S. 419 (1922)).

The constitution provides that the unappropriated water of every natural stream is the property of the public, subject to appropriation, and that the right of appropriation shall never be denied (art. XVI, secs. 5 and 6). The statutes also provide for the appropriation of waters of natural flowing springs, and of waters that have escaped to natural channels after having been raised from mines. A further statute governs the appropriation of waste, seepage, or spring waters, giving the person on whose land the seepage or spring waters first arise the prior right if capable of use on his lands, but the supreme court has held that the landowner's prior right does not apply to such waters if they are naturally tributary to a stream (Nevius v. Smith, 88 Colo. 178, 279 Pac. 44 (1928, 1929)). Permits to appropriate water are not required in Colorado; the intending appropriator commences his construction work, and then files a claim with the State engineer, a copy of which, if in proper form, is later filed with the county clerk and recorder. The appropriation is completed by diverting the water and applying it to beneficial use, without certificate or license from the State engineer. Adjudications of water rights are made exclusively by the courts. The administration of all decreed appropriations is effected by an organization of irrigation division engineers and district water commissioners, under the supervision of the State engineer.

Underground sources.—Waters in definite underground streams are subject to the same rules as those in streams upon the surface (Medano Ditch Co. v. Adams, 29 Colo. 317, 68 Pac. 431 (1902)). These rules in Colorado are those of the appropriation doctrine.

Percolating waters tributary to a surface stream are a part of that stream and are subject to the same system of appropriative rights (Faden v. Hubbell, 93 Colo. 358, 28 Pac. (2d) 247 (1933)). No supreme court decision yet has been rendered as to the rights of use of percolating waters that are not physically tributary to some watercourse, but the reasonable inference is that such waters likewise are subject to appropriation.

Idaho

Surface sources.—The riparian doctrine is not recognized in Idaho (Jones v. McIntire, 60 Ida. 338, 91 Pac. (2d) 376 (1939)), and even in former times never was acknowledged as conflicting with the rights of appropriators for beneficial use (Schodde v. Twin Falls Land & Water Co., 224 U. S. 107 (1912)).

The constitution provides that the right to appropriate the waters of any natural stream shall never be denied, except that the State may control the use thereof for power purposes (art. XV, sec. 3). The statutes subject to appropriation all waters when flowing in their natural channels, the waters of rivers, streams, lakes, springs, and subterranean waters, and seepage, waste, and spring waters. Either of two methods of appropriation may be followed: (1) application to the State Department of Reclamation for a permit, construction of works under the terms of the permit, completion of construction that results in the issuance of a certificate, and application of

the water to beneficial use, proof of which entitles the appropriator to a license; or (2) construction of works and diversion and application of water to beneficial use, without formalities of any kind. An appropriation made according to either method is equally valid; but the priority of one who complies in all respects with the statutory procedure dates from the time of applying for the permit, while the priority of one who does not follow the statute dates from the completion of the appropriation (Bachman v. Reynolds Irr. Dist., 56 Ida. 507, 55 Pac. (2d) 1314 (1936)). A statute, which authorized State water commissioners to bring suits to adjudicate water rights was held unconstitutional (Bear Lake County v. Budge, 9 Ida. 703, 75 Pac. 614 (1904)). However, whenever suit is brought to adjudicate the waters of a stream, the court in its discretion may request the department to make a hydrographic survey. The department is charged with the responsibility of creating water districts in which adjudications have been made and of controlling the distribution of water according to priorities.

Underground sources.—Ground waters are subject to appropriation under the statute. Court decisions have held that such waters may be appropriated (Hinton v. Little, 50 Ida. 371, 296 Pac. 582 (1931)), and that the appropriation may be made, either by the statutory permit method or simply by diverting and applying the water to beneficial use (Silkey v. Tiegs, 51 Ida. 344, 5 Pac. (2d) 1049 (1931)).

Kansas

Surface sources.—The appropriation and riparian doctrines are recognized concurrently in Kansas. The riparian doctrine was well established in a case decided in 1905 (Clark v. Allaman, 71 Kans. 206, 80 Pac. 571 (1905)), and it now appears to be of paramount importance in this State (Frizzell v. Bindley, 144 Kans. 84, 58 Pac. (2d) 95 (1936)).

The statutes provide that water may be appropriated, and that in the portion of the State west of the 99th meridian, all natural waters may be diverted from natural beds, basins, and channels for domestic, irrigation, and other industrial purposes, but that natural surface lakes and ponds having no outlet may be drawn off or appropriated only by the owners of the lands on which located. Appropriations of water may be made upon application to the Division of Water Resources of the State Board of Agriculture, the chief engineer of which is charged with distribution of water under rights adjudicated by the courts.

Underground sources.—A statute provides that water obtained by means of artesian wells may be appropriated. Other statutes, which relate only to the portion of the State west of the 99th meridian, provide that surface or subterranean waters may be diverted from natural beds, basins, or channels for domestic, irrigation, and other industrial purposes; but that south of township 18 and west of the 99th meridian, all waters flowing in subterranean channels and courses, or flowing or standing in subterranean sheets or lakes, shall be appurtenant to the overlying lands and devoted to the above-named uses. The few court decisions acknowledge ownership of percolating water by the owner of overlying land (Emporia v. Soden, 25 Kans. 588, 37 Am. Rep. 265 (1881); Gilmore v. Royal Salt Co., 84 Kans. 729, 115 Pac. 541 (1911)).

Montana

Surface sources.—The appropriation doctrine is exclusive in operation with respect to surface streams, inasmuch as the riparian doctrine has been repudiated by the courts (Mettler v. Ames Realty Co., 61 Mont. 152, 201 Pac. 703 (1921)). The statutes provide that appropriations may be made of water in any river, stream, ravine, coulee, spring, lake, or other natural source of supply; and of flood, seepage, and waste waters by impounding them.

There is no centralized State control in Montana over the appropriation and administration of water. An appropriation from an unadjudicated stream may be made, either by following the statute, which requires posting a notice at the point of diversion and filing a copy with the county clerk, in which case the priority dates from the time of posting notice, or by

simply diverting water and applying it to beneficial use, in which event the priority dates from completion of the appropriation. An appropriation from a stream or other source, the waters of which have been adjudicated, may be made only by filing a petition in the county court and securing a decree allowing the appropriation. Determination of water rights are made exclusively by the courts, but the State engineer, at the direction of the State Water Conservation Board, may bring action to adjudicate the waters of any stream, and may make hydrographic surveys for use in the proceedings. Waters, the rights to which have been adjudicated, may be distributed by commissioners appointed by the courts at the request of holders of at least 15 percent of the water rights affected.

Underground sources.—Water flowing in a defined underground stream is subject to the same rules of appropriation as the water of a surface stream; but percolating water belongs to the owner of the soil in which it is found (Ryan v. Quinlan, 45 Mont. 521, 124 Pac. 512 (1912)).

Nebraska

Surface sources.—The appropriation and riparian doctrines both exist in Nebraska. The constitution provides that the water of every natural stream is dedicated to the people of the State, and that the right to divert unappropriated waters from every natural stream for beneficial use shall never be denied except when the public interest demands it (art. XV, secs. 5 and 6). A statute provides, further, that water flowing in any river, stream, canyon, or ravine may be appropriated. Supplemental appropriations may be made from natural lakes or reservoirs. An application must be made to the State Department of Roads and Irrigation for a permit to appropriate water, and when the appropriation has been perfected the department sends to the county clerk a certificate for record. The department makes determinations of appropriative water rights on stream systems, which are final unless appealed to the supreme court. The department has jurisdiction over the administration of water rights, and appoints superintendents and water commissioners to distribute water.

The riparian doctrine has been established in a number of court decisions, two leading cases having been decided in 1903, but riparian rights attach only to lands that have passed to private ownership after the enactment of the irrigation act of 1889 (Crawford Co. v. Hathaway, 87 Nebr. 325, 93 N. W. 781 (1903); Mong v. Coffee, 87 Nebr. 500, 93 N. W. 713 (1903)). Furthermore, the remedies of riparian owners who have not made use of water, against appropriators from the same stream, have been substantially limited by court decisions (McCook Irr. & Water Power Co. v. Crews, 70 Nebr. 109, 115, 98 N. W. 996 (1903), 102 N. W. 249 (1905); Cline v. Stock, 71 Nebr. 70, 79, 98 N. W. 454 (1904), 102 N. W. 265 (1905)).

Underground sources.—Subterranean waters are subject to reasonable use upon the overlying land, and cannot be extracted in quantities that result in injury to owners of other overlying lands (Olson v. Wahoo, 124 Nebr. 802, 248 N. W. 304 (1933)).

Nevada

Surface sources.—The appropriation doctrine now is the sole legal system under which rights to the use of surface streams may be acquired. The riparian doctrine was recognized in some very early cases and certain riparian rights became established (Vansickle v. Haines, 7 Nev. 249 (1872)). However, the riparian doctrine was repudiated in 1885, and has not since been recognized (Jones v. Adams, 19 Nev. 78, 6 Pac. 442 (1885); In re Humboldt River, 49 Nev. 357, 246 Pac. 692 (1926)).

The statutes provide that the water of all sources of supply, whether above or beneath the surface of the ground, belongs to the public, and, subject to existing rights, may be appropriated. An application for a permit to appropriate water must be made to the State engineer, and, upon completion of the appropriation, a certificate is issued. The State engineer may determine the rights upon a stream, upon petition of one or more water users, and file his determination in court in the form of a complaint in a civil action. In any suit brought by private parties for the determination of water rights, the

court is required by statute to direct the State engineer to furnish a hydrographic survey, and in its discretion the court may transfer the suit to the State engineer for a statutory determination. The State engineer has the duty of distributing water and of creating water districts and appointing water commissioners for adjudicated streams.

Underground sources.—All ground waters are subject to appropriation, except for domestic purposes where the draught does not exceed 2 gallons per minute and where the water is not artesian. Application for a permit must be made to the State engineer, as in case of surface streams. The State engineer may designate ground-water administrative basins upon petition of at least 10 percent of the owners of wells having appropriative rights, and with his approval artesian-wells supervisors and assistants may be appointed. The State engineer on his own motion, or upon petition of water users, may hold hearings to determine the adequacy of the water supply within an area or subarea, and is required to order withdrawals restricted during a period of shortage to conform to priority rights.

New Mexico

Surface sources.—Rights to the use of waters of surface streams in New Mexico are governed solely by the appropriation doctrine. The riparian doctrine never has been recognized in this State (Snow v. Abalos, 18 N. Mex. 681, 140 Pac. 1044 (1914)).

The constitution declares that the unappropriated water of every natural stream, perennial or torrential, belongs to the public and is subject to appropriation (art. XVI, sec. 2). According to statute, seepage water from constructed works may be appropriated, the owner of the works having the first right, if exercised within one year. Application must be made to the State engineer for a permit to appropriate water; upon completion of the works a certificate of construction is issued, followed upon application of the water to beneficial use by a license to appropriate water. The appropriation statute does not apply to uses of water for watering livestock. Determinations of rights may be made in suits brought by the attorney general at the request of the State engineer, upon completing of hydrographic surveys. In suits brought by private parties the attorney general is required to intervene if the State engineer so advises, and in any adjudication suit the court is required to direct the State engineer to furnish a hydrographic survey. Administration of rights is entrusted to the State engineer, who creates districts and subdistricts, and may appoint a watermaster and assistants upon request of a majority of the users in a district.

Underground sources.—The waters of underground streams, channels, artesian basins, reservoirs, or lakes, having reasonably ascertainable boundaries, are declared by statute to be public waters subject to appropriation. An application for a permit to appropriate such water for irrigation or industrial purposes must be made to the State engineer, and claimants of vested rights may file declarations of their rights with that official. The State engineer formulates rules and regulations for administering the statute; and in certain instances he has concurrent authority with artesian conservancy districts in regulating artesian wells within such districts.

North Dakota

Surface sources.—The appropriation and riparian doctrines both are in effect in this State. A statute provides that all waters from all sources of supply belong to the public and are subject to appropriation. An earlier statute, still in effect, vests in the owner of land the ownership of water upon or under his land if it does not form a definite stream, and gives him the right to use a definite stream so long as it remains on his land, but forbids his preventing its natural flow. Seepage water from constructed works may be appropriated. An application for a permit to appropriate water must be made to the State engineer, who may grant water rights subject to the approval of the State Water Conservation Commission. A certificate of construction is issued upon completion of works, and a license to appropriate upon application of

water to beneficial use. The State engineer is required to make hydrographic surveys as the basis for suits brought by the attorney general to determine water rights. The attorney general is required to intervene in any adjudication suit upon advice of the State engineer. The court, in any adjudication suit, is to direct the State engineer to furnish a hydrographic survey. The State is divided by statute into water divisions, with provision for appointment of officials to distribute water under the supervision of the State engineer.

There has been very little litigation over water rights in North Dakota. Riparian rights, however, were recognized by the United States Supreme Court in a Territorial case (Sturr v. Beck, 133 U. S. 541 (1890)), and the common-law riparian doctrine appears to be well established (Bigelow v. Draper, 6 N. Dak. 152, 69 N. W. 570 (1896); McDonough v. Russell-Miller Milling Co., 38 N. Dak. 465, 165 N. W. 504 (1917)).

Underground sources.—A statute provides that the owner of land owns water standing thereon, or flowing over or under the surface, but not forming a definite stream, and that he may use a definite surface or subterranean stream while it remains within his boundaries, but may not prevent its natural flow.

Oklahoma

Surface sources.—The appropriation and riparian doctrines presumably are concurrent in Oklahoma. However, while there have been several court decisions concerning the rights of riparian owners, the controversies have been mainly over the pollution of streams or damage to land caused by raising water levels, and none have involved the use of water for irrigation. Hence, the status of the riparian doctrine in relation to the claims of appropriators of water has not been determined.

A statute provides that the owner of land owns water standing on it or flowing over or under the surface in other than a definite stream; that he may use a definite surface or underground stream while on his land, but may not prevent its natural flow.

Water may be appropriated by making first an application to the Oklahoma Planning and Resources Board for a permit. The supreme court has held that a hydrographic survey and adjudication are conditions precedent to the granting of a valid permit to appropriate water; pending this determination, an application for a permit may be accepted by the board to fix priority (Gay v. Hicks, 33 Okla. 875, 124 Pac. 1077 (1912); Owens v. Snider, 52 Okla. 772, 153 Pac. 833 (1915)). A certificate of completion of construction is issued when the works are completed, and a license to appropriate water when it has been applied to beneficial use. Seepage from constructed works may similarly be appropriated. Hydrographic surveys of stream systems form the basis of suits brought by the attorney general for determination of rights, and the attorney general is required by statute to intervene in a suit, if advised by the board that the public interest so requires. Furthermore, the court in an adjudication suit is required to direct the board to furnish a hydrographic survey. The board is charged with supervision over the apportionment of water, and may create water districts and appoint watermasters.

Underground sources.—The statute provides that the owner of land owns water under the surface, but not forming a definite stream. However, the supreme court has held that the use of percolating water by the landowner must be reasonable, and that he may not exhaust a neighbor's ground-water supply for transport to distant lands, but that this does not mean that in actual practice there must be an apportionment of the water (Canada v. Shawnee, 179 Okla. 53, 64 Pac. (2d) 694 (1936)).

Oregon

Surface sources.—Oregon is essentially an appropriation doctrine State. Various court decisions, principally early ones, decided riparian rights as between riparian landowners, but the water code of 1909 restricted riparian rights to beneficial use made prior to the passage of the act, or within a reasonable time thereafter. The validity of this legislation has been upheld in the courts (In re Hood River, 114 Ore. 112, 227 Pac. 1065 (1924); California-Oregon Power Co. v. Beaver Portland Cement Co., 73 Fed. (2d) 555, C.C.A. 9th (1934)). Only

appropriative rights can be adjudicated under the statutory procedure, which means that a riparian owner's claim can be so adjudicated only for a specific flow of water with a fixed date of priority, that is, on an appropriative basis (In re Deschutes River and Tributaries, 134 Ore. 623, 286 Pac. 563, 294 Pac. 1049 (1930)). The result of the legislation and court decisions has been a practical abrogation of the riparian doctrine, except as to certain vested rights principally for domestic and stock-watering purposes.

All water from all sources of water supply is declared by statute to belong to the public, and subject to existing rights, may be appropriated. However, certain streams are exempted from appropriation in order to preserve the natural flow for scenic and other purposes. Waste, spring, or seepage waters may be appropriated, subject to the prior right of use by the person on whose land the seepage or spring water first arises. However, a spring that discharges into a watercourse is subject to rights on the stream (Hildebrandt v. Montgomery, 113 Ore. 687, 234 Pac. 287 (1925)).

Applications for permits to appropriate water for irrigation and other purposes, except for power (which are governed by the hydroelectric act), are made to the State engineer, and upon perfection of the appropriation a certificate is issued. Determinations of rights are made by the State engineer, upon petition signed by one or more users of water from a stream, and are filed in court in proceedings similar to suits in equity. The court in its discretion may transfer a water-right case to the State engineer for determination, and in a suit to which the State is a party the court is required to call upon the State engineer for a hydrographic survey. The State engineer is in control of the administration of water rights through watermasters appointed for districts which he creates.

Underground sources.—In the portion of Oregon east of the summit of the Cascade Mountains, waters in underground streams, channels, artesian basins, reservoirs, or lakes, the boundaries of which may be reasonably ascertained, are declared by statute to be public waters subject to appropriation for any purpose other than for domestic and culinary use, stock, or watering of lawns and gardens not exceeding one-half acre. Permits from the State engineer are required, as in case of surface streams. Court decisions in Oregon have acknowledged the rule that percolating water belongs to the landowner (Hayes v. Adams, 109 Ore. 51, 218 Pac. 933 (1923)), so that this rule of ownership prevails in western Oregon, but has been modified by statute in the eastern part of the State.

South Dakota

Surface sources.—The appropriation and riparian doctrines both are recognized in South Dakota. The riparian doctrine was recognized in the Territory of Dakota by the United States Supreme Court (Sturr v. Beck, 133 U. S. 541 (1890)), as well as in a number of decisions of the State Supreme Court (Platt v. Rapid City, 291 N. W. 800 (1940)), and is of major importance in South Dakota water law.

The code provides that, subject to the provisions relating to artesian wells and water, the owner of land owns the water over or under the surface, other than that flowing in a definite stream, and may use a definite surface or underground stream so long as it remains there, but may not prevent its natural flow. The supreme court has held that under this statute, water, which does not constitute a "definite stream," even though it flows for several weeks in the spring in a long channel, belongs to the landowner (Benson v. Cook, 47 S. Dak. 611, 201 N. W. 528 (1924)), and is not governed either by the appropriation or riparian doctrine (Terry v. Heppner, 59 S. Dak. 317, 239 N. W. 759 (1931)). The code also states that, subject to the foregoing statutory provision, and subject to vested private rights, all waters from every source of supply belong to the public and, except navigable waters, are open to appropriation. Seepage from constructed works may be appropriated. An appropriation is initiated by applying to the State engineer for a permit. The permittee receives a certificate of construction upon completion of works, and upon applying the water to beneficial use, a license to appropriate the water.

Under the dry-draw law, a right to the use of water from a ravine or watercourse not having a flow of at least 20 miner's inches during the greater part of the year, may be initiated by filing a location certificate with the register of deeds, posting a notice at the point of diversion, and mailing a copy to the State engineer. The claimant may obtain a certificate from the State engineer, but is not under his jurisdiction.

In an action to adjudicate water rights, the court is directed to request the State engineer to furnish a hydrographic survey, no part of the costs of the State or of the survey to be charged against private parties without their express consent. A previous provision, under which such costs were charged against private parties, was held unconstitutional (St. Germain Irrigating Ditch Co. v. Hawthorne Ditch Co., 32 S. Dak. 260, 143 N. W. 124 (1913)).

The attorney general may bring suit for the determination of rights. The State engineer is given control over all waters in definite streams, so far as they relate to irrigation or other water rights, and upon request of 5 or more holders of riparian rights in a definite stream, he is required to apportion the water. The State engineer may appoint a water commissioner for the distribution of water from any source, after consultation with the water users, to act under his direction.

Underground sources.—The ownership of ground water not in a definite stream—that is, percolating water—is vested by statute in the landowner. The supreme court has upheld the principle as stated in this statute (Madison v. Rapid City, 61 S. Dak. 83, 246 N. W. 283 (1932)). Defined or known underground streams, however, are governed by the laws that apply to surface streams (Deadwood Central R. R. v. Barker, 14 S. Dak. 558, 86 N. W. 619 (1901)).

Texas

Surface sources.—Texas recognizes both the appropriation and riparian doctrines. The appropriation statute declares the waters of the ordinary flow and underflow and tides of every flowing river or natural stream, of all lakes, bays, or arms of the Gulf of Mexico, and the storm, flood, or rain waters of every river or natural stream, canyon, ravine, depression, or watershed, to be the property of the State and subject to appropriation. An application for a permit to appropriate water must be made to the State Board of Water Engineers, and use of water for 3 years under the terms of a permit gives the appropriator a title by limitation against all other claimants to water from the same source of supply. (This limitation, however, is not operative as against the rights of riparian landowners: Freeland v. Peltier, 44 S. W. (2d) 404 (Tex. Civ. App. 1931).) Adjudications of rights are made exclusively in the courts; a statute authorizing determinations by the Board of Water Engineers having been held unconstitutional (Board of Water Engineers v. McKnight, 111 Tex. 82, 229 S. W. 301 (1921)). As a further result of this decision, the statutory provisions relating to the distribution of water under the supervision of the Board, according to rights as determined by the Board, have been repealed.

Lands that were granted prior to the passage of the irrigation act of 1889 have riparian rights, but such rights attach only to the ordinary flow and underflow of streams (Mottl v. Boyd, 118 Tex. 82, 286 S. W. 458 (1926)). Waters not needed to satisfy the reasonable requirements of lands having these preexisting riparian rights, as well as storm and flood waters, may be appropriated.

Underground sources.—The underflow of streams is subject to appropriation, according to the statute; and it is also riparian water (Mottl v. Boyd, *supra*). Percolating waters are the property of the owner of the land in which they are found (Texas Co. v. Burkett, 117 Tex. 16, 296 S. W. 273 (1927)).

Utah

Surface sources.—The appropriation doctrine governs rights to the use of water in Utah. Riparian rights never have been recognized (Stowell v. Johnson, 7 Utah 215, 26 Pac. 290 (1891); Whitmore v. Salt Lake City, 89 Utah 387, 57 Pac. (2d) 726 (1936)). The statutes provide that all waters, whether above or under the ground, are the property of the public, subject

to existing rights of use; and that water may be appropriated only by complying with the statutory procedure, under which an application for an appropriation must be made to the State engineer and under which a certificate is issued upon completion of the appropriation. The State engineer may initiate suits to determine water rights, and, upon the filing of any adjudication suit, the State engineer is notified by the clerk of the court, and is required to make a hydrographic survey and a proposed determination, which is filed in court as the basis of hearings and final adjudication. The State engineer has general administrative supervision over the waters of the State, and may appoint water commissioners for any river system or water source, after consultation with the water users.

Underground sources.—All ground waters are subject to appropriation under the statute as amended in 1935. Even prior to this amendment, the supreme court had applied the appropriation doctrine to the waters of artesian basins (*Wrathall v. Johnson*, 86 Utah 50, 40 Pac. (2d) 755 (1935); *Justesen v. Olsen*, 86 Utah 158, 40 Pac. (2d) 802 (1935)). The procedure for acquiring appropriative rights out of surface streams applies to ground waters as well. Existing claimants to the use of ground waters are required to file notice of their claims with the State engineer. The State engineer may define ground-water areas, and at any time on his own motion, or on petition of not less than one-third of the ground-water users in such an area, he may hold hearings to determine whether the supply is adequate for existing claims, and may apportion the supply if found inadequate. Water commissioners may be appointed for such areas.

