

DEPARTMENT OF THE INTERIOR,
CENSUS OFFICE.

ROBERT P. PORTER,
Superintendent.
Appointed April 20, 1889; resigned July 31, 1893.

CARROLL D. WRIGHT,
Commissioner of Labor in charge.
Appointed October 5, 1893.

REPORT

ON

AGRICULTURE BY IRRIGATION

IN THE

WESTERN PART OF THE UNITED STATES

AT THE

ELEVENTH CENSUS: 1890.

F. H. NEWELL,

SPECIAL AGENT.



WASHINGTON, D. C.:
GOVERNMENT PRINTING OFFICE.
1894.

IRRIGATION.

MEAN MONTHLY AND ANNUAL RAINFALL AT STATIONS IN ARIZONA.

[T. indicates a trace of rain, less than 0.01 inch.]

LOCALITIES.	Altitude in feet.	Length of record.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Annual.
Apache county:			<i>Yrs. Mos.</i>												
Holbrook	5,047	3 10	0.54	0.71	0.72	0.67	0.16	0.12	1.51	1.40	1.18	0.68	1.06	0.72	9.29
Fort Apache	5,050	18 10	1.34	1.80	1.65	0.84	0.47	0.72	4.04	4.20	1.84	1.34	1.17	1.93	21.04
Fort Defiance	6,500	29 2	0.98	0.70	0.84	0.67	0.52	0.72	2.44	2.73	1.88	0.70	1.16	0.87	14.19
Cochise county:															
Wilcox	4,164	29 0	0.89	0.90	0.92	0.93	0.12	0.21	2.37	2.70	1.21	0.67	0.44	0.84	11.35
Benson	3,580	9 10	0.59	0.45	0.51	0.93	0.09	0.28	1.77	2.23	0.71	0.50	0.24	0.75	8.06
Fort Bowie	4,781	23 2	1.11	1.77	1.27	0.19	0.28	0.69	3.23	2.90	1.84	0.57	0.74	1.27	15.41
Fort Huachuca	4,785	4 8	0.60	1.27	0.97	0.11	0.15	0.39	4.29	2.93	2.81	0.94	1.02	0.95	16.43
San Simon	3,611	28 5	0.27	0.28	0.53	0.92	0.11	0.04	0.56	1.64	0.22	0.80	0.24	0.89	4.56
Gila county:															
Fort San Carlos	3,456	29 3	1.23	1.63	1.38	0.31	0.22	0.24	1.85	2.43	0.91	0.75	0.67	1.85	13.48
Graham county:															
Fort Thomas	2,700	10 6	0.84	1.18	1.08	0.25	0.45	0.20	2.03	2.81	0.93	0.63	0.48	1.30	11.84
Camp Goodwin	2,650	22 11	2.41	1.82	1.04	1.30	T.	0.69	3.85	5.78	3.80	1.39	1.18	2.81	25.57
Fort Grant	4,800	217 2	0.92	1.24	1.13	0.38	0.29	0.65	3.88	3.22	1.84	0.94	0.88	1.52	16.35
Maricopa county:															
Fort McDowell	1,250	23 10	1.06	1.24	0.74	0.42	0.13	0.12	1.28	1.48	0.94	0.42	0.81	1.70	10.38
Phoenix	1,069