Washington

Surface sources.—Both the appropriation and the riparian doctrines are in force in Washington. The water code declares that subject to existing rights, all waters belong to the public, and that rights may be acquired only by appropriation in the manner provided by statute; existing riparian or appropriative rights are not to be affected. An appropriation is initiated by applying to the State Supervisor of Hydraulics for a permit, and upon completion of the appropriation the claimant is entitled to a certificate. The supervisor of hydraulics may take the first step in determining rights, when in his judgment it is necessary, by preparing a statement and plan or map of the locality, and filing the same in court, and is required to do so upon petition of one or more claimants of water rights. In such suit the court refers the proceedings to the supervisor for the taking of testimony as referee, on completion of which a report is filed for further action of the court. The supervisor is in charge of the administration of water rights, in which connection he may designate water districts and appoint watermasters and stream patrolmen, when necessary, upon application of interested parties.

The riparian doctrine is important in the water law, but is of secondary importance in the irrigation economy of the

State. Riparian rights do not attach to navigable waters (*State ex rel. Ham, Yearsley and Ryrie v. Superior Court*, 70 Wash. 442, 126 Pac. 945 (1912)), and the waters of nonnavigable streams to which the riparian doctrine applies are those that can be beneficially used on or in connection with riparian land, either directly or prospectively within a reasonable time, the excess being subject to appropriation (*Brown v. Chase*, 125 Wash. 542, 217 Pac. 23 (1923)). To secure protection, a riparian owner must show that either at present, or in the near future, he will make beneficial use of the water (*State v. American Fruit Growers*, 135 Wash. 156, 237 Pac. 498 (1925)).

Underground sources.—The waters of a defined underground stream are subject to the rules that apply to surface streams (*Meyer v. Tacoma Light & Water Co.*, 8 Wash. 144, 35 Pac. 601 (1894)). Percolating waters may be used by the owner of overlying land to a reasonable extent, and in a manner consistent with the reasonable use of his land (*Patrick v. Smith*, 75 Wash. 407, 134 Pac. 1076 (1913); *Evans v. Seattle*, 182 Wash. 450, 47 Pac. (2d) 984 (1935)).

Wyoming

Surface sources.—Rights to the use of surface streams in Wyoming are governed solely by the appropriation doctrine. The riparian doctrine was repudiated in a fairly early case as inapplicable to conditions within the State (*Moyer v. Preston*, 6 Wyo. 308, 44 Pac. 845 (1896)), and has never been acknowledged (*Wyoming v. Colorado*, 259 U. S. 419 (1922)). The constitution declares that the waters of all natural streams, springs, lakes, or other collections of still water are the property of the State, subject to prior appropriation, and that no appropriation shall be denied, except when such denial is demanded by the public interests (art. VIII, secs. 1 and 3). The constitution also provides for a board of control, composed of the State engineer as president, and the superintendents of the 4 water divisions, and vests the board with supervision of the waters of the State (art. VIII, secs. 2, 4 and 5).

To appropriate water, application must be made to the State engineer for a permit. When an appropriation has been perfected and the right has been adjudicated by the board of control, a certificate of appropriation is issued by the board. Adjudications of rights of streams are made by the board of control, in each case after the State engineer has made a hydraulic survey and the superintendent of the water division has taken testimony. A determination or adjudication so made is final unless appealed to the courts. Distribution of water according to priorities is made by the organization of water superintendents and district water commissioners, under the general direction of the State engineer.

Underground sources.—Percolating waters developed artificially belong to the owner of the land upon which they are developed (*Hunt v. Laramie*, 26 Wyo. 160, 181 Pac. 137 (1919)).

TABLE 19.—PROPORTION (PERCENT) OF TOTAL OF AREAS IRRIGATED, BY TYPE OF WATER RIGHTS, BY STATES: 1939, 1929, AND 1919

STATE	APPROPRIATION ¹			RIPARIAN			APPROPRIATION AND RIPARIAN			UNDERGROUND			APPROPRIATION AND UNDERGROUND			RIPARIAN AND UNDERGROUND			ADJUDICATED BY COURT			OTHER, MIXED, AND NOT REPORTED		
	1939 ²	1929	1919	1939 ²	1929	1919	1939 ²	1929	1919	1939 ²	1929	1919	1939 ²	1929	1919	1939 ²	1929	1919	1939 ²	1929	1919	1939 ²	1929	1919
Total (17 States) ^b	50.1	41.6	45.9	3.0	2.8	1.9	4.6	—	—	10.6	9.3	5.7	4.5	—	—	0.6	—	—	25.2	41.6	38.5	1.4	4.8	7.9
Arizona	25.7	22.4	69.3	—	—	—	—	—	—	21.3	16.3	8.9	49.7	—	—	—	—	—	0.9	58.2	18.2	2.4	3.1	3.6
California	24.3	58.2	30.5	8.4	7.5	5.7	15.4	—	—	29.1	30.6	20.5	9.4	—	—	2.1	—	—	9.8	16.4	23.3	1.5	7.3	20.0
Colorado	40.7	10.4	9.7	—	—	—	—	—	—	2.0	0.5	0.4	0.2	—	—	—	—	—	55.8	88.4	67.2	1.3	0.7	2.7
Idaho	40.8	43.4	48.1	—	—	—	—	—	—	0.3	0.2	0.1	3.6	—	—	—	—	—	53.5	53.2	44.4	1.8	5.1	7.4
Kansas	15.4	56.9	64.8	2.7	0.1	—	1.9	—	—	44.8	16.3	28.5	0.4	—	—	0.2	—	—	28.1	17.7	0.9	6.5	9.0	5.7
Montana	75.6	43.7	53.6	—	—	—	—	—	—	0.1	0.1	(*)	(*)	—	—	—	—	—	23.0	50.5	41.7	1.8	5.7	4.7
Nebraska	85.3	72.4	93.0	0.7	(*)	(*)	0.1	—	—	13.3	4.4	0.1	0.3	—	—	0.3	—	—	1.5	22.3	2.1	0.5	0.9	4.7
Nevada	77.9	53.7	85.2	(*)	(*)	(*)	—	—	—	0.7	0.5	0.2	1.5	—	—	—	—	—	18.6	33.3	52.8	3.3	12.5	5.9
New Mexico	77.9	53.7	85.2	(*)	(*)	(*)	—	—	—	6.4	8.5	9.7	0.2	—	—	—	—	—	10.7	17.5	17.1	1.4	1.4	11.7
North Dakota	81.3	72.6	61.5	—	—	—	—	—	—	0.2	—	—	—	—	—	—	—	—	—	10.2	—	1.3	7.1	3.8
Oklahoma	94.5	82.7	96.2	4.0	—	—	—	—	—	13.9	5.0	4.1	—	—	—	2.1	—	—	6.4	—	74.1	4.1	46.8	0.3
Oregon	55.1	47.1	18.8	18.4	1.1	2.7	—	—	—	0.7	0.4	0.3	0.8	—	—	0.3	—	—	28.9	44.4	29.8	1.5	5.3	2.7
South Dakota	56.7	39.6	65.7	4.5	10.3	1.5	6.6	—	—	1.1	0.8	0.1	—	—	—	0.3	—	—	7.0	17.4	7.8	5.4	5.8	1.4
Texas	75.2	71.0	89.3	6.1	5.0	1.6	4.9	—	—	25.7	7.7	7.6	0.2	—	—	1.0	—	—	2.5	6.2	0.5	0.6	6.4	8.6
Utah	56.5	73.7	70.9	8.3	6.0	12.4	7.2	—	—	0.8	1.5	0.6	0.2	—	—	—	—	—	52.3	49.2	42.4	0.4	7.5	1.3
Washington	46.3	41.8	55.7	—	—	—	—	—	—	2.7	3.5	3.9	(*)	—	—	0.2	—	—	4.2	15.0	10.6	1.5	6.7	2.3
Wyoming	81.6	68.9	80.0	8.3	5.9	3.2	1.5	—	—	0.2	(*)	(*)	(*)	—	—	—	—	—	2.4	17.6	13.4	0.7	3.2	3.0

¹"Appropriation" includes water rights published in the 1930 and 1920 Census reports as "Appropriation and use," "Notice filed and posted," "Permit from State," "Certificate or license from State," also includes "Riparian" rights for Montana and New Mexico in 1919.

²Water rights for supplemental enterprises not included (see State table 16 for each State in the separate State Reports).

³Water rights have not been established in Arkansas, Louisiana, or Florida.

⁴Less than one-tenth of 1 percent.

⁵Riparian rights are not recognized in Nevada, except those adjudicated by courts prior to 1885. The proportion reported as "Riparian," owing to misapprehension as to its legal status, is included with that reported as "Adjudicated by Court."

CENSUS OF IRRIGATION: 1940

TABLE 20.—AREA IRRIGATED WITH PUMPED WATER, 1939, 1929, AND 1919; AND AREA WORKS OF ENTERPRISES

(For the 17 western States)

ITEM (For definitions and explanations, see text)		TOTAL	Arizona	Arkansas	California	Colorado
Total area entirely and partly supplied with pumped water-----						
	1939-----acres	6,990,655	566,298	160,818	3,186,053	101,682
	1929-----acres	5,767,604	406,917	151,305	3,044,209	54,945
	1919-----acres	3,105,331	264,727	141,969	1,298,423	49,505
	Increase or decrease (-), 1929-1939-----	percent	39.2	6.3	4.7	84.9
ENTIRE SUPPLY PUMPED						
Area irrigated-----						
	1939-----acres	4,451,343	149,935	160,112	2,142,514	61,720
	1929-----acres	3,918,985	112,761	149,555	1,959,577	42,421
	1919-----acres	2,525,338	46,370	141,719	1,126,687	23,732
	Increase or decrease (-), 1929-1939-----	percent	33.0	7.1	9.3	45.5
Area works were capable of supplying with water-----						
	1940-----acres	6,678,636	211,297	285,166	3,082,138	85,210
	1930-----acres	5,420,619	161,384	206,766	2,507,713	66,642
Pumped from--						
Streams--						
	Area irrigated-----					
	1939-----acres	1,724,800	1,055	6,733	470,538	4,691
	1929-----acres	1,713,380	8,123	1,502	469,944	27,765
	1919-----acres	1,226,510	6,671	6,009	295,673	12,747
	Increase or decrease (-), 1929-1939-----	percent	0.7	-87.0	348.3	0.1
	Proportion of total-----					
	1939-----percent	100.0	0.1	0.4	27.2	0.3
	1929-----percent	100.0	0.5	0.1	27.4	1.6
Area works were capable of supplying with water-----						
	1940-----acres	2,761,219	1,851	10,946	813,716	8,351
	1930-----acres	2,708,789	12,380	1,717	818,004	48,331
Wells--						
	Area irrigated-----					
	1939-----acres	2,508,076	144,175	149,915	1,511,789	58,771
	1929-----acres	2,051,735	104,637	142,978	1,453,272	12,143
	1919-----acres	1,263,098	39,694	135,260	826,846	10,114
	Increase or decrease (-), 1929-1939-----	percent	22.2	37.8	4.9	4.0
	Proportion of total-----					
	1939-----percent	100.0	5.7	6.0	60.4	2.3
	1929-----percent	100.0	5.1	7.0	70.8	0.6
Area works were capable of supplying with water-----						
	1940-----acres	3,621,991	201,201	268,145	2,070,540	76,587
	1930-----acres	2,465,868	149,003	199,849	1,646,280	15,463
Lakes--						
	Area irrigated-----					
	1939-----acres	45,831	100	134	21,972	134
	1929-----acres	77,818		75	4,097	405
	1919-----acres	35,730	5	450	4,168	871
	Increase or decrease (-), 1929-1939-----	percent	-41.1	78.7	436.3	-66.9
	Proportion of total-----					
	1939-----percent	100.0	0.2	0.3	48.0	0.3
	1929-----percent	100.0		0.1	5.3	0.5
Area works were capable of supplying with water-----						
	1940-----acres	70,318	481	361	23,584	138
	1930-----acres	135,880		200	4,524	410
Other sources--						
	Area irrigated-----					
	1939-----acres	172,636	4,605	3,330	138,215	(³)
	1929-----acres	76,052	1	5,000	32,264	2,108
	Proportion of total-----					
	1939-----percent	100.0	2.7	1.9	80.0	(³)
Area works were capable of supplying with water-----						
	1940-----acres	225,108	7,664	5,714	174,298	(³)
	1930-----acres	110,082	1	5,000	38,905	2,438

¹ Percent not shown when more than 1,000.² Less than one-tenth of 1 percent.³ Data are included only in totals because less than 3 enterprises reported in the 1940 Census.

GENERAL DISCUSSION

XLVII

OPERATING PUMPS WERE CAPABLE OF SUPPLYING WITH WATER, 1940 AND 1930; BY SOURCE OF PUMPED WATER, BY STATES

and Arkansas and Louisiana)

Idaho	Kansas	Louisiana	Montana	Nebraska	Nevada	New Mexico	North Dakota	Oklahoma	Oregon	South Dakota	Texas	Utah	Washington	Wyoming
520,233	58,437	403,931	184,192	109,462	15,179	166,291	2,906	2,089	194,320	36,875	815,689	183,525	258,799	23,976
291,544	15,562	449,435	107,243	28,492	7,876	44,433	1,669	468	137,551	61	600,579	160,612	256,854	9,859
114,734	16,155	433,316	35,988	2,626	8,684	25,496	2,469	295	68,887	1,369	464,149	29,450	145,017	2,072
78.4	275.5	-10.1	71.8	315.2	92.7	274.3	74.1	356.1	41.3	(¹)	35.8	14.3	0.8	143.2
504,927	55,921	396,112	37,017	91,629	2,325	81,869	2,406	2,089	57,522	1,962	800,585	23,741	66,059	10,898
120,921	15,157	448,339	44,419	26,272	3,136	37,541	1,669	458	62,024	61	595,248	125,948	167,803	9,675
112,507	13,965	409,576	15,961	1,661	2,942	17,599	2,469	295	68,189	869	461,618	29,097	48,410	1,672
152.2	268.9	-11.2	-16.7	248.8	-25.9	118.1	44.2	356.1	-7.3	(¹)	34.9	-80.8	-60.6	12.6
317,469	79,717	667,721	59,516	147,532	3,404	111,450	6,781	4,133	77,601	3,951	1,402,096	39,708	79,113	14,683
173,403	22,372	792,008	61,699	37,236	8,295	44,332	1,824	931	100,136	246	893,185	140,540	186,689	15,218
294,402	8,279	247,190	35,925	10,176	652	3,887	2,359	1,163	45,008	1,723	525,547	13,445	44,167	7,860
103,262	3,216	257,590	38,620	2,458	821	6,856	1,669	320	50,537	61	527,700	65,809	139,738	9,489
107,181	730	248,308	15,745	1,115	2,647	1,890	2,469	188	64,576	869	421,538	10,369	26,244	1,525
184.8	157.4	-4.0	-7.0	314.0	-20.6	-43.3	41.3	263.4	-10.9	(¹)	-0.4	-78.9	-68.4	-17.2
17.1	0.5	14.3	2.1	0.6	(²)	0.2	0.1	0.1	2.6	0.1	30.4	0.8	2.6	0.5
6.0	0.2	15.0	2.3	0.1	(²)	0.4	0.1	(²)	2.9	(²)	30.8	3.7	8.2	0.6
302,667	12,344	420,321	58,205	19,462	805	5,903	6,678	2,699	59,955	3,658	955,541	15,939	51,120	10,938
114,487	4,010	518,225	51,094	5,485	1,026	10,071	1,824	630	85,624	246	801,502	65,303	155,945	14,867
5,868	44,972	135,192	844	80,673	568	75,556	47	792	8,173	108	262,774	8,925	17,928	3,008
3,546	11,648	172,695	243	23,452	2,117	30,425	-----	63	3,804	-----	60,793	10,283	19,456	180
414	13,235	154,304	139	546	295	15,709	-----	107	1,993	-----	39,483	7,308	17,504	147
65.5	286.1	-21.7	247.3	244.0	-73.2	148.3	-----	(¹)	114.9	-----	332.2	-13.2	-7.9	(¹)
0.2	1.8	5.4	(²)	3.2	(²)	3.0	(²)	(²)	0.3	(²)	10.5	0.4	0.7	0.1
0.2	0.5	8.4	(²)	1.1	0.1	1.5	-----	(²)	0.2	-----	3.0	0.5	0.9	(²)
8,616	63,876	220,316	980	126,423	1,493	102,953	53	1,143	11,805	112	428,992	11,761	23,290	3,715
4,443	18,069	240,005	289	30,922	7,071	33,864	-----	66	4,179	-----	82,296	12,092	21,712	285
4,334	38	6,528	244	251	-----	(³)	-----	40	3,298	-----	4,406	1,371	2,948	(³)
5,144	-----	1,459	5,528	255	-----	15	-----	35	6,092	-----	1,861	49,451	3,395	6
4,912	-----	6,966	79	-----	-----	-----	-----	-----	1,620	-----	597	11,400	4,662	-----
-15.7	-----	347.4	-95.6	-1.6	-----	(³)	-----	14.3	-45.9	-----	156.8	-97.2	-13.2	(³)
9.5	0.1	14.2	0.5	0.5	-----	(³)	-----	0.1	7.2	-----	9.6	3.0	6.4	(³)
6.6	-----	1.9	7.1	0.3	-----	(²)	-----	(²)	7.8	-----	2.4	63.5	4.4	(²)
5,729	78	12,190	308	589	-----	(³)	-----	95	4,373	-----	6,898	12,016	3,432	(³)
38,645	-----	1,859	10,288	540	-----	65	-----	35	10,354	-----	2,562	62,615	3,717	66
323	2,632	9,202	(³)	529	1,105	2,423	-----	(³)	1,043	(³)	7,858	-----	1,018	-----
8,869	293	16,795	26	107	198	245	-----	40	1,591	-----	2,894	405	5,214	-----
0.2	1.5	5.3	(³)	0.3	0.6	1.4	-----	(³)	0.6	(³)	4.6	-----	0.6	-----
457	3,419	14,894	(³)	1,038	1,106	2,578	-----	(³)	1,468	(³)	10,667	-----	1,271	-----
15,828	293	31,919	28	209	198	332	-----	200	1,979	-----	6,825	530	5,317	-----

CENSUS OF IRRIGATION: 1940

TABLE 20.—AREA IRRIGATED WITH PUMPED WATER, 1939, 1929, AND 1919; AND AREA WORKS OF ENTERPRISES OPERATING

(For the 17 western States)

ITEM (For definitions and explanations, see text)	TOTAL	Arizona	Arkansas	California	Colorado
PART OF SUPPLY PUMPED					
Area irrigated—1939—acres—	2,539,312	416,363	706	1,043,539	39,862
1929—acres—	1,848,619	294,158	1,760	1,084,632	12,524
1919—acres—	579,993	218,357	250	171,736	25,773
Increase or decrease (-), 1929-1939—percent—	37.4	41.5	-59.7	-3.8	216.3
Area works were capable of supplying with water—1940—acres—	3,354,816	516,149	1,229	1,427,377	53,634
1930—acres—	2,530,903	390,108	2,694	1,503,517	13,284
Supplied from—					
Streams, gravity and pumped—					
Area irrigated—1939—acres—	1,266,148	47,614	(²)	251,196	24,334
1929—acres—	258,094	53		85,169	2,628
1919—acres—	199,595			60,278	9,430
Increase or decrease (-), 1929-1939—percent—	390.6	(¹)		194.9	760.5
Proportion of total—1939—percent—	100.0	3.8	(²)	19.9	1.9
1929—percent—	100.0	(³)		33.0	1.1
Area works were capable of supplying with water—1940—acres—	1,796,105	55,592	(²)	454,260	36,246
1930—acres—	437,233	70		200,955	3,032
Wells, pumped and flowing—					
Area irrigated—1939—acres—	20,835	374		5,877	462
1929—acres—	16,798	258		9,761	
1919—acres—	35,685	558		23,861	85
Increase or decrease (-), 1929-1939—percent—	24.0	45.0		-39.8	
Proportion of total—1939—percent—	100.0	1.8		28.2	2.3
1929—percent—	100.0	1.5		58.1	
Area works were capable of supplying with water—1940—acres—	24,850	457		6,757	902
1930—acres—	20,767	438		11,442	
Streams, gravity and wells, pumped—					
Area irrigated—1939—acres—	1,252,329	368,375	479	786,466	15,046
1929—acres—	1,164,349	292,681		780,960	8,956
1919—acres—	344,713	217,799	250	87,897	16,258
Increase or decrease (-), 1929-1939—percent—	7.6	25.9		0.7	68.0
Proportion of total—1939—percent—	100.0	29.4	(³)	62.7	1.2
1929—percent—	100.0	25.1		67.1	0.8
Area works were capable of supplying with water—1940—acres—	1,533,861	459,100	729	966,560	16,466
1930—acres—	1,507,586	358,691		1,022,726	9,412
Other combinations—					
Area irrigated—1939—acres—					
1929—acres—	409,378	1,164	1,750	208,742	740
Proportion of total—1939—percent—					
Area works were capable of supplying with water—1940—acres—					
1930—acres—	565,317	30,709	2,694	268,394	840
Supplemental from pumped streams ⁴ —					
Area irrigated—1939—acres—	25,844	(²)	(²)	5,807	8,892
1929—acres—	24,871	80		2,453	527
Proportion of total—1939—percent—	100.0	(²)	(²)	22.6	34.6
Area works were capable of supplying with water—1940—acres—	35,357	(²)	(²)	11,002	11,605
1930—acres—	32,787	98		4,046	542
Supplemental from pumped wells ⁴ —					
Area irrigated—1939—acres—	518,429	15,210	502	355,435	104,309
1929—acres—	293,026	1,592		287,136	1,343
Proportion of total—1939—percent—	100.0	2.9	0.1	68.5	20.1
Area works were capable of supplying with water—1940—acres—	693,540	21,452	1,216	484,197	126,120
1930—acres—	321,748	1,595		314,399	2,229
Other mixed ⁵ —					
Area irrigated—1939—acres—	266,927	6,186	623	50,757	17,398
Proportion of total—1939—percent—	100.0	2.3	0.2	19.0	6.5
Area works were capable of supplying with water—1940—acres—	325,947	7,100	1,210	70,627	20,027

¹ Percent not shown when more than 1,000.² Data are included only in totals because less than 3 enterprises reported in the 1940 Census.³ Less than one-tenth of 1 percent.⁴ Areas shown under supplemental pumping are parts of areas shown under primary pumping and therefore are not added again into the totals (see text).⁵ May include data for enterprises having unsegregated pumped or partly pumped sources and not included in above classifications or totals.

GENERAL DISCUSSION

XLIX

PUMPS WERE CAPABLE OF SUPPLYING WITH WATER, 1940 AND 1930; BY SOURCE OF PUMPED WATER, BY STATES—Continued
and Arkansas and Louisiana)

Idaho	Kansas	Louisiana	Montana	Nebraska	Nevada	New Mexico	North Dakota	Oklahoma	Oregon	South Dakota	Texas	Utah	Washington	Wyoming
215,306	2,516	5,819	147,175	17,833	12,864	84,422	500		136,798	34,913	15,104	159,784	192,740	13,078
170,823	405	1,096	82,824	220	4,740	6,892			75,627		7,331	36,684	89,051	184
2,227	2,190	23,740	20,027	965	5,742	7,897			698	500	2,531	353	96,607	400
26.2	521.2	430.9	134.3	(¹)	171.2	(¹)			81.1		106.0	335.8	116.4	(¹)
240,238	3,345	7,454	229,956	32,167	13,489	127,672	590		172,379	73,749	19,906	193,497	227,826	14,153
206,440	800	1,195	114,194	315	22,884	8,212			91,117		9,041	43,922	122,993	187
174,792	(²)	1,830	145,679	12,814	2,780	70,129	500		132,382	34,913	12,007	151,206	191,824	11,908
76,894			56,970						14,636		3,200	14,200	4,144	
1,870	600	12,620	19,872	850	720				253		350	50	92,702	
127.3			155.7						804.5		275.2	964.8	(¹)	
13.9	(²)	0.1	11.5	1.0	0.2	5.5	(³)		10.5	2.8	0.9	11.9	15.2	0.3
29.8			22.1						5.6		1.2	5.5	1.6	
197,391	(²)	2,665	228,320	26,301	2,895	110,675	590		166,279	73,749	15,694	184,225	226,781	12,692
90,212			104,449						14,636		4,700	14,200	4,979	
414	(²)	214			237	11,729					1,141	307		
50		196			177	5,855						398	103	
	50	1,075			65	6,556			340		1,727	178	1,490	
728.0		9.2			33.9	100.3						-22.9		
2.0	(²)	1.0			1.1	56.3					5.5	1.5		
0.3		1.2			1.1	34.8						2.4	0.6	
419	(²)	393			360	13,704					1,258	428		60
64		220			189	6,879						518	1,017	
40,100	2,443	3,775	1,496	5,019	9,837	2,564			4,416		1,956	8,271	916	1,170
72,959	405		2,694	70	2,260	655			994		850	20	708	137
357	1,540	10,045	155	115	4,957	1,341			105	500	454	125	2,415	400
-45.0	503.2		-44.5	(¹)	335.3	291.5			344.3		130.1	(¹)	29.4	754.0
3.2	0.2	0.3	0.1	0.4	0.8	0.2			0.4		0.2	0.7	0.1	0.1
6.3	(³)		0.2	(²)	0.2	(³)			(²)		(³)	(³)	(³)	(³)
42,428	3,183	4,396	1,636	5,866	10,234	3,299			6,100		2,954	8,844	1,045	1,201
90,044	800		4,520	70	17,045	935			1,158		860	20	965	140
20,720		900	3,160	150	2,303	382			59,897		3,281	22,048	84,096	47
26,120		975	5,225	245	5,650	398			75,323		3,481	29,184	116,032	47
552	(²)	304	2,708			(²)			2,424		1,802	(²)	145	2,781
8,915	60					20			7,887		254	75	4,600	
2.2	(²)	1.2	10.6			(²)			9.5		7.0	(²)	0.6	10.8
605	(²)	387	3,413			(²)			2,453		2,395	(²)	160	2,830
9,256	1,000					20			11,074		1,700	118	4,933	
2,517	13,429	2,429	1	15,548	518	5,031			703		(²)	1,943	850	(²)
120	1,050	200							812			816	157	
0.5	2.6	0.5	(³)	3.0	0.1	1.0			0.1		(²)	0.4	0.2	(²)
3,303	18,928	3,985	2	23,750	605	5,775			893		(²)	2,258	854	(²)
128	1,162	650							612			816	157	
57,173	146	6,745	12,467	4,680	22,781	23,910		85	17,386	278	8,984	20,272	12,575	4,601
21.5	0.1	2.5	4.7	1.8	8.5	9.0		(³)	6.5	0.1	3.3	7.6	4.7	1.7
64,570	288	11,609	13,171	6,786	24,685	31,573		154	19,262	402	12,549	20,811	15,756	5,408

CENSUS OF IRRIGATION: 1940

TABLE 21.—ENTERPRISES USING PUMPED WATER—INVESTMENT, 1940, 1930, AND 1920; AND COST

(For the 17 western States)

ITEM (For definitions and explanations, see text)		TOTAL	Arizona	Arkansas	California	Colorado	
Total investment, entire supply pumped and part supply pumped-----		1940--dollars--	512,390,046	76,698,208	5,733,495	243,575,872	7,843,065
		1930--dollars--	¹ 413,456,976	52,877,571	6,824,598	¹ 235,767,865	6,452,510
		1920--dollars--	178,519,476	21,087,181	7,143,223	85,276,671	3,486,853
ENTIRE SUPPLY PUMPED							
Investment, total-----		1940--dollars--	241,970,954	13,091,794	5,683,745	138,983,467	1,447,748
		1930--dollars--	¹ 242,782,577	10,206,959	6,773,348	¹ 135,252,088	6,001,642
		1920--dollars--	138,274,490	3,939,591	7,134,723	70,414,827	2,893,707
Average, per acre-----		1940--dollars--	36.23	61.96	19.93	45.09	16.99
		1930--dollars--	¹ 44.79	63.25	32.76	¹ 53.93	90.06
		1920--dollars--	35.88	56.94	40.52	45.32	77.19
Pumped from--							
Streams--							
Investment-----		1940--dollars--	81,236,358	38,096	145,077	19,458,731	142,190
		1930--dollars--	102,027,681	1,459,527	30,675	31,603,584	5,451,389
		1920--dollars--	59,271,070	521,852	96,450	16,267,561	2,490,900
Average, per acre-----		1940--dollars--	29.42	19.53	13.25	23.91	17.03
		1930--dollars--	37.67	117.89	17.86	38.63	112.79
		1920--dollars--	27.97	55.53	14.65	33.83	122.97
Maintenance and operation cost per acre-----		1939--dollars--	3.81	2.93	5.07	3.18	1.79
		1929--dollars--	4.30	9.83	6.27	4.47	3.89
		1919--dollars--	6.50	8.12	7.06	5.10	9.49
Wells--							
Investment-----		1940--dollars--	139,675,087	9,594,076	5,414,533	104,729,374	1,300,983
		1930--dollars--	¹ 131,426,464	8,747,182	6,640,773	¹ 100,421,609	474,033
		1920--dollars--	76,741,804	3,417,339	7,028,773	54,057,185	375,277
Average, per acre-----		1940--dollars--	38.56	47.68	20.19	50.58	16.99
		1930--dollars--	¹ 53.30	58.70	33.23	¹ 61.00	30.66
		1920--dollars--	45.82	57.16	41.70	50.60	23.37
Maintenance and operation cost per acre-----		1939--dollars--	6.92	7.98	5.53	8.41	3.87
		1929--dollars--	9.17	10.76	7.04	10.05	5.56
		1919--dollars--	10.07	13.15	14.06	10.40	4.54
Lakes--							
Investment-----		1940--dollars--	1,885,165	2,530	2,725	49,938	1,575
		1930--dollars--	3,591,977	-----	1,900	494,070	13,100
		1920--dollars--	2,261,616	400	9,500	90,081	27,530
Average, per acre-----		1940--dollars--	26.52	5.26	7.55	2.12	11.41
		1930--dollars--	26.43	-----	9.50	109.21	31.95
		1920--dollars--	37.84	80.00	10.00	20.34	25.51
Maintenance and operation cost per acre-----		1939--dollars--	3.40	6.45	5.87	0.73	4.37
		1929--dollars--	3.93	-----	3.49	3.97	3.21
		1919--dollars--	5.20	10.00	11.78	1.66	3.21
Other sources--							
Investment-----		1940--dollars--	19,194,344	3,457,092	121,410	14,725,424	(²)
		1930--dollars--	5,736,455	250	100,000	2,732,825	63,100
Average, per acre-----		1940--dollars--	85.27	451.08	21.25	84.48	(²)
		1930--dollars--	52.11	250.00	20.00	70.24	25.88
Maintenance and operation cost per acre-----		1939--dollars--	6.19	9.96	4.09	6.61	(²)
		1929--dollars--	7.22	100.00	8.00	7.09	1.28

¹ Revised.² Data are included only in totals because less than 3 enterprises reported in the 1940 Census.

GENERAL DISCUSSION

LI

OF MAINTENANCE AND OPERATION, 1939, 1929, AND 1919; BY SOURCE OF SUPPLY AND BY STATES
and Arkansas and Louisiana)

Idaho	Kansas	Louisiana	Montana	Nebraska	Nevada	New Mexico	North Dakota	Oklahoma	Oregon	South Dakota	Texas	Utah	Washington	Wyoming
24,265,166	1,517,280	10,927,612	17,450,113	4,129,886	308,297	13,417,215	286,412	202,532	21,638,955	4,944,593	43,736,279	7,969,053	27,195,198	553,000
14,516,484	856,725	15,505,090	6,860,390	707,372	650,144	2,009,411	10,340	25,395	9,857,113	11,423	31,133,165	7,313,634	21,782,541	295,204
5,906,728	868,257	13,504,957	2,540,067	86,566	335,187	1,524,688	552,007	51,285	2,970,495	96,340	22,649,707	1,496,839	8,815,261	127,144
8,915,204	1,243,788	10,823,142	2,016,691	2,229,585	87,984	2,427,197	229,282	202,532	2,421,921	122,161	43,352,590	1,787,045	6,613,858	311,800
8,235,156	785,606	15,446,414	2,419,277	699,042	200,851	1,652,607	10,340	25,395	4,967,428	11,423	30,644,803	6,112,809	15,048,157	293,254
5,878,928	763,725	15,062,362	924,751	62,851	189,800	961,523	552,007	51,285	2,952,695	95,340	22,391,970	1,451,168	4,694,483	110,374
28.08	15.60	16.21	33.88	15.11	25.85	21.78	34.06	48.96	31.21	30.92	30.92	45.01	85.60	21.22
55.95	55.05	19.50	39.21	18.77	24.21	37.28	5.87	27.28	49.61	46.43	34.31	43.50	80.61	19.27
40.20	34.46	19.87	24.92	17.38	45.70	36.88	44.89	108.42	34.60	29.07	24.92	29.91	63.12	30.69
8,265,470	1,67,340	6,297,629	1,957,655	219,587	10,635	85,892	226,162	87,378	1,824,856	105,110	36,591,597	834,571	4,781,231	222,773
5,218,180	176,378	8,831,806	2,208,928	71,933	45,000	334,111	10,340	9,670	4,468,284	11,423	26,266,985	4,355,987	11,170,057	283,444
5,108,912	22,142	7,538,954	900,216	39,681	119,900	36,520	552,007	4,210	2,807,806	85,340	19,432,010	733,077	2,605,718	99,914
27.30	15.56	14.98	33.64	11.27	13.21	14.21	33.87	24.96	30.44	28.19	38.08	52.36	93.53	20.37
45.58	43.99	17.04	43.23	13.11	43.86	33.18	5.67	15.35	53.43	46.43	32.80	66.70	71.63	19.06
38.83	14.37	16.78	24.49	16.04	44.82	12.46	44.89	11.86	34.61	29.07	25.70	44.23	52.59	28.98
1.92	3.60	4.05	3.47	3.33	1.88	2.08	3.45	2.98	4.14	4.73	4.89	2.57	8.81	1.82
4.32	3.43	3.66	2.38	3.85	7.01	2.01	1.59	3.00	5.72	8.17	4.96	1.29	3.84	1.58
3.43	7.57	7.76	5.63	2.86	1.76	1.30	12.21	3.74	3.09	4.03	7.55	5.16	11.16	9.91
132,831	1,015,070	4,159,354	34,741	1,989,248	56,249	2,312,580	3,120	87,265	499,877	6,000	6,437,794	345,889	1,468,048	88,075
87,248	804,328	6,013,183	14,259	616,939	142,761	1,312,396	12,225	246,833	3,879,881	3,879,881	3,879,881	418,916	1,785,628	8,250
24,935	741,583	5,366,948	16,285	23,250	19,900	925,003	47,075	118,306	2,783,260	2,783,260	2,783,260	153,091	1,633,134	10,460
15.42	15.89	16.88	35.45	15.75	37.68	22.46	58.87	76.35	42.34	53.57	15.01	29.43	63.03	33.71
19.64	33.44	25.05	49.34	19.95	20.19	38.75	185.23	59.06	59.06	47.15	34.84	82.24	28.95	28.95
48.81	36.14	25.59	106.44	20.25	37.88	39.97	398.94	48.93	48.93	39.24	11.83	81.91	70.68	70.68
2.71	3.35	3.48	4.64	3.49	8.21	4.27	7.26	6.48	6.42	14.55	3.10	3.71	10.34	4.66
2.30	3.69	4.45	9.38	4.03	4.82	6.44	6.44	14.30	10.72	8.50	3.58	15.43	34.76	34.76
5.35	6.96	5.95	5.41	5.16	12.10	7.51	7.51	40.78	8.04	11.07	2.08	12.71	7.79	7.79
512,043	2,375	125,515	22,997	4,325	---	(²)	---	7,509	59,040	---	168,872	606,585	298,284	(²)
720,528	---	46,750	194,880	5,000	---	500	---	1,000	185,800	---	51,737	1,317,258	558,096	1,560
544,981	---	356,960	8,250	---	---	---	---	---	26,583	---	176,700	565,000	455,631	---
98.38	30.45	10.30	74.87	7.34	---	(²)	---	79.04	13.50	---	24.48	50.48	86.91	(²)
18.64	---	25.15	18.94	9.26	---	7.69	---	28.57	17.92	---	20.19	21.04	150.15	23.64
59.20	---	35.20	43.65	---	---	---	---	---	14.88	---	22.38	29.74	114.51	---
4.56	5.28	4.49	4.34	4.90	---	(²)	---	9.38	1.73	---	2.41	12.07	15.65	(²)
8.51	---	2.97	4.32	5.88	---	5.00	---	---	2.16	---	3.69	2.60	19.73	4.17
6.72	---	9.17	11.07	---	---	---	---	---	2.52	---	6.32	3.58	13.05	---
6,860	59,005	240,464	(²)	16,425	21,100	30,625	---	(²)	38,168	(²)	354,127	---	66,295	---
207,200	2,900	554,675	1,210	5,170	13,070	5,600	---	2,500	66,709	---	426,200	20,650	1,534,398	---
15.01	17.26	18.15	(²)	15.82	19.08	11.88	---	(²)	26.00	(²)	33.20	---	52.16	---
13.09	9.80	17.38	43.21	17.89	66.01	16.87	---	12.50	33.70	---	62.45	38.96	288.58	---
3.80	4.72	2.62	(²)	3.77	1.16	0.80	---	(²)	5.43	(²)	3.79	---	12.68	---
2.67	0.85	8.20	6.96	6.74	3.21	7.52	---	5.00	3.07	---	10.57	5.69	14.26	---

CENSUS OF IRRIGATION: 1940

TABLE 21.—ENTERPRISES USING PUMPED WATER—INVESTMENT, 1940, 1930, AND 1920; AND COST OF

(For the 17 western States)

ITEM (For definitions and explanations, see text)		TOTAL	Arizona	Arkansas	California	Colorado
PART OF SUPPLY PUMPED						
Investment, total	1940—dollars	270,419,092	85,606,409	49,750	104,610,405	6,395,317
	1930—dollars	170,874,399	42,670,612	51,250	100,515,777	450,868
	1920—dollars	40,244,986	17,147,590	8,500	14,861,844	595,146
Average, per acre	1940—dollars	80.61	123.23	40.48	73.29	119.24
	1930—dollars	87.44	106.38	19.02	66.85	35.94
	1920—dollars	60.05	71.02	28.33	78.42	22.60
Supplied from—						
Streams, gravity and pumped—						
Investment	1940—dollars	138,541,602	8,195,261	(²)	34,584,451	3,270,498
	1930—dollars	20,825,588	2,550		9,730,362	90,360
	1920—dollars	9,406,594			3,084,038	397,392
Average, per acre	1940—dollars	77.13	144.81	(²)	76.13	90.23
	1930—dollars	47.63	58.45		48.42	29.80
	1920—dollars	39.57			49.02	41.72
Maintenance and operation cost per acre	1939—dollars	2.23	2.48	(²)	3.18	3.29
	1929—dollars	4.41	3.49		8.25	2.72
	1919—dollars	2.33			1.93	2.54
Wells, pumped and flowing—						
Investment	1940—dollars	1,855,318	34,487		1,315,926	11,630
	1930—dollars	1,548,810	28,750		1,153,841	
	1920—dollars	2,487,049	54,700		1,776,156	5,300
Average, per acre	1940—dollars	74.66	75.46		194.45	12.69
	1930—dollars	74.58	65.64		100.84	
	1920—dollars	58.47	68.46		65.02	33.12
Maintenance and operation cost per acre	1939—dollars	7.96	5.15		20.81	0.33
	1929—dollars	9.27	10.64		13.47	
	1919—dollars	8.04	13.64		7.63	4.78
Streams, gravity and wells, pumped—						
Investment	1940—dollars	111,874,861	54,903,401	7,200	55,040,258	209,757
	1930—dollars	99,936,110	37,553,267		60,683,254	212,058
	1920—dollars	28,541,343	17,092,690	8,500	10,001,850	190,454
Average, per acre	1940—dollars	72.94	119.59	9.88	56.96	12.72
	1930—dollars	66.29	104.64		59.33	22.53
	1920—dollars	72.71	71.03	28.33	100.74	11.50
Maintenance and operation cost per acre	1939—dollars	3.56	4.69	1.36	3.24	1.80
	1929—dollars	4.46	5.06		5.29	1.74
	1919—dollars	5.97	2.70	30.15	15.62	0.75
Other combinations—						
Investment	1940—dollars					
	1930—dollars	37,811,165	5,027,245	51,250	19,437,761	26,100
Average, per acre	1940—dollars					
	1930—dollars	66.89	163.71	19.02	72.42	31.07
Maintenance and operation cost per acre	1939—dollars					
	1929—dollars	4.33	7.73	4.09	6.05	2.33
Supplemental from pumped streams—						
Investment	1940—dollars	1,622,648	(²)	(²)	515,449	956,433
	1930—dollars	927,158	10,200		70,681	87,000
Average, per acre	1940—dollars	45.89	(²)	(²)	46.85	82.43
	1930—dollars	28.28	104.08		17.47	123.62
Maintenance and operation cost per acre	1939—dollars	4.84	(²)	(²)	7.83	4.84
	1929—dollars	6.27	14.63		5.39	6.15
Supplemental from pumped wells—						
Investment	1940—dollars	16,584,863	472,510	14,500	13,156,321	1,947,019
	1930—dollars	9,327,568	48,600		9,439,878	55,350
Average, per acre	1940—dollars	25.23	22.03	11.92	27.17	15.44
	1930—dollars	29.92	30.47		30.03	24.83
Maintenance and operation cost per acre	1939—dollars	3.86	3.59	4.89	4.55	3.06
	1929—dollars	5.91	2.44		5.97	5.17
Other mixed ³ —						
Investment	1940—dollars	14,200,902	294,173	29,000	4,872,435	469,591
Average, per acre	1940—dollars	45.57	41.43	25.97	68.99	23.45
Maintenance and operation cost per acre	1940—dollars	2.44	3.53	2.25	6.07	1.02

² Data included only in totals because less than 3 enterprises reported in the 1940 Census.³ May include data for enterprises having unsegregated pumped or partially pumped sources and not included in above classifications or totals.

GENERAL DISCUSSION

LIII

MAINTENANCE AND OPERATION, 1939, 1929, AND 1919; BY SOURCE OF SUPPLY AND BY STATES—Continued
and Arkansas and Louisiana)

Idaho	Kansas	Louisiana	Montana	Nebraska	Nevada	New Mexico	North Dakota	Oklahoma	Oregon	South Dakota	Texas	Utah	Washington	Wyoming
15,349,962	275,492	104,670	15,435,422	1,900,301	220,315	10,990,018	57,130	-----	19,217,034	4,822,232	383,889	6,182,008	20,581,340	241,400
8,263,328	75,120	58,676	4,441,115	8,330	449,313	358,804	-----	-----	4,889,687	-----	488,362	1,200,825	6,734,364	1,950
227,900	104,532	442,095	1,615,316	23,735	195,387	563,165	-----	-----	17,800	3,000	257,737	45,671	4,120,798	16,770
63.89	81.76	14.04	67.11	59.08	16.33	86.08	96.83	-----	111.48	65.39	19.29	31.95	90.34	17.06
40.12	91.40	49.10	38.89	26.44	19.63	43.45	-----	-----	53.66	-----	54.02	27.34	54.75	10.43
47.20	27.95	10.53	47.85	17.32	22.17	62.32	-----	-----	25.14	3.00	53.63	65.81	40.69	26.45
14,225,602	(²)	26,950	15,406,871	1,515,810	27,103	10,411,418	57,130	-----	18,977,045	4,822,232	281,287	6,048,221	20,513,648	150,200
5,663,215	-----	-----	4,374,096	-----	-----	-----	-----	-----	347,667	-----	229,067	105,650	280,321	-----
168,200	50,000	172,000	1,612,316	18,700	8,000	-----	-----	-----	3,700	-----	60,000	5,100	3,827,148	-----
72.07	(²)	10.11	67.48	57.63	9.36	94.07	96.83	-----	114.13	65.39	17.92	32.85	90.46	11.65
62.78	-----	-----	41.88	-----	-----	-----	-----	-----	23.77	-----	48.74	7.44	56.30	-----
37.83	58.82	6.21	47.99	16.40	11.11	-----	-----	-----	14.07	-----	100.00	25.50	39.97	-----
1.82	(²)	2.70	1.31	2.08	0.25	3.74	3.40	-----	2.50	1.46	6.08	1.09	2.08	0.14
2.80	-----	-----	1.91	-----	-----	-----	-----	-----	1.54	-----	8.00	1.73	8.24	-----
8.30	20.00	6.06	1.77	1.04	0.76	-----	-----	-----	2.55	-----	8.57	-----	1.99	-----
6,800	(²)	21,169	-----	-----	22,927	401,118	-----	-----	-----	-----	26,395	11,265	-----	4,000
28,500	-----	17,326	-----	-----	10,760	251,863	-----	-----	-----	-----	-----	20,870	36,900	-----
-----	4,000	22,500	-----	-----	5,500	389,165	-----	-----	2,600	-----	163,057	18,571	56,500	-----
16.23	(²)	53.87	-----	-----	63.69	29.27	-----	-----	-----	-----	20.98	26.32	-----	66.67
445.31	-----	78.75	-----	-----	56.93	36.61	-----	-----	-----	-----	-----	40.29	56.28	-----
-----	68.67	16.98	-----	-----	79.57	52.09	-----	-----	7.85	-----	47.57	71.15	37.92	-----
4.27	(²)	5.94	-----	-----	1.67	2.69	-----	-----	-----	-----	1.90	2.56	-----	-----
16.80	-----	3.90	-----	-----	5.26	3.00	-----	-----	-----	-----	-----	3.49	2.91	-----
-----	-----	4.19	-----	-----	61.77	8.99	-----	-----	18.00	-----	16.69	9.48	1.86	-----
1,018,895	15,622	39,850	15,411	85,477	98,398	73,933	-----	-----	183,680	-----	62,360	64,948	30,100	25,391
1,098,605	30,010	-----	25,267	2,330	119,903	86,301	-----	-----	32,292	-----	43,887	3,500	43,836	1,600
59,700	50,532	247,595	3,000	5,035	181,887	175,000	-----	-----	11,500	3,000	34,680	22,000	237,150	16,770
24.01	4.91	9.07	9.42	14.57	9.61	22.41	-----	-----	30.11	-----	21.11	7.34	28.80	21.14
12.20	37.51	-----	5.59	33.29	7.03	92.30	-----	-----	27.89	-----	51.03	175.00	45.42	11.43
166.76	17.86	19.05	17.85	21.89	22.87	110.48	-----	-----	109.52	3.00	44.58	94.42	58.28	26.45
1.75	1.00	4.31	0.75	1.38	0.55	2.89	-----	-----	2.48	-----	3.54	0.81	5.30	1.67
1.55	10.12	-----	1.11	2.86	2.29	1.13	-----	-----	5.58	-----	8.84	19.00	8.86	0.52
1.00	1.55	10.69	6.67	3.00	1.57	39.77	-----	-----	17.89	-----	16.63	2.84	20.70	1.20
1,277,300	-----	28,550	41,750	6,000	318,650	13,640	-----	-----	4,278,278	-----	213,400	1,047,800	6,043,091	350
48.90	-----	29.28	7.99	24.49	56.40	34.27	-----	-----	56.80	-----	61.30	35.90	52.08	7.45
2.22	-----	3.89	0.72	1.67	4.22	4.19	-----	-----	1.45	-----	5.66	2.99	3.08	0.85
9,317	-----	(²)	10,940	30,370	-----	(²)	-----	-----	15,062	-----	12,147	(²)	7,204	61,509
210,208	-----	10,000	-----	-----	-----	5,000	-----	-----	229,690	-----	2,008	1,505	320,866	-----
15.40	-----	(²)	28.27	8.90	-----	(²)	-----	-----	6.14	-----	5.07	(²)	45.02	21.73
22.71	-----	10.00	-----	-----	-----	250.00	-----	-----	20.74	-----	1.18	12.75	65.04	-----
1.90	-----	(²)	2.03	2.65	-----	(²)	-----	-----	0.64	-----	2.50	(²)	6.61	4.94
6.11	-----	-----	-----	-----	-----	38.15	-----	-----	2.48	-----	7.87	5.60	13.55	-----
89,348	256,095	15,273	200	268,644	71,885	102,068	-----	-----	41,247	-----	(²)	57,365	30,388	(²)
5,500	43,110	2,800	-----	-----	-----	-----	-----	-----	1,460	-----	-----	21,500	9,370	-----
27.05	13.53	3.83	100.00	11.31	118.82	17.67	-----	-----	46.19	-----	(²)	25.41	35.58	(²)
42.97	37.10	4.31	-----	-----	-----	-----	-----	-----	2.38	-----	-----	26.35	59.68	-----
2.70	2.21	1.55	15.00	1.44	1.96	2.01	-----	-----	6.73	-----	(²)	2.21	4.64	(²)
8.82	2.40	3.50	-----	-----	-----	-----	-----	-----	0.29	-----	-----	2.09	8.09	-----
1,403,443	17,400	252,535	279,235	57,617	207,591	1,378,932	-----	5,600	917,211	10,352	411,305	332,197	2,549,048	713,239
21.74	60.42	21.76	21.20	8.52	8.42	43.67	-----	36.36	47.62	25.75	32.78	15.96	161.78	131.89
1.63	4.75	3.39	0.95	0.94	0.25	0.63	-----	6.78	1.57	2.17	2.03	1.26	5.79	0.97

Areas and Investments of the Bureau of Reclamation

Census of Irrigation.—According to statistics of the Bureau of the Census, the total area of agricultural land served with water by the Bureau of Reclamation of the United States Department of Interior, shows an increase of about 20 percent in the 10-year period, 1930 to 1940. This increase is divided almost equally between new land furnished a full supply of irrigation water, and land furnished a part supply to supplement inadequate water received from other systems.

The gains are analyzed as follows:

ITEM	Acres	Increase since 1929 (percent)
LAND WITHIN FEDERAL RECLAMATION PROJECTS		
Area irrigated-----1939-----	1,824,004	22
Area works were capable of irrigating-----1940-----	2,348,987	20
LAND OUTSIDE FEDERAL RECLAMATION PROJECTS		
Area supplied supplemental water-----1939-----	1,480,470	18
Area works were capable of supplying supplemental water-----1940-----	1,782,721	21

Scope of operations.—The most extensive construction program undertaken by the Bureau since the enactment of the Reclamation Law in 1902 began in 1933. This program resulted from an acceleration of interest in water conservation in the West, the need for public works to provide employment, and the demand for newly irrigated land for the settlement of the increasing population of the West. Increasing drafts on underground water supplies and the prolonged droughts of the 1930-40 decade affected the water supplies of established irrigated areas, which brought demands for storage and diversion facilities to provide supplemental water. Increased recognition of the possibilities of power developments in multiple-purpose projects as a means of providing revenue to aid in repayment of irrigation costs was a major contributing factor.

Because of the magnitude of some of the projects, the full results of the program will not be fully realized for several years. The rate of progress towards completion is governed by appropriations, and since the opening of World War II also by priorities for critical materials and availability of labor. Since 1930, several major projects involving new land were completed, older undertakings were extended, and storage facilities were constructed on 11 projects for the purpose of supplementing the water supplies of land inadequately irrigated by other systems. When the construction program authorized as of January 1, 1940 is completed, the Bureau will be prepared to furnish a full supply of water to 5,115,224 acres, and supplemental water to 5,700,343 acres. In operation or planned in connection with the program on January 1, 1940 are power facilities with an ultimate capacity of 4,190,162 kilowatts.¹

Since the Census of 1930, dams were completed by the Bureau which increased the reservoir capacity on projects operated primarily for irrigation to 17,292,933 acre-feet. Dams under construction or authorized will, when completed, more than double this capacity and make a total of 39,088,000 acre-feet.

In addition, the Bureau completed the storage facilities for three major multiple-purpose projects which provide a total storage capacity of 36,189,000 acre-feet: Boulder Dam, (32,359,000 acre-feet) and Parker Dam (710,000 acre-feet) on the Colorado River in the Pacific Southwest; and Marshall Ford Dam (3,120,000 acre-feet) on the Colorado River in Texas. While these projects have a direct bearing on irrigation, their other functions predominate, and statistics relating to them are not included with data on projects dealt with in the 1940 Irrigation Census.

Projects in operation.—The Bureau of Reclamation had 40 projects in operation in 1940 in 15 States: Arizona, California, Colorado, Idaho, Montana, Nebraska, Nevada, New Mexico, North Dakota, Oregon, South Dakota, Texas, Utah, Washington, and Wyoming. Of these, 7 are interstate projects. Most of the 40 are completed, but several require substantial additions to the distribution systems before their full capacities

may be utilized. Data on the acreage, irrigation and nonirrigation investment, and estimates of the costs to be repaid by irrigators on project land, supplemental water users, and power consumers have been tabulated.²

While irrigation is the major function of the Bureau of Reclamation, most of its projects in operation or under construction have multiple purposes, adding greatly to their feasibility.

Generally speaking, projects in operation are of the following types:

1. Those which provide a full or primary water supply for land wholly within project boundaries, and have no other function except in many instances the drainage of the area irrigated.
2. Those which provide a full supply for project lands brought into cultivation and at the same time afford supplemental water for areas outside of project boundaries inadequately irrigated by other systems. Some of this type have extensive power facilities which serve commercial customers and return a substantial revenue which aids in the repayment of project costs.
3. Those which store supplemental water for the irrigation of nonproject areas threatened with retrogression to desert through shortages or failure of primary water supplies. The demand for this type of project greatly increased during the drought years of the 30's and resulted in the authorization of several large projects, many with power facilities.
4. Multiple-purpose projects such as those created by construction of Boulder, Parker, and Marshall Ford Dams.

The relationship to irrigation of the projects in the first three classifications are summarized in detail in the Census Irrigation State Reports.

Of those in the fourth class, Boulder's storage and flow regulation of the Colorado River will aid irrigation in Arizona and southern California. Through the All-American Canal system, authorized by the Boulder Canyon Project Act of 1928 and which began service with the irrigation season of 1941, an adequate water supply is promised by a route entirely within the United States to half a million irrigable acres in California in the Imperial Valley and to a large potentially irrigable area which can be served by the Coachella branch of the system on the East Mesa and in the Coachella Valley.

Power developments.—Power revenues of the Boulder Plant will advance investigations and the construction of irrigation and power projects elsewhere in the 7 States of the Colorado River Basin, through the allocation of \$25,000,000 for this purpose over a period of 50 years. Power is expected to repay in 50 years about 90 percent of the cost of Boulder Dam. Storage of water for municipal purposes in southern California, flood control, river regulation, and recreation are other major functions of the project.

Parker Dam, constructed by the Bureau as a part of the Boulder system with funds provided by the Metropolitan Water District of southern California, creates a forebay from which water is pumped into the District's aqueduct for transfer 241 miles to Los Angeles and 12 other cities of the metropolitan area of southern California. The power plant at Parker Dam, beginning operation in 1942, will also supply pumping energy for Federal projects in Arizona, and for industrial and commercial purposes.

Marshall Ford Dam in Texas is primarily for flood control and power, but will also regulate the Colorado River of Texas thus aiding downstream irrigation of rice and other lands.

Projects under construction.—In addition to the three types of irrigation and the major multiple-purpose projects in operation, the Bureau of Reclamation has 18 other projects under construction nearly all of which have several purposes that were taken into consideration when the projects were authorized as economically feasible—a prerequisite to construction. These purposes include power development, municipal

¹ See footnote (3) page LV. Also, see footnote on page LVI. ² See table A on page LVII.

water supply, flood control, navigation, river regulation, soil conservation, recreation, and wildlife protection. These projects are located in the 14 States of Arizona, California, Colorado, Idaho, Montana, Nebraska, New Mexico, North Dakota, Oklahoma, Oregon, South Dakota, Utah, Washington, and Wyoming. These projects are listed in the applicable State reports under the heading "Bureau of Reclamation areas and investment."

The projects under construction are divided into two classes:

1. Those which will bring new land under irrigation (with or without power or other functions to assist in repaying the cost of construction).
2. Those which will provide supplemental water for areas inadequately irrigated (with power or other facilities included).

Both classes include projects having nonreimbursable features charged to flood control or navigation, or which may represent allocations of work by the Civilian Conservation Corps or the Work Projects Administration.

Among the major multiple-purpose projects under construction which are included in the State summaries in table B, is the Columbia River Basin development in Washington, of which Grand Coulee Dam is the major engineering feature scheduled for completion in 1941. This project is expected ultimately to bring under irrigation 1,200,000 acres of land. The Central Valley Project in California as planned will benefit 2,000,000 acres now mostly under irrigation, through substituted and supplemental water supplies and the prevention of salt water intrusion in the Sacramento-San Joaquin Delta Region. It may also bring in 50,000 or more acres of new land. The Colorado-Big Thompson Project will serve 625,000 acres of producing land now mostly irrigated, in northeastern Colorado through the diversion of 300,000 acre-feet of water annually from the Colorado River Basin through a transmountain tunnel to the South Platte River Basin on the eastern slope of the Rocky Mountains. All these projects depend on revenue from power facilities for the repayment of a substantial part of the construction costs of irrigation facilities.

Other projects under construction or authorized, in addition to the All-American Canal system in California, previously mentioned, are located in Arizona, California, Idaho, New Mexico, Oklahoma, Oregon, Utah, Washington, and Wyoming, and are discussed individually in the separate Census of Irrigation State Reports under "Bureau of Reclamation areas and investments."

Included in the projects authorized or under construction is a third or new type of development represented by six projects designed to rehabilitate dry-farm or partly irrigated areas principally in the Great Plains States which were seriously affected by drought in the 1930-40 decade. These projects authorized under Water Conservation and Utilization legislation cover relatively small acreages, and contributions of nonreimbursable labor are made by Work Projects Administration and the Civilian Conservation Corps. These contributions are designed to keep the reimbursable costs of the project chargeable against the land within the ability of water users to repay from agricultural production. The Water Conservation and Utilization projects included in table B summaries are located in the States of Montana, Nebraska, North Dakota, and South Dakota. Other projects of this type authorized from 1940 to 1942 are located in Colorado, Idaho, Utah, and Wyoming.

Investigations of future irrigation projects.—Preliminary estimates by Bureau of Reclamation engineers in 1940 indicate that projects can be developed, under current standards of economic feasibility involving multiple-purpose projects, to conserve water for the irrigation of 22,120,000 acres of land in the 17 western States, west of or bisected by the 100th meridian in addition to that irrigated in 1939. These States are Arizona, California, Colorado, Idaho, Kansas, Montana,

Nebraska, Nevada, New Mexico, North Dakota, Oklahoma, Oregon, South Dakota, Texas, Utah, Washington, and Wyoming.

In addition, the Reclamation engineers estimate that there are 11,700,000 acres of presently irrigated land which will require supplemental water if their agricultural production is to be sustained and the established communities dependent on them maintained.

To some extent the needs of the West for water conservation for irrigation of additional lands and supplemental water are being met by the construction program made up principally of multiple-purpose projects involving irrigation, power, and flood control. In addition, in 1940 the Bureau had under way or planned investigations of 175 additional projects in the 17 western States. Many of the investigations were basin-wide and were expected to uncover feasible individual projects.¹

Power development in Reclamation irrigation projects.—The development of hydroelectric power on irrigation projects engineered by the Bureau of Reclamation is incidental to the release of water from storage reservoirs and to the utilization of drops in the canals of distribution systems. The power thus generated in many instances is used to pump irrigation water to areas that cannot be served by gravity systems. Surplus power is sold on a wholesale basis; preference in the right to buy is given to publicly-owned nonprofit utilities.

There were 28 Reclamation power plants, including Boulder Dam, in operation in 1940. The installed capacity was 879,000 kilowatts.² By 1945, the scheduled installations were to total 3,207,662 kilowatts.

Irrigation costs on Reclamation projects.—In order to display the actual costs of Bureau of Reclamation projects which the water users or lands within Reclamation projects are expected to pay for the irrigation system, and to make the statistics comparable with those presented for non-Federal irrigation enterprises, the Bureau of Reclamation separated for inclusion in the 1940 Census of Irrigation those costs which came within the Census definition of the investment in works on operating projects on December 31, 1939 (see table A). These were generally the costs of irrigation storage and distribution facilities which were charged to the agricultural lands served or to be served. The influence of multiple-purpose features upon irrigation costs was recognized, but the costs of power facilities in most instances were eliminated as were also drainage costs which are reported in the 1940 Drainage Census. In preceding censuses the drainage costs and all the Federal and non-Federal power investments (in Arizona, as an example)³ were included in the irrigation schedules on which reports of the Bureau's investments were made and no specific recognition was made of costs incurred in providing supplemental water for nonproject lands.

The investment attributed to the Bureau includes certain expenditures by irrigation districts or water-user associations on Federal projects, principally in the States of Arizona, Idaho, Oregon, Washington, and Montana. The Federal investment reported to the Census also includes construction costs which have been written off by The Congress but which continue to represent an original outlay for irrigation by the United States. The over-all investment of the Bureau, as shown by the Irrigation Census Reports, includes the construction costs of facilities which provide supplemental as well as primary water supplies.

The gross per-acre construction costs of Federal Reclamation projects are three times higher than those reported by non-Federal enterprises. This is accounted for in a large measure by the accurate records of expenditures which are maintained and the outlays for storage facilities. More than 50 percent of the irrigation storage facilities of irrigation enterprises are credited to the Bureau and all these are of a permanent type of construction as are also most of the main canals and laterals. Construction work has been carried on

¹ In 1942 the Bureau was concentrating on a shelf of at least 50 or more irrigation and multiple-purpose projects which could be quickly launched at the conclusion of World War II to provide employment, during construction, and settlement opportunities for returning service men and emergency industrial workers.

² The capacity of power plants on additional projects and revision of capacity of others authorized by July 1942 increased the ultimate capacity planned to 4,795,262 kilowatts.

³ The investment credited to the Bureau of Reclamation in State table 7, Arizona, for 1930, includes all power costs. The 1940 investment figure reflects the elimination from the irrigation investment of certain power costs and includes additional construction by the United States since 1930 which included Bartlett Dam and substantial betterments to the Salt River Project facilities.

extensively by the Government in periods of high prices of labor and materials, while there has been relatively little non-Federal construction in recent years. Much of the non-Federal irrigation was undertaken when diversions were simple and construction costs relatively low.

A more complete financial picture of Federal Reclamation projects reported to the 1940 Irrigation Census is presented by an analysis in table A of data by States on acreage and construction costs distributed among irrigation and other purposes. To show the costs repayable by water users on project lands for primary water supplies, the estimated amounts which will be returned by other beneficiaries—contractors for supplemental water, power consumers, lessors of grazing land—are given. Charge-offs and other nonreimbursable costs are also tallied.

Thus approximately 56 percent of the over-all costs of the operating projects are repayable directly from lands receiving a primary supply of water from Bureau works. The average net irrigation costs, on a basis comparable to non-Federal irrigation enterprises, is about \$71 an acre. The average per-acre cost of supplemental water provided by the Federal systems is \$22 compared with \$18.61 for similar service by non-Federal enterprises.

On Bureau of Reclamation projects under construction the influence of multiple-purpose features on the costs to be repaid by irrigation water users is even more pronounced. The double use of stored water for irrigation and generation of power; also the use of irrigation reservoirs for flood control and aid to navigation and prevention of salt water intrusion (on the Pacific Coast) are important factors. The provision of municipal water for growing cities of the arid west is an increasing consideration in Reclamation construction.

The construction program under way in 1940 involved an ultimate outlay of \$900,000,000 (exclusive of future requirements for Boulder Dam and for similar large multiple-purpose projects in operation in 1940). Of this amount more than half will be repayable by power revenues. About \$45,000,000 allocated to flood control, navigation, and relief labor, will be nonreimbursable; and \$10,000,000 will be repayable by municipalities receiving water supplies from multiple-purpose reservoirs. The remaining 43 percent of the construction costs will be repayable by water users on the 2,540,876 acres to receive primary water and on the 3,904,574 acres to receive supplemental water. Although detailed estimates of irrigation costs on some projects under construction were not available, the average construction charge for new lands brought under irrigation was estimated to be \$95 to \$100 an acre. The average charge per acre for supplemental water was estimated at \$45 to \$50 on land these new systems will benefit.¹

Under the Boulder Canyon Project Adjustment Act of 1940, the repayment of a flood control allocation of \$25,000,000 is deferred until expiration of the 50-year period of amortization. Practically all the remainder of the Boulder Dam construction costs and all other charges will be repaid by net power revenues within 50 years. The Metropolitan Water District of southern California will pay approximately 10 percent of the costs of Boulder Dam storage water. This water when released is diverted by pumping from Lake Havasu at Parker Dam downstream on the Colorado River into the District's aqueduct to supply Los Angeles and 12 other cities of the California coastal area.

For three years, \$500,000 a year from power revenues at Boulder Dam will be available for investigations of irrigation and power projects in the Colorado River Basin comprising Arizona, California, Colorado, Nevada, New Mexico, Utah, and Wyoming. The same amount annually from the same source will be available until 1987 for investigations and the construction of approved projects in this basin. In addition the States of Arizona and Nevada share extensively in Boulder Dam reserves in lieu of State taxes.

Title to Parker Dam, which was built with non-Federal funds advanced by the Metropolitan Water District of southern California, is retained in the United States. The power plant at the dam and the transmission system are being constructed with Government funds, and the Government will own one-half the power. The cost of the power facilities will be repaid from power revenues.

Of the cost of Marshall Ford Dam the amount to be repaid from power revenues by the Colorado River Authority of Texas, which operates the dam, is to be determined by the Secretary of the Interior.

None of the costs of these dams which are not directly serving irrigation nor of projects under construction are included in the Census Reports on Bureau of Reclamation investment.

Water conservation and utilization projects, designed to rehabilitate drought-stricken areas in the Great Plains and elsewhere and provide employment in rural areas, were first authorized by the Interior Department Appropriation Act of 1940. Later authorization was contained in the Water Conservation and Utilization Act (53 Stat. 1418), which provides for cooperation between the Departments of the Interior and Agriculture in the settlement and agricultural development of projects. The costs directly appropriated from the Federal Treasury are wholly reimbursable without interest in 40 annual payments, and do not include the contribution of labor by WPA forces and CCC enrollees, which are nonreimbursable.

Financial aspects of reclamation.—Until 1933, all Bureau of Reclamation construction except Boulder Dam was financed from the Reclamation Fund set up by the Reclamation Law of 1902. This fund comprised the proceeds from the sale of public lands, oil royalties, and repayments of construction costs, supplemented by occasional loans from the Federal Treasury which have all been repaid. Interest on bonds advanced for irrigation construction was waived in the Reclamation Law of 1902 as a concession to the national interest in the development of the area west of the 100th meridian where the Federal Government retains ownership of more than half of the land area. The interest-free policy has continued with funds subsequently allocated or appropriated from the Federal Treasury for irrigation facilities for large projects, including the Grand Coulee Dam (Columbia Basin Project) in Washington and the Central Valley in California. Interest is computed on the construction investment in power facilities at the rate of 3 percent annually.

The ultimate investment in Bureau of Reclamation projects, completed and under construction on July 1, 1940, is estimated at \$1,350,000,000.¹ Of this amount about \$600,000,000 is yet to be made available. Nearly half of the total investment will be repaid by water users, more than 45 percent by revenues from power and municipal water, and about 5 percent will be charged off to flood control, navigation, and other nonreimbursable activities.

The Reclamation Project Act of 1939 fixes the interest rate at not less than 3 percent on construction costs allocable to power facilities.

Although in times of unusual agricultural distress, as in the early 1930's, The Congress has granted moratoria on repayments to the Reclamation Fund. On July 1, 1940, fully 25 percent of construction costs of projects completed and in operation had been repaid.

Since 1926 the period of repayments of construction costs without interest to the Reclamation Fund has been 40 years. The Reclamation Project Act of 1939 reaffirmed that repayment period and provided for new contracts with a more flexible method of repayment based on varying crop returns with interest on unpaid or deferred balances.

A notable development in the matter of repayment of Reclamation construction costs is the creation of the Northern Colorado Conservancy District to aid in financing the Colorado-Big Thompson Project in Colorado. This project involves the diversion of water from the western portion of the State through the 13-mile Continental Divide Tunnel to supplement the supply for a highly developed irrigated area in the eastern portion. By popular vote the District imposed an ad valorem tax on urban and rural property with its limits, to assure the repayment of approximately one-fourth of the irrigation costs of the project. The remaining three-fourths of the irrigation costs charged to the District will be repaid by water users under the Reclamation Law. The irrigation costs repayable by the District will cover about half of the entire construction costs of the project. Power revenues will repay the remaining one-half of the construction costs.

¹ Projects authorized between January 1, 1940 and June 30, 1942, increase the total acreage to be served by the Bureau when the current program is completed to 5,115,224 acres with a primary supply and 7,116,074 acres with a supplemental supply, a total of 12,231,298 acres. These additional projects and increases in cost estimates place the over-all investment, when the current program of the Bureau of Reclamation is completed, including power facilities for 4,827,162 kilowatts, at \$1,653,607,005. The power facilities include the costs of Boulder Dam, Grand Coulee Dam, and other projects which are linked with irrigation.

GENERAL DISCUSSION

LVII

TABLE A.—SUMMARY OF DATA ON BUREAU OF RECLAMATION PROJECTS¹ IN OPERATION, JANUARY 1, 1940, WITH ESTIMATES OF COSTS REPAYABLE BY PROJECT LAND AND OTHER BENEFICIARIES

STATE	PROJECT LAND (PRIMARY SUPPLY)		OUTSIDE PROJECTS (SUPPLEMENTAL WATER)		CONSTRUCTION COSTS AND OTHER ITEMS REPAYABLE TO DEC. 31, 1939 ²			COSTS NOT REPAYABLE BY PROJECT LANDS			Amount repayable by all benefici- aries	REPAYABLE BY PROJECT LANDS		
	Irri- gated 1939	Works were capable of sup- plying 1940	Irri- gated 1939	Works were capable of sup- plying 1940	Irrigation (primary- supple- mental)	Nonirri- gation (power, drainage, etc.) ³	Total	Authorized charge- offs and other nonreim- bursable items ⁴	Repayable by non- project land, ⁵ power, etc.	Total		Net irrigation costs ⁶	Net drainage costs	Total
	Acres	Acres	Acres	Acres	Dollars	Dollars	Dollars	Dollars	Dollars	Dollars	Dollars	Dollars	Dollars	Dollars
Arizona-----	265,042	297,669	58,044	90,943	39,708,470	11,671,780	51,380,250	2,276,541	29,467,898	31,744,439	49,103,709	18,682,069	953,742	19,635,811
California-----	44,581	60,297	1,709	1,709	5,915,578	798,674	6,714,252	505,052	1,436,063	1,941,095	6,209,220	4,192,485	580,672	4,773,157
Colorado-----	83,137	121,746	13,074	16,356	12,928,239	1,411,577	14,339,816	2,073,165	1,644,315	3,717,480	12,266,651	9,481,970	1,140,366	10,622,336
Idaho-----	344,638	424,840	842,715	973,656	41,868,781	5,037,982	46,906,763	84,681	17,790,281	17,874,962	46,822,082	26,477,464	2,554,337	29,031,801
Montana-----	188,002	323,197			26,607,374	11,630,797	38,238,171	3,210,080	195,000	3,405,080	25,028,091	23,390,433	1,442,658	24,833,091
Nebraska-----	160,799	180,155	96,802	105,966	14,659,810	1,193,750	15,853,560		5,977,168	5,977,168	15,853,560	8,677,129	1,199,265	9,876,394
Nevada-----	57,471	66,788	11,874	41,210	8,838,237	1,460,121	10,298,358	4,437,820	2,867,749	7,305,569	5,860,538	1,857,460	1,135,329	2,992,789
New Mexico-----	98,064	115,695			7,760,844	10,334,649	18,095,493	2,879,007	5,879,445	8,758,452	15,216,468	7,001,827	2,355,214	9,337,041
North Dakota-----	14,131	19,928			1,393,237	176,431	1,569,668	131,162		131,162	1,438,506	1,262,075	176,431	1,438,506
Oregon-----	130,403	175,171	85,042	117,733	27,002,875	1,269,961	28,272,836	895,841	5,041,813	5,937,654	27,376,995	21,251,647	1,083,535	22,335,182
South Dakota-----	34,222	72,504			4,628,868	729,515	5,358,383	379,031		379,031	4,979,352	4,249,837	729,515	4,979,352
Texas-----	61,153	69,010	12,681	17,119	3,147,764	1,622,872	4,770,636	336,554	300,000	636,554	4,434,082	2,511,210	1,622,872	4,134,082
Utah-----	38,623	40,812	161,455	193,021	12,698,755	184,731	12,883,486		10,334,063	10,334,063	12,883,486	2,549,423		2,549,423
Washington-----	167,085	210,512	181,876	188,677	27,675,132	411,684	28,086,816	1,047,651	6,697,881	7,745,532	27,039,165	20,341,284		20,341,284
Wyoming-----	138,653	170,643	15,398	16,321	15,411,395	6,316,293	21,727,688	1,545,129	4,898,087	6,443,216	20,182,559	12,384,482	3,201,890	15,586,472
Totals-----	1,824,004	2,348,967	1,460,470	1,762,721	250,245,359	44,250,817	294,496,176	19,801,694	92,227,761	112,029,455	274,694,482	164,310,795	18,155,926	182,466,721
Less non-Federal expenditures-----												26,580,309		
Net Federal costs-----												248,114,173		

- ¹There are 40 projects mentioned under "Bureau of Reclamation Areas and Investment" in 15 State Reports.
²Other items repayable include operation and maintenance during construction, penalties, etc.
³Power plants are located in the States of Arizona, California, Colorado, Idaho, Nebraska, Nevada, New Mexico, Utah, Washington, and Wyoming.
⁴Principally charge-offs authorized by Act of May 25, 1926.
⁵Average net irrigation costs repayable by project land estimated at \$71 an acre.
⁶Additional areas of 226,381 acres in operating projects, principally in Idaho, Montana, and Wyoming, brings total ultimate area to be served under present plans to 2,574,348 acres.
⁷Primary irrigation costs, \$211,046,133; supplemental, \$39,199,226.
⁸Total power costs estimated at \$28,102,891, including small outlays for miscellaneous purposes; drainage costs, \$18,147,926.
⁹Estimated additional investment to complete projects under present plans is \$12,780,426, bringing total completed cost of 40 operating projects to \$307,276,602.
¹⁰Estimated net power revenues in 40 years, \$50,026,981; amounts repayable by supplemental water, grazing lessors, and other beneficiaries, \$42,200,780, making a total of \$92,227,761 from these sources to be applied to over-all project costs.
¹¹Principal non-Federal outlays in Arizona for power-irrigation facilities; others for irrigation in Idaho, Nevada, Washington, and Wyoming.

TABLE B.—SUMMARY OF STATE DATA ON BUREAU OF RECLAMATION PROJECTS, UNDER CONSTRUCTION OR AUTHORIZED AND IN OPERATION, JANUARY 1, 1940

STATE	ULTIMATE AREA TO BE SERVED		Construction cost to December 31, 1939	Estimated completed cost ¹	ESTIMATED CONSTRUCTION NOT REPAYABLE BY LAND			Estimated costs repayable by land ³
	Primary supply (new land)	Supplemental water ⁴			Nonreimbursable items ²	Net power revenues	Other sources of income	
	Acres	Acres	Dollars	Dollars	Dollars	Dollars	Dollars	Dollars
Projects under construction and authorized: ⁵								
Arizona-----	139,000	11,000	4,430,941	20,500,000	-----	-----	-----	20,500,000
California-----	742,000	2,525,000	56,256,521	293,863,000	12,000,000	108,000,000	853,000	173,010,000
Colorado-----	36,400	1,054,074	5,984,322	76,047,000	8,600,000	29,288,000	-----	38,189,000
Idaho-----	51,400	160,000	3,228,403	21,946,800	5,050,000	3,400,000	-----	13,496,800
Montana-----	12,800	-----	-----	2,010,000	940,000	-----	-----	1,070,000
Nebraska-----	12,000	-----	-----	2,560,000	1,575,000	-----	-----	985,000
New Mexico-----	45,000	-----	180,695	8,155,000	2,500,000	-----	-----	5,655,000
North Dakota-----	18,276	-----	-----	2,090,000	1,210,000	-----	-----	880,000
Oklahoma-----	70,000	-----	47,564	5,600,000	2,520,000	-----	\$1,080,000	2,000,000
Oregon-----	56,000	47,500	512,042	9,430,000	2,000,000	-----	\$500,000	7,430,000
South Dakota-----	-----	12,000	-----	2,470,000	1,490,000	-----	\$9,992,000	480,000
Utah-----	10,000	95,000	3,052,618	15,774,000	-----	-----	-----	5,782,000
Washington-----	1,272,000	-----	111,557,290	412,585,000	-----	288,908,000	-----	113,677,000
Wyoming-----	76,000	-----	20,125,803	28,500,000	-----	17,200,000	-----	9,300,000
Subtotal-----	2,540,876	3,904,574	205,370,789	899,530,000	37,885,000	458,796,000	12,425,000	392,424,800
Major multiple-purpose projects in operation, also under construction, July 1, 1940:								
Arizona-Nevada, Boulder Dam-----	-----	-----	120,923,931	135,000,000	-----	122,500,000	12,500,000	-----
Arizona-California, Boulder Dam (Power) ⁷ -----	-----	-----	2,900,000	12,895,000	-----	12,895,000	-----	-----
Arizona-California, Parker Dam (Power) ⁷ -----	-----	-----	13,306,179	24,991,000	-----	-----	\$24,991,000	-----
Texas, Marshall Ford Dam ⁸ -----	-----	-----	-----	-----	-----	135,395,000	37,491,000	-----
Subtotal-----	-----	-----	137,130,110	172,886,000	-----	-----	-----	-----
Irrigation projects in operation (see table A, footnotes 1, 2, and 4 to 11):								
Subtotal-----	\$2,574,348	1,795,769	\$294,496,176	307,276,602	19,801,694	49,945,865	-----	237,529,043
GRAND TOTAL-----	5,115,224	\$5,700,343	638,997,085	\$1,179,692,602	57,686,694	642,136,865	49,916,000	629,953,843

- ¹Revision upward of construction costs and additional authorizations, January 1, 1940 to July 1942, increase estimates of over-all costs of entire program to \$1,653,607,003.
²Nonreimbursable items include flood control and navigation allocations, contributions of labor by WPA and CCC.
³Includes reimbursable costs to be repaid by water users for primary and supplemental supplies.
⁴In California large areas will receive a substituted water supply or will be benefited by repulsion of salt water.
⁵Includes 18 projects authorized under the Reclamation Law and 6 under water conservation and utilization legislation.
⁶Allocations are for municipal water supplies.
⁷Funds advanced by Metropolitan Water District for construction of Parker Dam estimated at \$6,600,000 not included.
⁸Includes reimbursable costs of Marshall Ford Dam from power revenues to be determined by Secretary of the Interior.
⁹Ultimate acreage planned for operating projects shown in footnote number 5 on table A.
¹⁰Includes \$26,580,309 of non-Federal funds invested in operating projects principally in Arizona.
¹¹From January 1940 and July 1942 additional projects authorized increase ultimate supplemental acreage to 7,116,074 acres, making a total of 12,231,298 acres to be served when current program (1942) is completed.

CENSUS OF IRRIGATION: 1940

TABLE 22.—CENSUS OF AGRICULTURE—MORTGAGE STATUS OF IRRIGATED FARMS OPERATED BY FULL OWNERS AND PART OWNERS—NUMBER, ACREAGE, AND VALUE OF FARMS WITH CROPLAND HARVESTED WHOLLY IRRIGATED, 1940

(For the 17 western States, Arkansas, Louisiana, and Florida from the Census of Agriculture. Cropland harvested relates to calendar year 1939)

TENURE AND MORTGAGE STATUS	FARMS		LAND IN FARMS (ACRES)		Cropland harvested (acres)	VALUE OF LAND AND BUILDINGS (DOLLARS)		
	Number	Percent distrib- ution	Total	Average per farm		Total	Average	
							Per farm	Per acre
REGARDLESS OF ADDITIONAL LAND OWNED								
Full owners, total	138,997	100.0	19,949,715	143.5	4,977,112	1,244,010,936	8,950	62.36
Free from mortgage	64,694	46.5	8,796,122	136.0	1,749,144	474,584,794	7,336	53.95
Mortgaged	67,454	48.5	10,318,577	153.0	3,028,117	717,367,421	10,655	69.52
No mortgage report	6,849	4.9	835,016	121.9	199,851	52,058,721	7,601	82.34
Part owners, total (both owned and rented portions)	26,204	100.0	26,799,747	1,022.7	2,951,131	466,678,535	17,609	17.41
Free from mortgage	9,897	37.8	9,318,420	941.5	825,126	130,546,406	13,191	14.01
Mortgaged	15,324	58.5	16,793,861	1,095.9	2,036,929	322,830,136	21,067	19.22
No mortgage report	983	3.8	867,466	899.4	87,078	13,301,993	13,532	19.35
Owned portion only	26,204	100.0	12,532,897	478.3	(1)	283,065,459	10,039	20.99
Free from mortgage	9,897	37.8	4,110,010	415.3	(1)	69,945,881	7,067	17.02
Mortgaged	15,324	58.5	8,152,531	532.0	(1)	186,442,641	12,167	22.87
No mortgage report	983	5.8	270,356	275.0	(1)	6,676,937	6,792	24.70
NO ADDITIONAL LAND OWNED ²								
Full owners, total	105,183	100.0	14,424,083	137.1	3,501,779	879,980,727	8,366	61.01
Free from mortgage	49,589	47.1	6,502,896	131.2	1,220,122	331,413,088	6,686	50.96
Mortgaged	53,063	50.4	7,579,251	142.8	2,202,938	531,039,285	10,008	70.06
No mortgage report	2,551	2.4	341,936	134.0	78,719	17,528,354	6,871	51.26
Part owners, total (both owned and rented portions)	20,632	100.0	20,225,949	980.3	2,178,315	347,465,581	16,841	17.18
Free from mortgage	7,851	38.1	6,824,019	869.2	610,200	95,598,402	12,177	14.01
Mortgaged	12,773	59.5	13,125,247	1,069.4	1,528,580	246,081,999	20,051	18.75
No mortgage report	508	2.5	276,883	544.7	39,535	5,775,180	11,368	20.67
Owned portion only	20,632	100.0	9,284,154	450.0	(1)	195,576,717	9,479	21.07
Free from mortgage	7,851	38.1	2,929,208	373.1	(1)	50,876,905	6,480	17.37
Mortgaged	12,773	59.5	6,238,776	508.3	(1)	141,865,326	11,559	22.74
No mortgage report	508	2.5	116,172	228.7	(1)	2,834,486	5,580	24.40

¹Not available. ²Differences between these totals and totals for farms regardless of additional land owned do not represent data for operating owners who owned additional land. Some operators did not make a report as to this item.

TABLE 23.—MORTGAGED IRRIGATED FARMS OPERATED BY FULL OWNERS AND PART OWNERS REPORTING AMOUNT OF DEBT—NUMBER, ACREAGE, VALUE, AND AMOUNT OF DEBT FOR FARMS WITH CROPLAND HARVESTED WHOLLY IRRIGATED, 1940

(For the 17 western States, Arkansas, Louisiana, and Florida from the Census of Agriculture. Cropland harvested relates to calendar year 1939)

TENURE (Mortgaged farms reporting amount of debt)	Number of farms	LAND IN FARMS (ACRES)		Cropland harvested (acres)	VALUE OF LAND AND BUILDINGS (DOLLARS)			MORTGAGE DEBT (DOLLARS)			Average equity per farm (dollars)	Ratio of debt to value (per cent)	RATE OF INTEREST ON FIRST MORTGAGE	
		Total	Average per farm		Total	Average		Amount	Average per farm	Average per acre			Farms reporting	Average of the rates
						Per farm	Per acre							
REGARDLESS OF ADDITIONAL LAND OWNED														
Full owners-----	66,631	10,157,517	152.4	2,982,342	709,000,426	10,641	69.80	259,825,785	3,899	25.58	6,741	36.6	65,497	5.4
Part owners:														
Both owned and rented portions-----	15,170	16,530,837	1,089.7	2,018,408	319,116,180	21,036	19.30	(¹)	(¹)	(¹)	(¹)	(¹)	(¹)	(¹)
Owned portion only-----	15,170	8,013,283	528.2	(¹)	184,902,075	12,189	23.07	73,326,985	4,834	9.15	7,355	39.7	14,972	5.4
NO ADDITIONAL LAND OWNED ²														
Full owners-----	52,524	7,465,370	142.1	2,177,979	526,020,224	10,015	70.46	186,011,105	3,732	26.26	6,283	37.3	51,709	5.4
Part owners:														
Both owned and rented portions-----	12,166	12,914,601	1,061.5	1,515,486	244,077,548	20,082	18.90	(¹)	(¹)	(¹)	(¹)	(¹)	(¹)	(¹)
Owned portion only-----	12,166	6,118,037	502.9	(¹)	140,793,776	11,575	23.01	56,569,271	4,650	9.25	6,923	40.2	12,017	5.4

¹Not available. ²Differences between these totals and totals for farms regardless of additional land owned do not represent data for operating owners who owned additional land. Some operators did not make a report as to this item.

TABLE 24.—REAL-ESTATE AND PERSONAL-PROPERTY TAXES LEVIED IN 1939 ON FARMS WITH CROPLAND HARVESTED WHOLLY IRRIGATED, FOR FARMS OF FULL OWNERS AND OF PART OWNERS: CENSUS OF 1940

(For the 17 western States, Arkansas, Louisiana, and Florida from the Census of Agriculture. Number of farms, acreage, and value relate to Apr. 1, 1940; taxes reported are those levied in 1939)

TENURE	Number of specified irrigated farms	SPECIFIED IRRIGATED FARMS REPORTING REAL-ESTATE TAXES										PERSONAL-PROPERTY TAXES		
		Number	Land in farms (acres)		Cropland harvested (acres)	Value of land and buildings (dollars)			Real-estate taxes (dollars)			Farms re- port- ing	Amount (dollars)	Average per farm reporting (dollars)
			Total	Average per farm		Total	Average		Total	Average per acre	Per \$100 of value			
							Per farm	Per acre						
REGARDLESS OF ADDITIONAL LAND OWNED														
All owners-----	165,201	144,505	27,980,803	193.5	7,205,985	1,393,933,358	9,646	49.85	18,230,618	0.65	1.31	92,605	2,713,682	29
Full owners-----	138,997	121,061	16,510,586	136.4	4,483,299	1,149,611,723	9,496	69.63	14,673,038	0.89	1.28	74,412	1,845,665	25
Part owners ¹ -----	26,204	23,444	11,450,017	468.4	2,722,686	244,321,635	10,421	21.34	3,557,580	0.31	1.46	18,193	868,017	46
NO ADDITIONAL LAND OWNED ²														
All owners-----	125,820	111,428	20,410,380	183.2	5,251,331	1,008,694,736	9,052	49.42	12,924,285	0.63	1.28	72,030	1,938,141	27
Full owners-----	105,185	92,570	11,770,463	127.2	3,206,047	824,375,887	8,905	70.04	10,295,523	0.87	1.25	57,486	1,294,921	23
Part owners ¹ -----	20,635	18,858	8,639,917	458.2	2,045,284	184,318,849	9,774	21.33	2,628,762	0.30	1.43	14,544	645,220	44

¹Relates only to property owned by the operator. (See tables above)²Differences between these totals and totals for farms regardless of additional land owned do not represent data for operating owners who owned additional land. Some operators did not make a report as to this item.

GENERAL DISCUSSION

LIX

TABLE 25.—MORTGAGE STATUS OF IRRIGATED FARMS OPERATED BY FULL OWNERS AND BY PART OWNERS—NUMBER, ACREAGE, AND VALUE OF FARMS

WITH CROPLAND HARVESTED WHOLLY IRRIGATED, BY STATES, 1940

(For the 17 western States, Arkansas, Louisiana, and Florida from the Census of Agriculture. Cropland harvested relates to the calendar year 1939)

STATE AND MORTGAGE STATUS	SPECIFIED IRRIGATED FARMS OPERATED BY FULL OWNERS							SPECIFIED IRRIGATED FARMS OPERATED BY PART OWNERS														
	Number	Percent distributed	All land in farms (acres)	Cropland harvested (acres)	Value of land and buildings (dollars)			Number	Percent distributed	All land in farms (acres)	Cropland harvested (acres)	Value of land and buildings (dollars)		Acres	Owned portion							
					Amount	Average per farm	Average per acre					Amount	Average per farm		Value of land and buildings (dollars)	Average per farm	Average per acre					
Total (20 States)	158,997	100.0	19,949,715	4,977,112	1,244,010,856	8,950	62.56	26,204	100.0	28,799,747	2,851,151	466,678,535	17,809	12,532,897	263,065,459	10,039	20.99					
Free from mortgage	84,894	46.5	8,798,122	1,749,144	474,584,794	7,536	53.98	9,897	37.8	9,518,420	825,128	130,548,408	13,191	4,110,010	69,945,881	7,067	17.02					
Mortgaged	67,454	48.5	10,218,577	3,028,117	717,587,421	10,635	69.52	15,324	58.5	16,793,861	2,026,023	322,830,136	21,087	8,162,551	185,442,641	12,187	22.67					
No mortgage report	6,849	4.9	855,016	199,851	52,058,721	7,601	62.54	985	5.8	687,469	87,078	13,501,995	15,532	270,356	6,678,937	6,792	24.70					
Arizona, total	5,980	100.0	1,667,971	146,709	59,219,209	6,580	25.51	1,106	100.0	2,204,010	180,970	52,985,728	29,824	527,108	15,898,430	14,192	23.78					
Free from mortgage	5,635	61.0	1,384,976	52,458	15,546,541	4,224	11.08	391	35.4	1,280,826	32,552	8,489,514	21,712	287,587	5,781,814	9,672	13.15					
Mortgaged	1,797	30.2	248,407	84,953	21,395,352	11,906	86.13	655	59.2	900,089	126,511	24,008,517	36,654	226,875	11,683,279	17,807	51.41					
No mortgage report	530	8.9	34,588	9,320	2,477,516	4,875	71.63	60	5.4	43,145	1,907	488,095	8,155	12,645	251,337	4,189	19.87					
Arkansas, total	90	100.0	25,538	8,413	624,020	6,954	26.74	24	100.0	5,692	2,581	202,620	8,442	5,661	125,642	5,235	35.28					
Free from mortgage	46	51.1	9,556	5,698	218,250	4,745	22.84	15	62.5	3,875	1,579	148,920	9,928	2,337	80,492	6,053	38.72					
Mortgaged	35	38.9	12,435	4,248	361,110	10,317	29.04	9	37.5	1,817	982	55,700	5,967	1,224	35,150	3,906	28.72					
No mortgage report	9	10.0	1,347	469	44,660	4,962	33.16															
California, total	47,189	100.0	2,470,290	1,222,532	656,220,359	13,462	257.55	5,717	100.0	2,158,180	795,598	178,569,069	51,200	897,651	95,458,518	16,344	104.09					
Free from mortgage	19,641	41.8	928,358	406,492	246,171,710	12,534	265.74	1,788	51.2	474,493	146,808	42,210,919	25,654	151,967	20,891,600	11,697	108.63					
Mortgaged	25,110	53.2	1,429,174	765,661	381,114,329	14,381	252.67	3,778	66.1	1,648,184	632,049	131,982,810	34,923	669,799	70,564,498	18,712	102.49					
No mortgage report	2,458	5.2	114,758	52,379	28,934,300	11,868	252.13	153	2.7	55,503	14,943	4,189,340	27,421	15,665	1,850,420	12,094	116.64					
Colorado, total	12,286	100.0	2,623,546	680,268	67,905,877	7,147	33.47	2,988	100.0	3,588,885	352,274	58,719,293	12,958	1,528,154	25,027,731	7,707	15.07					
Free from mortgage	5,471	44.5	997,188	250,907	32,697,604	5,977	33.12	1,101	36.8	1,171,453	108,514	11,854,519	10,767	511,959	6,745,586	6,127	13.18					
Mortgaged	6,276	51.1	1,504,825	423,442	31,870,618	8,233	34.34	1,757	56.8	2,007,081	225,525	25,205,684	14,346	960,985	15,478,551	8,810	16.11					
No mortgage report	539	4.4	131,535	25,919	5,437,655	6,378	261.13	180	4.4	210,341	18,255	1,659,090	12,768	55,210	803,794	6,183	14.56					
Florida, total	1,738	100.0	95,792	38,627	22,476,108	12,332	234.63	133	100.0	75,098	6,686	2,999,141	22,550	28,143	1,814,998	13,647	64.49					
Free from mortgage	1,030	59.3	45,182	22,311	11,598,266	11,064	252.23	48	36.1	50,476	2,851	1,036,795	21,600	20,908	651,899	13,165	50.22					
Mortgaged	615	35.3	47,611	14,331	10,126,407	16,513	212.61	79	59.4	24,446	5,896	1,882,756	23,882	7,139	1,135,074	14,368	159.00					
No mortgage report	95	5.5	2,999	2,085	957,435	10,078	319.25	6	4.5	174	139	79,590	13,265	96	48,023	8,004	500.24					
Idaho, total	13,973	100.0	1,634,050	655,432	96,951,986	8,939	59.33	2,850	100.0	1,027,317	237,969	30,545,111	11,526	535,889	18,224,884	6,877	34.01					
Free from mortgage	5,007	35.8	537,899	184,623	28,556,695	5,989	53.05	741	26.0	309,872	58,555	7,099,333	9,581	163,577	3,945,485	5,325	24.12					
Mortgaged	8,296	59.4	1,015,411	439,741	64,594,527	7,762	65.42	1,784	67.3	657,994	167,694	21,940,427	12,298	340,302	13,372,333	7,498	29.30					
No mortgage report	670	4.8	80,740	31,068	4,020,966	6,001	49.80	125	4.7	59,451	11,720	1,506,351	12,043	32,010	907,086	7,257	28.34					
Kansas, total	244	100.0	46,725	9,571	1,992,693	8,167	42.65	96	100.0	49,888	9,916	1,394,790	14,233	22,619	715,951	7,285	51.56					
Free from mortgage	91	37.3	15,262	3,175	627,520	6,896	41.12	19	19.4	9,064	1,487	225,455	11,886	3,592	132,965	6,988	37.01					
Mortgaged	134	54.9	28,065	5,414	1,203,623	8,962	42.89	76	77.6	39,970	8,350	1,149,555	15,125	18,949	578,536	7,612	50.69					
No mortgage report	19	7.8	3,398	982	161,540	8,502	47.54	3	3.1	824	79	19,800	6,600	178	2,440	813	13.71					
Louisiana, total	855	100.0	105,997	38,554	4,766,399	7,277	44.97	295	100.0	100,118	42,269	4,221,513	14,510	45,607	2,266,799	7,691	49.53					
Free from mortgage	344	52.5	50,652	17,080	2,341,899	6,808	46.25	147	49.8	31,841	16,345	1,450,344	9,866	13,755	727,281	4,948	62.86					
Mortgaged	241	28.6	46,823	17,678	2,073,750	8,605	44.86	138	46.8	67,405	25,411	2,740,036	19,855	31,822	1,535,597	11,118	48.19					
No mortgage report	70	10.7	9,140	3,996	350,750	5,011	38.38	10	3.4	874	513	31,133	3,113	232	7,911	791	54.10					
Montana, total	5,222	100.0	1,618,506	566,587	37,615,089	7,205	23.24	1,772	100.0	4,377,729	324,075	30,265,042	17,078	1,984,961	20,456,075	11,533	10.40					
Free from mortgage	2,522	44.5	718,542	135,547	14,232,103	6,129	18.78	647	36.5	1,372,859	101,714	9,587,065	14,787	655,517	6,806,007	10,519	10.42					
Mortgaged	2,695	49.7	825,728	210,145	21,591,545	8,289	26.15	1,054	59.5	2,905,227	213,020	19,789,385	18,785	1,274,874	13,187,536	12,464	10.30					
No mortgage report	305	5.8	73,238	16,094	1,781,441	5,874	24.46	71	4.0	95,673	9,339	896,582	12,628	56,770	492,532	6,937	13.59					
Nebraska, total	874	100.0	165,811	62,144	6,877,741	9,929	52.34	298	100.0	184,756	38,091	4,670,969	15,874	109,419	2,741,540	9,200	25.06					
Free from mortgage	331	37.9	58,131	19,972	2,928,848	8,848	50.38	94	31.5	49,592	11,567	1,342,190	14,279	27,219	878,649	7,220	24.93					
Mortgaged	515	58.9	100,719	40,450	5,509,018	10,687	54.70	189	65.4	132,885	25,868	3,213,454	17,002	81,258	2,010,856	10,640	24.75					
No mortgage report	28	3.2	6,961	1,722	239,875	8,367	34.46	15	5.0	2,921	1,138	115,532	7,668	942	51,955	3,464	55.15					
Nevada, total	2,145	100.0	1,272,066	241,412	24,790,663	11,557	18.49	279	100.0	521,409	55,744	5,578,587	19,995	282,581	3,428,332	12,288	12.14					
Free from mortgage	1,181	55.1	615,278	100,592	10,022,478	8,496	16.29	140	50.2	265,609	19,475	2,573,075	18,739	101,074	1,542,439	9,589	13.28					
Mortgaged	612	28.6	635,719	132,781	13,868,657	17,104	21.85	125	44.8	258,584	35,380	2,804,612	23,157	180,110	2,059,941	16,480	11.44					
No mortgage report	152	7.1	21,069	6,239	879,528	5,786	41.75	14	5.0	3,242	889	110,900	7,921	1,197	25,960	1,854	21.69					
New Mexico, total	10,179	100.0	1,255,984	189,196	56,227,860	3,559	28.84	1,658	100.0	2,035,154	72,900	15,871,665	9,690	780,688	8,516,438	5,077	10.85					
Free from mortgage	7,951	77.9	784,423	97,153	18,989,126	2,594	24.21	1,110	67.8	1,016,167	29,760	6,454,108	5,756	410,566	3,448,410	3,307	8.40					
Mortgaged	1,692	16.6	440,707	84,439	15,841,672	9,422	36.17	489	28.6	959,105	40,487	8,958,379	19,058	354,251	4,637,908	9,689	13.09					
No mortgage report	556	5.5	30,854	7,624	1,297,062	2,333	42.04	59	3.6	57,882	2,673	499,160	8,461	15,871	230,122	3,900	14.50					
North Dakota, total	84	100.0	16,110	5,737	769,200	9,157	47.75	14	100.0	5,443	1,254	132,720	9,460	1,580	85,060	6,078	54.53					
Free from mortgage	43	51.2	11,412	2,707	374,160	6,701	32.79	10	71.4	2,786	789	91,620	9,162	1,143	57,970	5,797	50.72					
Mortgaged	39	46.4	4,585	2,981	389,790	9,995	85.05	4	28.6	657	445	41,100	10,275	417	27,090	6,772	84.96					
No mortgage report	2	2.4	115	39	5,250	2,625	45.65															
Oklahoma, total	55	100.0	1,505	193	228,720	6,535	151.97	3	100.0	28,862	537	100,070	16,678	17,202	76,092	12,682	4.42					
Free from mortgage	15	37.1	689	56	70,280	5,406	105.05															

CENSUS OF IRRIGATION: 1940

TABLE 26.—MORTGAGED IRRIGATED FARMS OPERATED BY FULL OWNERS REPORTING AMOUNT OF DEBT—NUMBER, ACREAGE, VALUE, AND AMOUNT OF DEBT FOR FARMS WITH CROPLAND HARVESTED WHOLLY IRRIGATED, BY STATES, 1940

(For the 17 Western States, Arkansas, Louisiana, and Florida from the Census of Agriculture)

STATE	SPECIFIED IRRIGATED FARMS OPERATED BY FULL OWNERS REPORTING AMOUNT OF DEBT							SPECIFIED IRRIGATED FARMS OPERATED BY FULL OWNERS OWNING NO ADDITIONAL LAND ¹ AND REPORTING AMOUNT OF DEBT							No report as to other land owned (number)	RATE OF INTEREST ON FIRST MORTGAGE DEBT	
	Number	Land in farms (acres)	Value of land and buildings (dollars)	Mortgage debt (dollars)		Average equity per farm (dollars)	Ratio of debt to value (percent)	Number	Land in farms (acres)	Value of land and buildings (dollars)	Mortgage debt (dollars)		Average equity per farm (dollars)	Ratio of debt to value (percent)		Farms reporting	Average of the interest rates
				Amount	Average per farm						Amount	Average per farm					
Total (20 States)	66,631	10,157,517	709,000,426	259,825,785	5,899	6,741	36.6	52,524	7,465,370	528,020,224	196,011,105	3,732	6,283	37.3	6,745	65,497	5.4
Arizona	1,772	245,832	21,235,548	7,139,561	4,029	7,954	33.6	1,374	138,350	15,426,234	5,497,606	4,001	7,226	35.6	158	1,736	5.3
Arkansas	55	12,435	361,110	137,995	3,945	6,375	38.2	23	6,237	253,050	88,180	3,854	7,168	34.8	3	35	5.7
California	24,826	1,403,652	556,791,052	128,054,826	5,077	9,295	35.3	19,979	1,053,024	266,446,780	95,280,574	4,769	8,567	35.8	2,219	24,357	5.4
Colorado	6,208	1,481,264	51,128,588	21,721,546	3,499	4,737	42.5	4,711	1,028,268	36,573,396	15,597,471	3,311	4,455	42.6	740	6,111	5.6
Florida	602	47,335	9,973,957	3,073,486	5,105	11,463	30.8	410	37,041	6,534,047	2,273,059	5,544	10,393	34.8	44	594	5.3
Idaho	8,208	993,909	65,395,855	25,940,145	3,148	4,578	40.8	5,899	645,725	43,437,081	16,074,703	3,064	4,299	41.6	1,388	8,065	5.2
Kansas	131	27,887	1,192,423	422,355	3,224	5,878	35.4	69	12,622	621,185	206,527	2,993	6,010	35.2	33	128	5.5
Louisiana	237	45,211	2,051,560	793,374	3,348	5,224	39.1	118	20,018	870,555	377,827	3,202	4,176	43.4	26	256	5.9
Montana	2,569	816,264	21,568,250	8,516,740	3,315	5,001	39.9	2,046	647,588	16,541,214	6,805,953	3,228	4,857	39.9	270	2,548	5.3
Nebraska	512	100,294	5,478,018	2,012,807	3,931	6,768	36.7	372	67,209	3,797,458	1,410,966	3,793	6,415	37.2	33	507	5.1
Nevada	794	613,765	13,629,650	5,298,293	6,675	10,493	38.9	627	392,431	9,798,796	3,939,264	6,283	9,345	40.2	70	785	5.3
New Mexico	1,651	438,782	15,822,587	4,466,333	2,705	6,878	28.2	1,218	231,197	10,581,422	3,119,548	2,561	6,128	29.5	207	1,599	5.4
North Dakota	39	4,583	589,790	104,587	2,681	7,313	26.8	33	4,029	290,390	66,187	2,005	6,795	22.8	1	39	5.3
Oklahoma	18	618	146,290	59,994	3,333	4,905	40.5	11	764	91,240	37,285	3,390	4,905	40.9	1	18	6.1
Oregon	3,786	965,602	30,285,251	10,375,193	2,740	5,259	34.3	3,037	770,282	23,327,358	8,198,018	2,699	4,982	35.1	321	3,737	5.5
South Dakota	70	25,371	539,080	208,385	2,977	4,724	36.7	60	22,885	451,020	167,588	2,793	4,724	37.2	3	69	5.1
Texas	1,498	774,164	25,247,253	6,796,212	4,537	10,982	29.2	1,146	624,927	15,615,513	4,981,588	4,347	9,279	31.9	96	1,472	5.4
Utah	6,278	836,149	38,310,885	15,772,888	2,512	3,590	41.2	4,982	635,467	29,850,965	12,252,631	2,459	3,532	41.0	615	6,187	5.4
Washington	5,399	256,675	34,562,980	13,940,956	2,592	3,820	40.3	4,811	217,851	30,017,543	12,188,111	2,533	3,706	40.6	108	5,315	5.5
Wyoming	1,998	1,067,349	19,112,439	7,110,333	3,559	6,007	37.2	1,598	906,914	15,494,977	5,650,039	3,536	6,161	36.5	209	1,979	5.4

¹Differences between these totals and totals for farms regardless of additional land owned do not represent data for operating owners who owned additional land. Some operators did not make a report as to this item.

TABLE 27.—MORTGAGED IRRIGATED FARMS OPERATED BY PART OWNERS REPORTING AMOUNT OF DEBT—NUMBER, ACREAGE, VALUE, AND AMOUNT OF DEBT FOR FARMS WITH CROPLAND HARVESTED WHOLLY IRRIGATED, BY STATES: 1940

(For the 17 Western States, Arkansas, Louisiana, and Florida from the Census of Agriculture)

STATE	SPECIFIED IRRIGATED FARMS OPERATED BY PART OWNERS REPORTING AMOUNT OF DEBT						SPECIFIED IRRIGATED FARMS OPERATED BY PART OWNERS OWNING NO ADDITIONAL LAND ¹ AND REPORTING AMOUNT OF DEBT						No report as to other land owned (num-ber)	RATE OF INTER-EST ON FIRST MORTGAGE DEBT			
	Number	Land in farms (acres)	Value of land and buildings (dollars)	Owned portion		Ratio of debt to value (per-cent)	Number	Land in farms (acres)	Value of land and buildings (dollars)	Owned portion		Ratio of debt to value (per-cent)		Farms re- port- ing	Aver- age of the inter-est rates		
				Mortgage debt (dollars)	Average equity per farm (dol- lars)					Mortgage debt (dollars)	Average equity per farm (dol- lars)						
				Amount	Average per farm					Amount	Average per farm						
Total (20 States)	15,170	8,013,283	184,902,075	73,328,985	4,834	7,355	39.7	12,166	6,118,037	140,793,776	56,569,271	4,650	6,923	40.2	1,326	14,972	5.4
Arizona	647	223,020	11,481,109	4,521,440	6,679	11,035	37.7	519	188,025	8,702,490	3,255,843	6,273	10,495	37.4	49	636	5.3
Arkansas	9	1,224	35,150	14,250	1,585	2,322	40.5	5	664	21,600	9,900	1,980	2,340	45.8	3	9	6.2
California	3,745	680,705	70,220,818	26,356,977	7,006	11,745	37.4	3,100	465,525	52,807,048	20,289,310	8,548	10,466	36.4	249	3,694	5.3
Colorado	1,739	956,518	15,532,352	6,846,857	3,937	4,908	44.5	1,351	674,986	11,230,017	5,095,951	3,772	4,540	45.4	165	1,724	5.6
Florida	79	7,159	1,135,074	427,699	5,414	8,954	37.7	55	5,779	695,644	298,884	5,434	7,177	43.1	6	77	5.7
Idaho	1,771	539,541	13,320,765	6,025,765	3,402	4,119	45.2	1,335	244,596	9,679,884	4,392,886	3,291	3,960	45.4	245	1,736	5.2
Kansas	75	18,858	575,936	258,680	3,449	4,250	44.9	51	11,913	423,330	181,880	3,566	4,734	43.0	14	75	5.3
Louisiana	156	31,661	1,527,447	704,946	5,183	6,048	46.2	80	17,127	759,042	372,342	4,654	4,584	50.4	11	134	6.8
Montana	1,047	1,268,753	13,042,658	5,471,973	5,226	7,231	42.0	830	1,012,968	10,216,445	4,329,696	5,217	7,092	42.4	87	1,040	5.3
Nebraska	187	77,508	1,955,856	748,305	4,002	6,458	36.3	150	68,947	1,532,764	587,180	3,914	6,437	37.8	16	182	5.1
Nevada	119	171,220	2,014,798	806,885	6,780	10,151	40.0	89	48,165	1,827,396	558,716	6,278	8,837	42.1	11	119	5.1
New Mexico	467	354,184	4,635,018	1,572,689	3,380	6,540	34.1	365	277,882	3,430,663	1,246,173	3,414	5,985	36.3	53	460	5.5
North Dakota	4	417	27,090	7,532	1,866	4,890	27.8	2	417	27,090	7,532	1,866	4,890	27.8	4	4	5.5
Oklahoma	3	8,950	64,750	28,000	9,333	12,250	43.2	2	7,700	39,150	20,000	10,000	9,975	51.1	3	4	4.7
Oregon	706	620,497	7,758,414	3,200,275	4,535	6,456	41.2	580	522,345	6,105,512	2,551,826	4,400	6,127	41.8	46	700	5.4
South Dakota	54	41,224	526,957	190,048	3,519	6,239	36.1	49	39,001	509,507	175,290	3,577	6,817	34.4	3	55	5.1
Texas	729	690,661	9,952,242	3,279,342	4,498	9,133	33.0	574	584,536	8,191,288	2,583,529	4,501	9,770	31.5	49	717	5.6
Utah	1,692	485,358	10,552,624	4,632,874	2,596	3,072	45.8	1,526	351,327	8,504,004	3,626,412	2,507	5,065	45.0	230	1,842	5.5
Washington	851	112,150	6,006,683	2,474,586	2,908	4,151	41.2	750	72,249	4,913,656	2,071,421	2,762	5,780	42.2	14	842	5.5
Wyoming	940	1,953,687	14,708,458	5,871,884	6,247	9,401	39.9	751	1,523,869	11,679,446	4,704,320	6,264	9,288	40.3	75	925	5.4

¹Differences between these totals and totals for farms regardless of additional land owned do not represent data for operating owners who owned additional land. Some operators did not make a report as to this item.

GENERAL DISCUSSION

LXI

TABLE 28.—FARM TAXES FOR IRRIGATED FARMS OPERATED BY OWNERS—TAXES ON FARM PROPERTY OF OWNER OPERATORS FOR FARMS WITH CROPLAND HARVESTED WHOLLY IRRIGATED, BY STATES, 1939

(For the 17 western States, Arkansas, Louisiana, and Florida from the Census of Agriculture. Number of farms, acreage, and value relate to Apr. 1, 1940; taxes reported are those levied in 1939)

STATE AND TENURE	SPECIFIED IRRIGATED FARMS OPERATED BY OWNERS						SPECIFIED IRRIGATED FARMS OPERATED BY OWNERS OWNING NO ADDITIONAL LAND ¹						TAXES ON PERSONAL PROPERTY ² ON FARMS				
	Reporting real-estate taxes					Total number	Reporting real-estate taxes					Real-estate taxes ² (dollars)			Average per farm re- port- ing		
	Total number	Number	Land in farms ² (acres)	Cropland har- vested (acres)	Value of land and buildings ² (dollars)		Number	Land in farms ² (acres)	Cropland har- vested (acres)	Value of land and buildings ² (dollars)		Amount	Average per acre	Per \$100 of value			
Total (20 States)	165,201	144,505	27,960,803	7,205,985	1,393,933,558	125,820	111,428	20,410,580	5,251,331	1,006,694,736	12,924,285	0.63	1.26	92,605	2,713,682	29	
Owners-----	158,997	121,061	16,510,568	4,483,299	1,149,611,723	105,185	92,570	11,770,465	3,206,047	824,375,887	10,295,523	0.87	1.25	74,412	1,945,665	25	
Full owners-----	26,204	23,444	11,450,017	2,722,686	244,321,835	20,655	18,658	8,639,917	2,045,284	184,318,849	2,628,782	0.50	1.43	18,193	868,011	48	
Part owners-----																	
Arizona:																	
Owners-----	7,066	3,811	864,221	259,692	44,831,140	5,598	2,970	841,820	187,755	33,278,466	545,389	0.65	1.64	2,805	155,311	46	
Full owners-----	5,960	2,925	401,857	114,469	30,805,028	4,755	2,268	266,846	84,729	22,798,474	348,089	1.30	1.53	2,073	74,741	36	
Part owners-----	1,106	886	462,364	145,223	14,026,112	853	702	374,974	103,008	10,480,012	197,303	0.55	1.68	732	80,570	85	
Arkansas:																	
Owners-----	114	104	25,052	10,445	698,050	72	66	15,096	6,021	431,500	3,315	0.22	0.77	92	1,658	16	
Full owners-----	90	83	21,625	7,935	578,020	59	54	13,215	4,619	369,800	2,913	0.22	0.79	75	1,421	19	
Part owners-----	24	21	3,427	2,510	120,030	13	12	1,885	1,402	61,700	402	0.21	0.65	17	237	14	
California:																	
Owners-----	52,908	49,240	3,111,680	1,897,029	689,859,658	40,324	38,062	2,262,480	1,402,076	496,926,981	6,107,203	2.70	1.23	28,334	650,436	25	
Full owners-----	47,189	43,861	2,263,355	1,156,080	600,430,874	35,701	33,728	1,673,810	832,772	430,576,700	5,249,844	3.14	1.22	24,437	489,341	20	
Part owners-----	5,719	5,379	848,325	760,949	89,428,784	4,623	4,364	588,670	569,304	66,350,281	857,359	1.46	1.29	3,897	161,095	41	
Colorado:																	
Owners-----	15,274	14,164	3,799,985	935,760	103,606,877	11,202	10,566	2,562,411	655,662	72,275,208	1,214,353	0.47	1.68	9,706	405,449	42	
Full owners-----	12,266	11,411	2,405,488	657,069	82,261,695	8,918	8,419	1,607,049	419,502	56,791,847	917,807	0.57	1.62	7,443	272,176	37	
Part owners-----	2,988	2,773	1,394,515	326,691	21,344,782	2,284	2,147	955,362	236,160	15,483,361	296,546	0.51	1.92	2,263	133,273	59	
Florida:																	
Owners-----	1,671	1,669	111,671	40,460	21,844,811	1,152	1,041	58,972	21,269	12,839,776	98,940	1.66	0.77	321	7,955	25	
Full owners-----	1,738	1,551	84,246	34,353	20,184,358	1,068	963	52,189	17,943	11,899,347	69,169	1.71	0.75	265	6,422	24	
Part owners-----	133	118	27,625	6,107	1,660,473	84	78	6,783	3,326	940,429	9,761	1.44	1.04	56	1,533	27	
Idaho:																	
Owners-----	16,623	14,822	1,940,104	798,092	104,682,731	11,501	10,454	1,294,880	535,904	70,320,242	1,087,671	0.84	1.55	9,909	250,674	25	
Full owners-----	13,973	12,447	1,456,104	584,325	88,277,723	9,571	8,684	941,194	384,188	58,594,527	877,281	0.93	1.50	8,140	195,376	24	
Part owners-----	2,650	2,375	484,000	213,767	16,605,008	1,930	1,770	353,686	151,718	11,725,715	210,390	0.59	1.79	1,769	55,498	31	
Kansas:																	
Owners-----	342	314	57,163	18,307	2,445,274	197	183	35,081	10,650	1,408,130	17,268	0.49	1.23	241	6,575	27	
Full owners-----	244	221	35,632	8,463	1,743,083	131	120	20,907	3,636	869,745	11,068	0.53	1.24	184	4,697	27	
Part owners-----	98	93	21,531	9,844	702,191	66	63	14,174	7,014	538,385	6,200	0.44	1.20	57	1,678	29	
Louisiana:																	
Owners-----	950	410	103,127	50,257	4,713,361	511	202	54,046	26,465	2,255,297	33,126	0.61	1.47	39	1,181	30	
Full owners-----	655	257	68,773	23,224	3,030,594	329	111	35,068	10,057	1,381,875	20,635	0.59	1.49	15	457	30	
Part owners-----	295	153	34,354	27,033	1,682,767	182	91	18,978	16,400	873,422	12,491	0.66	1.43	24	724	30	
Montana:																	
Owners-----	6,994	6,254	3,222,340	624,720	52,678,285	5,252	4,853	2,558,135	478,193	40,163,814	535,251	0.21	1.33	5,407	225,722	42	
Full owners-----	5,222	4,674	1,467,479	327,392	34,052,399	3,696	3,616	1,129,749	249,772	25,658,096	323,683	0.29	1.26	3,987	121,549	30	
Part owners-----	1,772	1,580	1,754,861	297,328	18,625,886	1,556	1,237	1,408,386	228,421	14,505,718	211,568	0.15	1.46	1,420	104,173	73	
Nebraska:																	
Owners-----	1,172	1,125	267,505	96,961	11,100,464	649	612	195,291	68,992	7,561,296	95,193	0.49	1.26	1,133	40,949	36	
Full owners-----	874	843	159,131	60,022	8,415,056	610	588	101,430	40,080	5,433,594	65,782	0.65	1.21	859	27,397	33	
Part owners-----	298	282	108,374	36,939	2,685,408	239	224	93,861	28,912	2,127,702	29,411	0.51	1.58	294	13,552	46	
Nevada:																	
Owners-----	2,424	1,894	1,374,687	257,167	24,951,577	1,919	1,504	893,905	174,549	18,671,051	256,011	0.26	1.26	1,742	128,372	74	
Full owners-----	2,145	1,646	1,097,035	203,971	21,643,999	1,703	1,310	784,668	142,708	16,316,388	197,671	0.25	1.21	1,507	101,795	68	
Part owners-----	279	248	277,652	53,196	3,307,578	216	194	109,234	31,841	2,354,663	58,340	0.55	1.63	235	26,577	118	
New Mexico:																	
Owners-----	11,817	7,613	1,562,897	213,165	36,795,638	9,615	6,059	1,060,006	150,932	25,536,069	245,696	0.23	0.96	4,071	76,649	19	
Full owners-----	10,179	6,308	828,218	148,699	29,241,598	8,277	4,988	525,454	100,629	20,018,854	185,052	0.35	0.92	3,289	51,695	16	
Part owners-----	1,638	1,305	734,679	64,466	7,554,040	1,338	1,073	534,552	50,303	5,519,215	60,644	0.11	1.10	782	24,954	32	
North Dakota:																	
Owners-----	98	92	17,031	6,672	822,060	85	79	15,514	5,956	673,710	4,259	0.27	0.63	96	2,280	24	
Full owners-----	84	79	15,551	5,646	741,200	72	67	14,051	4,731	593,550	3,633	0.26	0.61	82	2,012	25	
Part owners-----	14	13	1,480	1,026	80,860	13	12	1,463	1,225	80,160	626	0.43	0.78	14	268	19	
Oklahoma:																	
Owners-----	41	34	18,661	712	283,162	2,855	26	23	17,279	518	177,470	1,630	0.09	0.92	23	369	16
Full owners-----	35	28	1,479	175	207,070	1,969	22	19	1,599	156	127,020	1,151	0.62	0.81	18	258	13
Part owners-----	6	6	17,202	537	76,092	866	4	4	15,680	362	50,450	479	0.05	0.95	5	131	26
Oregon:																	
Owners-----	8,557	7,810	2,542,058	410,201	57,385,536	6,839	6,111	1,916,551	298,687	42,709,293	588,053	0.31	1.38	5,445	173,029	32	
Full owners-----	7,377	6,712	1,487,490	265,804	45,954,592	5,883	5,218	1,101,110	194,798	34,066,244	449,303	0.41	1.32	4,491	113,373	25	
Part owners-----	1,180	1,098	1,054,568	144,397	11,430,944	956	893	815,441	104,089	8,643,049	138,750	0.17	1.61	954	59,656	65	
South Dakota:																	
Owners-----	266	251	105,691	17,106	1,752,812	215	206	96,790	14,619	1,460,192	28,292	0.29	1.94	252	11,242	45	
Full owners-----	146	135	41,812	6,678	866,140	107	101	36,922	5,241	663,870	12,713	0.34	1.81	133	4,475	54	
Part owners-----	120	116	63,879	10,428	886,672	108	105	59,868	9,378	796,322	15,579	0.26	1.96	119	6,767	37	
Texas:																	
Owners-----	8,192	5,600	2,136,878	255,406	54,240,403	4,450	4,090	1,421,815	174,071	36,430,488	354,262	0.25	0.97	2,351	59,003	25	
Full owners-----	4,457	4,037	1,296,251	119,178	39,964,599	3,103	2,873	748,208	78,631	25,335,814	245,906	0.53	0.97	1,564	35,760	23	
Part owners-----	1,735	1,563	840,627	136,230	14,275,805	1,347	1,217	673,607	95,440	11,094,674	108,356	0.16	0.98	787	23,243	30	
Utah:																	

Irrigation Census by Drainage Basins

The special Irrigation Census of 1902 presented the first list of major and tributary drainage basins used for Census purposes. For the Census of 1940, the number of tributary drainage basins was greatly increased and for the first time specific boundary lines for drainage basins were determined and delineated on maps to define more clearly the drainage basins used as unit areas for the Census of Irrigation.

The boundaries shown on the maps follow natural divides between stream systems as closely as could be determined from available topographical maps and other sources. However, where valley lands of tributary streams approach similar lands of the arterial stream, it often became necessary to select more or less arbitrary locations for boundaries, although in each case the boundaries of a given basin were located, as far as possible, to include irrigation projects and areas irrigated from water originating within that basin. It is realized that in many instances, with adequate field studies, more exact and desirable boundaries could be established and some of the drainage basins listed might be replaced by more important ones. It would also add to the usefulness of Census data if the larger drainage basins or divisions thereof, used in the Census of Irrigation, could be closely harmonized with the sections of major basins used as units for the measurement of stream flow, administration of water, and for water and land conservation planning.

The summary drainage basin tables in section C of this volume do not show all individual basins mapped or for which statistics are tabulated in the State reports reprinted in section D.

The summary tables do, however, show interstate drainage basins. The drainage basins not named in these tables represent intra-state tributary drainage basins, the statistics for which are totaled in groups by States, and the groups in turn are listed in their proper positions within the major basins.

The 17 western States and Arkansas and Louisiana extend into and are a part or all of 12 major basins and arbitrary groups of basins designated as, Red River of the North (I) (Lake Winnipeg Basin, Canada); Missouri River (II); Mississippi River, exclusive of Missouri River (III); Gulf of Mexico streams, other than Mississippi River and Rio Grande (IV); Rio Grande (V); Colorado River (VI); Gulf of California (Mexico), exclusive of Colorado River (VII), Whitewater Draw (I) and Vamori Wash (2); Great Basin (VIII); Columbia River (IX); Klamath River (X); Pacific Ocean Streams, excluding Gulf of California streams and Columbia and Klamath Rivers (XI); and Sacramento-San Joaquin Delta and tributary streams (XII). These principal drainage basins are divided into secondary and minor tributary basins as shown in the drainage basin tables of the State reports, the map lists, and the following master list. The master list gives names of the drainage basins which reported irrigated lands in 1939, while the lists attached to the State and composite maps show all basins mapped regardless of irrigated acreage. The numbers in parentheses (), following each basin and State name, are index numbers of basins as delineated on the State maps. The numbers and letters shown in column 2 of the master list are for drainage basins on the composite map. Basins for the State of Florida are shown at the end of the list.

NAMES OF DRAINAGE BASINS WITH INDEX NUMBERS

(For the 17 western States and Arkansas, Louisiana, and Florida. State and composite maps, "Irrigation—by Drainage Basins—1939," available from the Superintendent of Documents, Washington, D. C.)

NAME OF DRAINAGE BASIN AND INDEX NUMBERS FOR STATE MAPS AND STATE BASIN TABLES	Index numbers for composite map and summary tables	NAME OF DRAINAGE BASIN AND INDEX NUMBERS FOR STATE MAPS AND STATE BASIN TABLES	Index numbers for composite map and summary tables	NAME OF DRAINAGE BASIN AND INDEX NUMBERS FOR STATE MAPS AND STATE BASIN TABLES	Index numbers for composite map and summary tables
Lake Winnipeg Basin (Canada):		Missouri River—Continued		Missouri River—Continued	
Red River (of the North)—N. Dak. (1)-----	I	Yellowstone River—Continued		Big Sioux River—S. Dak. (5)-----	56
Souris River—N. Dak. (2)-----	1	Big Horn River—Continued		Platte River direct—Nebr. (8)-----	II-B
Missouri River Direct—Mont. (1); N. Dak. (4); S. Dak. (5); Nebr. (1); Kans. (1)-----	II	Nowood Creek—Wyo. (19)-----	14	North Platte River direct—Colo. (6);	
Jefferson River direct—Mont. (2)-----	1	Graybull River—Wyo. (15)-----	15	Wyo. (52); Nebr. (4)-----	II-Ba
Beaverhead River direct—Mont. (5)-----	2	Shell Creek—Wyo. (74)-----	16	Beaver Creek—Wyo. (62)-----	1
Blacktail Deer Creek—Mont. (4)-----	3	Shoshone River—Sage Creek—Wyo. (11);		Encampment Creek—Colo. (83);	2
Ruby River—Mont. (5)-----	4	Mont. (42)-----	17	Wyo. (81)-----	2
Big Hole River—Mont. (6)-----	5	Little Horn River—Wyo. (9);		Spring Creek—Wyo. (60)-----	3
Boulder River—Mont. (7)-----	6	Mont. (45)-----	18	Pass Creek—Wyo. (56)-----	4
Madison River—Mont. (8); Wyo. (77)-----	7	Rosebud Creek—Mont. (44)-----	19	Medicine Bow River direct—Wyo. (51)-----	5
Gallatin River—Mont. (9); Wyo. (78)-----	8	Tongue River direct—Wyo. (6);		Rock Creek—Wyo. (71)-----	6
Smith River—Mont. (10)-----	9	Mont. (45)-----	20	Little Medicine Bow River direct—	
San River—Mont. (11)-----	10	Goose Creek—Wyo. (8)-----	21	Wyo. (75)-----	7
Belt River—Mont. (12)-----	11	Powder River direct—Wyo. (5);		Sheep Creek—Wyo. (72)-----	8
Marias River direct—Mont. (18)-----	12	Mont. (46)-----	22	Muddy Creek—Wyo. (68)-----	9
Teton River—Mont. (14)-----	13	South Fork—Wyo. (24)-----	23	Great Divide—Wyo. (50)-----	10
Arrow River—Mont. (15)-----	14	Middle Fork—Wyo. (22)-----	24	Sweetwater River—Wyo. (58)-----	11
Judith River—Mont. (16)-----	15	Crazy Woman Creek—Wyo. (20)-----	25	Boxelder Creek—Wyo. (57)-----	12
Dog Creek—Mont. (17)-----	16	Clear Creek—Wyo. (7)-----	26	La Poudre Creek—Wyo. (56)-----	13
Musselshell River direct—Mont. (18)-----	17	Little Powder River—Wyo. (4);		La Bonte Creek—Wyo. (55)-----	14
Boxelder and Flat Willow Creeks—		Mont. (47)-----	27	Laramie River direct—Colo. (5);	
Mont. (19)-----	18	O'Fallon Creek—Mont. (48)-----	28	Wyo. (64)-----	15
Dry Creek—Mont. (20)-----	19	Little Missouri River direct—Wyo. (5);		Little Laramie River—Wyo. (65)-----	16
Milk River direct—Mont. (21)-----	20	Mont. (49); South Dak. (7); N. Dak. (7)-----	II-Con.—81	Sybilie Creek—Wyo. (55)-----	17
Sandy Creek—Mont. (22)-----	21	Boxelder Creek—Mont. (50); S. Dak.;		North Laramie River—Wyo. (52)-----	18
Clear Creek—Mont. (23)-----	22	N. Dak.-----	52	Chugwater Creek—Wyo. (54)-----	19
Lodge and Battle Creeks—Mont. (24)-----	23	Little Beaver Creek—Mont. (51);		Rawhide Creek—Wyo. (54)-----	20
Snake Creek—Mont. (25)-----	24	N. Dak. (15)-----	53	Horse Creek—Wyo. (53)-----	21
Frenchman Creek—Mont. (28)-----	25	Beaver Creek—Mont. (52); N. Dak. (9)-----	54	Blue Creek—Nebr. (5)-----	22
Beaver Creek—Mont. (27)-----	26	Knife River—N. Dak. (6)-----	55	South Platte River direct—Colo. (32);	
Rock Creek—Mont. (28)-----	27	Heart River—N. Dak. (10)-----	56	Nebr. (6)-----	II-Bb
Redwater Creek—Mont. (29)-----	28	Cannonball River—S. Dak.; N. Dak. (11)-----	57	Plum Creek—Colo. (51)-----	1
Poplar River—Mont. (30)-----	29	Grand River—N. Dak. (12); S. Dak. (6)-----	58	Bear Creek—Colo. (29)-----	2
Big Muddy Creek—N. Dak.; Mont. (51)-----	30	Moreau River—S. Dak. (8)-----	59	Cherry Creek—Colo. (19)-----	3
Yellowstone River direct—Wyo. (18);		Cheyenne River direct—S. Dak. (10)-----	40	Clear Creek—Colo. (28)-----	4
Mont. (53); N. Dak. (8)-----	II-A	Belle Fourche River direct—Wyo. (2);		St. Vrain Creek direct—Colo. (15)-----	5
Shields River—Mont. (34)-----	1	Mont. (53); S. Dak. (12)-----	41	Boulder Creek—Colo. (20)-----	6
Boulder River—Mont. (35)-----	2	Redwater Creek—Wyo. (1); S. Dak. (13)-----	42	Thompson River—Colo. (14)-----	7
Stillwater River direct—Mont. (36)-----	3	South Fork Cheyenne River direct—		Cacha la Poudre River—Wyo. (70);	
Finch and West Rosebud Creeks		Wyo. (21); Nebr. (12); S. Dak. (26)-----	43	Colo. (4)-----	8
direct—Mont. (37)-----	5	Battle and Spring Creeks—S. Dak. (24)-----	44	Crow Creek—Wyo. (66); Colo. (2)-----	9
East Rosebud Creek—Mont. (38)-----	4	Rapid and Box Elder Creeks—S. Dak. (15)-----	45	Bijou Creek group—Colo. (16)-----	10
Clarks Fork direct—Wyo. (12); Mont. (39)-----	5	Elk Creek—S. Dak. (14)-----	46	Pawnee Creek—Colo. (72)-----	11
Red Lodge and Rock Creeks—Mont. (40)-----	6	Cherry Creek—S. Dak. (11)-----	47	Hornet Creek—Colo. (1)-----	12
Big Horn River direct—Wyo. (10);	7	Bad River—S. Dak. (18)-----	48	Lodgepole Creek—Wyo. (65); Nebr. (10)-----	13
Mont. (41)-----	8	White River direct—Nebr. (5);			II-B-Con.
Popo Agie River—Wyo. (51)-----	9	S. Dak. (22)-----	49	Loup River—Nebr. (6)-----	1
Wind River—Wyo. (25)-----	10	South Fork White River—S. Dak. (20)-----	50	Elkhorn River—Nebr. (7)-----	2
Owl Creek—Wyo. (44)-----	11	Nebr. (2)-----	51	Kansas River direct—Kans. (7)-----	II-C
Cottonwood Creek—Wyo. (19)-----	12	Nebr. (11); Kans. (3)-----	52	Republican River direct—Colo. (18);	
Gooseberry Creek—Wyo. (17)-----	15	Keya Paha River—S. Dak. (19);	53	Nebr. (17)-----	1
		Nebr. (15)-----	54	Arikaree River—Colo. (17); Kans.;	2
		James River—N. Dak. (5); S. Dak. (4)-----		Nebr. (17)-----	2
				Frenchman Creek—Colo. (82); Nebr. (16)-----	5

GENERAL DISCUSSION

LXIII

NAMES OF DRAINAGE BASINS WITH INDEX NUMBERS—Continued

(For the 17 western States and Arkansas, Louisiana, and Florida. State and composite maps, "Irrigation—by Drainage Basins—1939," available from the Superintendent of Documents, Washington, D. C.)

NAME OF DRAINAGE BASIN AND INDEX NUMBERS FOR STATE MAPS AND STATE BASIN TABLES	Index num- bers for composite map and summary tables	NAME OF DRAINAGE BASIN AND INDEX NUMBERS FOR STATE MAPS AND STATE BASIN TABLES	Index num- bers for composite map and summary tables	NAME OF DRAINAGE BASIN AND INDEX NUMBERS FOR STATE MAPS AND STATE BASIN TABLES	Index num- bers for composite map and summary tables
Missouri River—Continued		Rio Grande—Continued		Colorado River—Continued	
Kansas River—Continued		Upper Rio Grande—Continued		Upper Colorado River—Continued	
Smoky Hill River direct—Colo. (71);		Alamosa and La Jara Creeks—Colo. (65)---	1	San Juan River—Continued	
Kans. (5)-----	4	Trinchera Creek—Colo. (55)-----	2	Los Pinos River—Colo. (63);	
Saline River—Kans. (6)-----	5	Conchos River direct—Colo. (67)-----	3	N. Mex. (36)-----	2
Solomon River—Kans. (4)-----	6	San Antonio River—N. Mex. (15)-----	4	Animas River—Colo. (62); N. Mex. (37)	3
White Woman Creek—Colo. (73);		Costilla Creek—Colo. (68);	5	La Plata River—Colo. (61);	
Kans. (12)-----	7	N. Mex. (16)-----	6	N. Mex. (38)-----	4
Big Blue River—Nebr. (15); Kans. (2)---	8	Latir Creek and Red River—N. Mex. (17)---	7	Chaco River—N. Mex. (39)-----	5
Ossage River—Kans. (8)-----	II-D	Rio Hondo—N. Mex. (18)-----	8	Mancos River—Colo. (60); N. Mex.-----	6
Mississippi River direct, exclusive of		Rio Pueblo de Taos—N. Mex. (19)-----	9	McElmo Creek—Colo. (59); Utah (36)---	7
Missouri River—Ark. (11); La. (1)-----	III	Embudo River—N. Mex. (20)-----	10	Montezuma Creek—Colo. (74); Utah (37)	8
St. Francis River direct—Ark. (1)-----	1	Rio Chama direct—Colo. (75);	11	Cottonwood Wash—Utah (38)-----	9
L'Anguille River—Ark. (10)-----	2	N. Mex. (21)-----	12	Chinle Creek—N. Mex. (40); Ariz. (3);	
White River direct—Ark. (13)-----	3	Caliente River—N. Mex. (22)-----	13	Utah (39)-----	10
Black River—Ark. (3)-----	4	Santa Cruz River—N. Mex. (23)-----	14	Paria River—Utah (40); Ariz. (4)-----	VI-A-Con.
Village River—Ark. (24)-----	5	Tesque Creek—N. Mex. (24)-----	15	Lower Colorado River direct (exclusive of	
Catche River direct—Ark. (2)-----	6	Jemez Creek—N. Mex. (25)-----	16	Imperial Valley)—Ariz. (1); Nev. (26);	
Bayou de Vue—Ark. (9)-----	7	Rio Puerco direct—N. Mex. (26)-----	17	Calif. (101)-----	VI-B
Big Creek—Ark. (28)-----	8	San Jose River—N. Mex. (27)-----	18	Little Colorado River direct—Ariz. (5);	
Arkansas River direct—Colo. (35);	9	Alamosa River—N. Mex. (28)-----	19	N. Mex. (41)-----	VI-Ba
Kans. (10); Okla. (8); Ark. (7)-----	10	San Luis Creek direct—Colo. (45)-----	20	Nutrisio Creek—Ariz. (6)-----	1
Texas Creek—Colo. (77)-----	11	Saguache Creek—Colo. (44)-----	21	Concho Creek—N. Mex.; Ariz. (7)-----	2
Grape Creek—Colo. (46)-----	12	San Luis Lake—Colo. (66)-----	22	Zuni River—N. Mex. (42); Ariz. (8)-----	3
Turkey Creek—Colo. (47)-----	13	San Augustine—N. Mex. (48)-----	23	Silver Creek—Ariz. (9)-----	4
Fountain Creek—Colo. (48)-----	14	Estancia Valley—N. Mex. (49)-----	24	Puerco River—N. Mex. (43); Ariz. (10)	5
St. Charles River—Colo. (49)-----	15	Tularosa Valley—N. Mex. (50)-----	25	Salt Lake and Rito Creek—N. Mex. (47)	6
Huerfano River direct—Colo. (54)-----	16	Rio Tularosa—N. Mex. (51)-----	26		VI-B-Con.
Cucharas River—Colo. (53)-----	17	Fresnal River—N. Mex. (52)-----	27	Kanab Creek—Utah (41); Ariz. (11)-----	1
Apishapa River—Colo. (52)-----	18	Sacramento River and Salt Lakes—N. Mex.	28	Virgin River direct—Utah (42);	
Mimbas Creek—Colo. (51)-----	19	(55); Tex. (21)-----	29	Ariz. (12); Nev. (27)-----	2
Purgatoire River—N. Mex. (1); Colo. (69)	20	Mimbres Valley—N. Mex. (54)-----	30	Ash Creek—Utah (43)-----	3
Big Sandy Creek—Colo. (30)-----	21	Lower Rio Grande direct—Tex. (1)-----	31	Santa Clara River—Utah (44)-----	4
Two Butte and Bear Creeks—Colo. (50);	22	Pecos River direct—N. Mex. (29);	32	Muddy River direct—Nev. (28)-----	5
Kans. (13)-----	23	Tex. (2)-----	33	Meadow Valley Wash—Nev. (29)-----	6
Pawnee River—Kans. (11)-----	24	Callinas River—N. Mex. (30)-----	34	Las Vegas Valley—Nev. (30)-----	7
Salt Fork Arkansas River—Kans. (16);	25	Rio Hondo—N. Mex. (31)-----	35	Williams River—Ariz. (15)-----	8
Okla. (4)-----	26	Rio Pecos—N. Mex. (32)-----	36	White River—Nev. (42)-----	9
Cimarron River—N. Mex. (2); Okla. (5);	27		37	Pahrnagat Valley—Nev. (43)-----	10
Colo. (70); Kans. (14)-----	28	Colorado River-----	38	Red Lake—Ariz. (31)-----	11
Verdigris River—Kans. (15); Okla. (2)---	29	Upper Colorado River direct—Colo. (15);	39	Whitewater River—Calif. (100)-----	12
Neosho River—Kans. (9); Okla. (1);	30	Utah (18); Ariz.-----	40	Gila River-----	VI-Bb
Ark. (5)-----	31	Fraser River—Colo. (21)-----	41	Upper Gila River direct—N. Mex. (44);	
Canadian River direct—N. Mex. (5);	32	Williams River—Colo. (22)-----	42	Ariz. (14)-----	1
Tex. (18); Okla. (7)-----	33	Muddy Creek—Colo. (12)-----	43	San Francisco River—N. Mex. (45);	
Vermajo River—N. Mex. (4)-----	34	Blue River—Colo. (27)-----	44	Ariz. (15)-----	2
Cimarron River—N. Mex. (5)-----	35	Eagle River—Colo. (28)-----	45	Blue River—N. Mex. (46);	
Coats Creek—N. Mex. (6)-----	36	Roaring Fork—Colo. (34)-----	46	Ariz. (16)-----	3
Mora River direct—N. Mex. (7)-----	37	Elk Creek—Colo. (78)-----	47	San Simon Creek—Ariz. (17)-----	4
Coyote Creek—N. Mex. (8)-----	38	Garfield Creek—Colo. (76)-----	48	San Carlos River—Ariz. (18)-----	5
Spallito Creek—N. Mex. (9)-----	39	Roan Creek—Colo. (25)-----	49	San Pedro River—Ariz. (19)-----	6
Ute Creek—N. Mex. (10)-----	40	Plateau Creek—Colo. (35)-----	50	Queen Creek—Ariz. (20)-----	7
Carrizo and Mustang Creeks—	41	Gunnison River direct—Colo. (40)-----	51	Santa Cruz River direct—Ariz. (21)---	8
N. Mex. (11); Tex. (17)-----	42	Taylor River—Colo. (42)-----	52	Rillito Creek—Ariz. (22)-----	9
North Canadian River—N. Mex. (12);	43	Slate River—Colo. (41)-----	53	Salt River direct—Ariz. (23)-----	10
Okla. (6); Tex. (18)-----	44	Tomichi Creek—Colo. (43)-----	54	Black River—Ariz. (24)-----	11
Red River direct—N. Mex. (13); Tex. (19);	45	Smith Fork—Colo. (38)-----	55	Tonto Creek—Ariz. (25)-----	12
Okla. (9); Ark. (19); La. (2)-----	46	North Fork—Colo. (39)-----	56	Verde River—Ariz. (26)-----	13
Washita River—Tex. (20); Okla. (10)---	47	Uncompahgre River—Colo. (37)-----	57	Lower Gila River direct—Ariz. (27)---	14
Black River—La. (5)-----	48	Salt Creek group—Colo. (24); Utah	58	Aqua Fria River—Ariz. (28)-----	15
Quachita River—Ark. (16); La. (4)-----	49	Little Dolores River—Colo. (81);	59	Hassayampa River—Ariz. (29)-----	16
Bartholomew Bayou—Ark. (22); La. (7)	50	Utah (19)-----	60	Centennial Wash—Ariz. (30)-----	17
Gulf of Mexico, other than Mississippi		Dolores River direct—Colo. (36);	61	Animas Valley—N. Mex. (55)-----	18
River and Rio Grande-----	IV	Utah (20)-----	62	Sulphur Springs—Ariz. (35)-----	19
Baffins Bay—Tex. (3)-----	1	San Miguel River—Colo. (58)-----	63	Imperial Valley—Calif. (102)-----	VI-C
Mueces River—Tex. (4)-----	2	Green River direct—Wyo. (40); Utah	64		
Gundalope River direct—Tex. (5)-----	3	(21); Colo. (9)-----	65	Gulf of California (Mexico), exclusive of	VII
San Antonio River—Tex. (6)-----	4	Horse Creek—Wyo. (29)-----	66	Colorado River, (total)-----	
Colorado River direct—N. Mex. (35);	5	Cottonwood Creek—Wyo. (75)-----	67	Whitewater Draw—Ariz. (34)-----	1
Tex. (7)-----	6	New Fork—Wyo. (30)-----	68	Vamori (Valshni) Wash—Ariz. (32)---	2
Llano River—Tex. (8)-----	7	South Piney Creek—Wyo. (41)-----	69		
Brazos River direct—N. Mex. (34); Tex. (9)	8	La Barge Creek—Wyo. (42)-----	70	Great Basin, total—Oreg.; Idaho; Wyo.;	VIII
Little River—Tex. (10)-----	9	Fontenelle Creek—Wyo. (43)-----	71	Utah; Nev.; Calif.-----	
San Jacinto River—Tex. (11)-----	10	Sandy Creek—Wyo. (39)-----	72	Bonneville Lake, total—Idaho; Utah; Nev.;	VIII-A
Trinity River—Tex. (12)-----	11	Bitter Creek—Wyo. (49)-----	73	Wyo.-----	
Sabine River direct—Tex. (13); La. (11)---	12	Blacks Fork direct—Utah (22); Wyo.	74	Great Salt Lake direct—Idaho (53);	1
Neches River—Tex. (14)-----	13	(48)-----	75	Nev.; Utah (1)-----	
Calcasieu River direct—La. (12)-----	14	Muddy Creek—Wyo. (47)-----	76	Bear River direct—Utah (2); Wyo. (46);	2
Bundick Creek—La. (15)-----	15	Hams Fork—Wyo. (45)-----	77	Idaho (54)-----	3
Bayou Serpent—La. (14)-----	16	Henry's Fork—Utah (24); Wyo. (58)---	78	Thomas Creek—Wyo. (23); Idaho (55)---	4
West Fork Calcasieu River—La. (15)---	17	Yampa River direct—Colo. (10)-----	79	Little Bear River—Idaho (56);	
Mormontau River direct—La. (18)-----	18	Elk River—Colo. (7)-----	80	Utah (5)-----	5
Nespique Bayou—La. (17)-----	19	Trout Creek—Colo. (11)-----	81	Maled River—Idaho (57); Utah (4)-----	6
Bayou Que de Tortue—La. (18)-----	20	Little Snake River—Wyo. (59);	82	Weber River direct—Utah (5)-----	7
Vermilion River—La. (19)-----	21	Colo. (8)-----	83	Chalk Creek—Utah (6)-----	8
Atchafalaya River direct—La. (20)-----	22	Brush Creek—Utah (25)-----	84	East Canyon Creek—Utah (7)-----	9
Bayou Teche direct—La. (21)-----	23	Ashley Creek—Utah (26)-----	85	Ogden River—Utah (8)-----	10
Bayou Boeuf—La. (22)-----	24	Duchess River—Utah (27)-----	86	Jordan River direct—Utah (9)-----	11
Bayou Lafourche—La. (23)-----	25	White River—Colo. (23); Utah (28)---	87	Utah Lake direct—Utah (10)-----	12
Lake Pontchartrain-----	26	Willow Creek—Utah (28)-----	88	Spanish Fork system—Utah (11)---	13
Anite River—La. (24)-----	27	Prios River—Utah (30)-----	89	Provo River system—Utah (12)-----	14
Natalbany River—La. (25)-----	28	San Rafael River—Utah (31)-----	90	Sevier River-----	
Tangipahoa River—La. (26)-----	29	Fremont River direct—Utah (32)-----	91	Upper Sevier River direct—Utah (13)---	15
Chefume River—La. (27)-----	30	Muddy River—Utah (33)-----	92	East Fork Sevier River direct—	
Rio Grande-----	V	Escalante River—Utah (34)-----	93	Utah (14)-----	16
Upper Rio Grand direct—Colo. (57);	V-A	San Juan River direct—Colo. (64);	94	Otter Creek—Utah (15)-----	17
N. Mex. (14)-----		N. Mex. (35); Utah (35); Ariz. (2)---	95	San Pitch River—Utah (16)-----	
		Piedra River—Colo. (76)-----	96		

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(For the 17 western States and Arkansas, Louisiana, and Florida. State and composite maps, "Irrigation—by Drainage Basins—1939," available from the Superintendent of Documents, Washington, D. C.)

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Great Basin—Continued		Columbia River—Continued		Columbia River—Continued	
Bonneville Lake—Continued		Upper Columbia River—Continued		Lower Columbia River direct—Wash. (1);	IX-C
Sevier River—Continued		Clark Fork—Continued		Oreg. (1)-----	1
Lower Sevier River—Utah (17)-----	18	Upper Clark Fork—Mont. (58)-----	3	Walla Walla River—Oreg. (15); Wash. (22)	2
Deep Creek (Box Elder County, Utah)-----	19	Blackfoot River—Mont. (57)-----	4	Umatilla River direct—Oreg. (18)-----	3
Idaho (65); Utah (47)-----	20	Bitterroot River—Mont. (58)-----	5	Birch Creek—Oreg. (17)-----	4
Grouse Creek—Nev.; Utah (48)-----	21	Flathead River direct—Mont. (59)-----	6	Butter Creek—Oreg. (15)-----	5
Thousand Spring Creek—Nev. (31); Utah	22	Swan River—Mont. (60)-----	7	Willow Creek—Oreg. (19)-----	6
Deep Creek (Tooele County, Utah)—Nev.	23	Little Bitterroot River—Mont. (61)-----	8	John Day River direct—Oreg. (20)-----	7
(85); Utah (49)-----	24	Priest River—Wash. (8); Idaho (51)-----	9	Rock Creek—Oreg. (21)-----	8
Snake Valley—Nev. (36); Utah (50)-----	25	Kettle River—Wash. (4)-----	10	Deschutes River direct—Oreg. (22)-----	9
Beaver River—Utah (51)-----	26	Colville River—Wash. (5)-----	11	Squaw Creek—Oreg. (23)-----	10
Little Salt Lake—Utah (52)-----	27	Spokane River direct—Idaho (45);	12	Crooked River—Oreg. (24)-----	11
Coal Creek—Utah (53)-----	28	Wash. (6)-----	13	White River—Oreg. (25)-----	12
Escalante Desert—Nev.; Utah (54)-----	29	Coeur d'Alene River—Idaho (46); Wash.	14	Fifteenmile Creek—Oreg. (26)-----	13
Shoal Creek—Nev.; Utah (55)-----	30	Latah Creek—Idaho (49); Wash. (7)-----	15	Klickitat River—Wash. (23)-----	14
Lahontan Lake Basin, total—Oreg.; Nev.;	VIII-B	Sanpoil River—Wash. (8)-----	16	Hood River—Oreg. (27)-----	15
Calif.-----	VIII-Ba	Okanogan River—Wash. (9)-----	17	White Salmon River—Wash. (24)-----	16
Northern Great Basin, total—Oreg.; Nev.;		Methow River—Wash. (10)-----	18	Sandy River—Oreg. (28)-----	17
Calif.-----		Lake Chelan—Wash. (11)-----	19	Willamette River direct—Oreg. (29)-----	18
Malheur Lake:		Entiat River—Wash. (12)-----	20	Calapooya River—Oreg. (30)-----	19
Silvies River—Oreg. (50)-----	1	Wenatchee River—Wash. (13)-----	21	Santiam River—Oreg. (31)-----	20
Harney Lake direct—Oreg. (51)-----	2	Crab Creek—Wash. (14)-----	22	Luckiamute River—Oreg. (32)-----	21
Silver Creek—Oreg. (52)-----	3	Yakima River direct—Wash. (15)-----	23	Yamhill River—Oreg. (33)-----	22
Donner und Blitzen River—Oreg. (53)-----	4	Naches River—Wash. (16)-----	24	Molalla River—Oreg. (34)-----	23
Benjamin Lake—Oreg. (54)-----	5	Ahtanum Creek—Wash. (17)-----	25	Tualatin River—Oreg. (35)-----	24
Silver Lake—Oreg. (55)-----	6	Snake River-----	IX-B	Clackamas River—Oreg. (36)-----	25
Summer Lake—Oreg. (56)-----	7	Upper Snake River direct—Idaho (1)-----	1	Lewis River—Wash. (25)-----	26
Lake Abert—Oreg. (57)-----	8	South Fork Snake River direct—Wyo.	2	Cowlitz River—Wash. (26)-----	
Cowhead and Warner Lakes—Calif. (61);	9	(14); Idaho (2)-----	3	Klamath River direct—Oreg. (45); Calif. (3)	X
Nev. (50); Oreg. (58)-----	10	Gros Ventre River—Wyo. (26)-----	4	Williamson River direct—Oreg. (46)-----	1
Trout Creek—Oreg. (59)-----	11	Grays River—Wyo. (28)-----	5	Sprague River—Oreg. (47)-----	2
Whitehorse Creek—Oreg. (60)-----	12	Salt River—Wyo. (27); Idaho (3)-----	6	Lost River—Calif. (4); Oreg. (48)-----	3
Black Rock Desert—Nev. (48)-----	13	Henrys Fork direct—Wyo. (69);	7	Shasta River—Calif. (5)-----	4
Quinn River direct—Nev. (49)-----	14	Idaho (4)-----	8	Scott River—Calif. (6)-----	5
McDermitt Creek—Nev.; Oreg. (61)-----	15	Teton River—Wyo. (13); Idaho (5)-----	9	Trinity River—Calif. (7)-----	6
Tenmile Creek—Oreg. (62)-----	16	Grays Lake—Idaho (6)-----	10		
Surprise Valley—Nev. (51); Calif. (82)-----	17	Blackfoot River—Idaho (7)-----	11	Pacific Ocean streams, excl. Gulf of Calif.	XI
Madeline Plains—Calif. (83)-----	18	Portneuf River—Idaho (8)-----	12	streams and Columbia and Klamath Rivers-----	
Smoke Creek—Calif. (85); Nev. (52)-----	19	Bannock Creek—Idaho (9)-----	13		
Sierra Nevada Slope, total—Nev.; Calif.	VIII-Bb	Lower Snake River direct—Idaho (10);	14	Pacific Ocean streams north of the	XI-A
Pyramid Lake direct—Nev. (18)-----	1	Oreg. (2); Wash. (18)-----	15	Columbia River-----	1
Truckee River direct (upper)-----	2	Raft River—Utah (45); Idaho (11)-----	16	Puget Sound direct—Wash. (27)-----	2
Calif. (87); Nev. (17)-----	3	Goose Creek—Nev. (1); Utah (46);	17	Nisqually River—Wash. (28)-----	3
Steamboat and Washoe Valleys-----	4	Idaho (12)-----	18	White and Puyallup Rivers—Wash. (29)	4
Nev. (19)-----	5	Salmon Falls Creek—Nev. (2);	19	Lake Washington—Wash. (30)-----	5
Truckee Canal—Nev. (18)-----	6	Idaho (13)-----	20	Snodosh River—Wash. (31)-----	6
Carson River (upper)—Calif. (88);	7	Little and Big Wood Rivers direct—	21	Skagit and Samish Rivers—Wash. (32)-----	7
Nev. (20)-----	8	Idaho (14)-----	22	Dungeness River—Wash. (33)-----	8
Truckee and Carson Rivers (lower)-----	9	Camas Creek—Idaho (15)-----	23	Nooksack River Area—Wash. (34)-----	9
Nev. (21)-----	10	Bruneau River—Nev. (3); Idaho (16)-----	24	Sumas River—Wash. (35)-----	10
Walker Lake direct—Nev. (22)-----	11	Boise River direct—Idaho (17)-----	25	Chehalis River—Wash. (36)-----	11
Walker River direct—Nev. (23)-----	12	North Fork Boise River—Idaho (18)-----	26	Other Pacific Slope streams in	
West Walker River—Calif. (89);	13	South Fork Boise River—Idaho (19)-----	27	Washington—Wash. (37)-----	
Nev. (24)-----	14	Moore Creek—Idaho (20)-----	28	Pacific Ocean streams between the Columbia	XI-B
East Walker River—Calif. (90);	15	Owyhee River direct—Idaho (21);	29	and Klamath Rivers-----	
Nev. (25)-----	16	Oreg. (3)-----	30	Rogue River direct—Oreg. (37)-----	1
Honey Lake—Nev. (55); Calif. (86)-----	17	South Fork Owyhee River direct—	31	Little Butte Creek—Oreg. (38)-----	2
Mono Lake—Calif. (91)-----	18	Nev. (5); Idaho (22); Oreg. (4)-----	32	Bear Creek—Oreg. (39)-----	3
Adobe Meadows—Calif. (92)-----	19	East Fork Owyhee River—Nev. (4);	33	Evans Creek—Oreg. (40)-----	4
Owens River—Calif. (93)-----	20	Idaho (23)-----	34	Applegate River—Calif. (1); Oreg. (41)	5
Central Great Basin and Eastern Nevada,	VIII-Bc	Jordan Creek—Idaho (24); Oreg. (5)-----	35	Illinois River—Calif. (2); Oreg. (42)	6
total—Nev.; Calif.-----		Malheur River direct—Oreg. (6)-----	36	Umpqua River—Oreg. (43)-----	7
Humboldt River:		Bully Creek—Oreg. (7)-----	37	Other Pacific Slope streams—Oreg. (44);	8
Upper Humboldt River direct—Nev. (6)	1	Willow Creek—Oreg. (8)-----	38	Calif. (11)-----	
Lamelle and Rabbit Creeks-----	2	Payette River direct—Idaho (25)-----	39	Pacific Ocean streams between the Klamath	XI-C
Nev. (7)-----	3	North Fork Payette River—Idaho (26)-----	40	River and San Francisco Bay-----	
North Fork Humboldt River—Nev. (8)	4	South Fork Payette River—Idaho (27)-----	41	Mad River—Calif. (8)-----	1
South Fork Humboldt River—Nev. (9)	5	Weiser River—Idaho (28)-----	42	Eel River—Calif. (9)-----	2
Maggie Creek—Nev. (10)-----	6	Burnt River—Oreg. (9)-----	43	Russian River—Calif. (10)-----	3
Pine Creek—Nev. (11)-----	7	Powder River—Oreg. (10)-----	44	Other coastal streams in northern	
Middle Humboldt River direct-----	8	Imnaha River—Oreg. (11)-----	45	California—Calif. (11)-----	4
Nev. (12)-----	9	Salmon River-----	46	San Francisco Bay direct—Calif. (12)-----	5
Beane River—Nev. (13)-----	10	Upper Salmon River direct—Idaho (29)	47	Petaluma Creek—Calif. (13)-----	6
Little Humboldt River—Nev. (14)-----	11	Pahsimeroi River—Idaho (30)-----	48	Sonoma Creek—Calif. (14)-----	7
Lower Humboldt River—Nev. (15)-----	12	Lenhi River—Idaho (31)-----	49	Napa River—Calif. (15)-----	8
Sonoma and Clear Creeks—Nev. (47)-----	13	Lower Salmon River direct—Idaho (32)	50	Suisun Bay direct—Calif. (16)-----	9
Clover Valley—Nev. (52)-----	14	North Fork Salmon River—Idaho (33)	51	Walnut Creek—Calif. (17)-----	10
Ruby Valley—Nev. (53)-----	15	Panther Creek—Idaho (34)-----	52	Alameda Creek—Calif. (18)-----	11
Ooshute and Steptoe Valleys—Nev. (54)-----	16	Middle Fork Salmon River-----	53	Santa Clara Valley streams—Calif. (19)	12
Spring Valley—Nev. (57)-----	17	Idaho (35)-----	54	Pacific Ocean streams south of San	XI-E
Crescent, Diamond, Grass, and Newark	18	South Fork Salmon River—Idaho (36)	55	Francisco Bay-----	
Valleys—Nev. (36)-----	19	Little Salmon River—Idaho (37)-----	56	Streams between San Francisco Bay and	XI-Ea
Big Smoky Valley—Nev. (39)-----	20	Grande Ronde River direct—Oreg. (12);	57	Santa Maria River-----	
Ralston, Monitor, and Hot Creek	21	Wash. (19)-----	58	Pajaro and San Benito Rivers-----	
Valleys—Nev. (40)-----	22	Wallowa River—Oreg. (13)-----	59	Calif. (20)-----	1
Railroad Valley—Nev. (41)-----	23	Joseph Creek—Oreg. (14)-----	60	Salinas River—Calif. (21)-----	2
Smith Creek and Dixie Valleys—Nev. (46)	24	Asotin Creek—Wash. (20)-----	61	Other coastal streams north of Santa	3
Fish Lake Valley—Calif. (94); Nev. (45)		Clearwater River direct—Idaho (38)-----	62	Maria River—Calif. (35)-----	4
Amargosa River and Dry Lakes—Nev.		Selway River—Idaho (40)-----	63	Santa Maria River and streams south-----	XI-Eb
(44); Calif. (95)-----		South Fork Clearwater River-----		Santa Maria River—Calif. (22)-----	1
Antelope Valley—Calif. (97)-----		Idaho (41)-----		San Antonio River—Calif. (23)-----	2
Mojave River—Calif. (98)-----		Palouse River—Idaho (44); Wash. (21)-----		Santa Ynez River—Calif. (24)-----	3
		Mud Lake direct—Idaho (58)-----		Ventura River—Calif. (25)-----	4
		Camas Creek direct—Idaho (59)-----		Santa Clara River and Calleguas	5
		Beaver Creek—Idaho (60)-----		Creek—Calif. (26)-----	6
		Medicine Lodge Creek—Idaho (61)-----		Los Angeles and San Gabriel Rivers-----	XI-Ec
		Birch Creek—Idaho (62)-----		Calif. (27)-----	
		Little Lost River—Idaho (63)-----		Santa Ana River—Calif. (28)-----	7
		Big Lost River—Idaho (64)-----			

GENERAL DISCUSSION

LXV

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Pacific Ocean streams south of San Francisco Bay—Continued		Sacramento-San Joaquin Delta direct—Con.		Sacramento-San Joaquin Delta direct—Con.	
Santa Maria River and streams south—Con.		Sacramento River—Continued		San Joaquin River direct—Continued	
Santa Margarita River—Calif. (29)-----	8	Upper Sacramento River direct—Con.		Kern River direct—Continued	
San Luis Rey River—Calif. (30)-----	9	Paynes Creek—Calif. (46)-----	10	Poso Creek and White River—	
San Dieguito River—Calif. (31)-----	10	Redbank Creek group—Calif. (47)-----	11	Calif. (66)-----	32
San Diego River—Calif. (32)-----	11	Antelope and Mill Creeks—		Tule River and Deer Creek—Calif. (69)	33
Sweetwater River—Calif. (33)-----	12	Calif. (48)-----	12	Kaweah River—Calif. (70)-----	34
Otay and Tia Juana Rivers—Calif. (34)-----	13	Thomas Creek—Calif. (49)-----	13	Panoche and Los Gatos Creeks group—	
Other coastal streams south of Santa		Deer Creek—Calif. (50)-----	14	Calif. (71)-----	35
Maria River—Calif. (36)-----	14	Middle Sacramento River direct—		Kings River—Calif. (72)-----	36
San Jacinto River—Calif. (39)-----	15	Calif. (51)-----	15	Fresno River—Calif. (73)-----	37
		Rock Creek—Calif. (52)-----	16	Meroed River—Calif. (74)-----	38
Sacramento-San Joaquin Delta and tributary streams-----	XII	Stony Creek—Calif. (53)-----	17	Orestimba and Los Banos Creeks group—	
		Chico Creek—Calif. (54)-----	18	Calif. (75)-----	39
Sacramento-San Joaquin Delta direct—		Butte Creek—Calif. (55)-----	19	Tuolumne River—Calif. (76)-----	40
Calif. (37)-----	1	West Side streams—Calif. (56)-----	20	Stanislaus River—Calif. (77)-----	41
Sacramento River:		Feather River direct—Calif. (57)-----	21	Calaveras River—Calif. (78)-----	42
Upper Sacramento River direct—		Tuba and Upper Bear Rivers—		Mokelumne River—Calif. (79)-----	43
Calif. (38)-----	2	Calif. (58)-----	22	Cosumnes River—Calif. (80)-----	44
Pit River direct—Calif. (39)-----	3	Lower Bear River—Calif. (59)-----	23		
Goose Lake—Oreg. (49); Calif. (40)-----	4	Lower Sacramento River direct—		FLORIDA	
Clear Creek—Calif. (41)-----	5	Calif. (60)-----	24	St. Marys River (1)-----	1
Cow Creek—Calif. (42)-----	6	American River—Calif. (61)-----	25	St. Johns River and North Atlantic slope (2)	2
Bear Creek—Calif. (43)-----	7	Catche Creek—Calif. (62)-----	26	Kissimmee and Caloosahatchee Rivers (3)	3
Cottonwood Creek—Calif. (44)-----	8	Putah Creek—Calif. (63)-----	27	Everglades (4)-----	4
Battle Creek—Calif. (45)-----	9	San Joaquin River direct—Calif. (64)-----	28	Aucilla River (11)-----	11
		Arenal and El Paso Creeks group—		Suwanee River (12)-----	12
		Calif. (65)-----	29	Withlacoochee River (13)-----	13
		Calliente Creek—Calif. (66)-----	30	Tampa Bay (14)-----	14
		Kern River direct—Calif. (67)-----	31	Peace Creek (15)-----	15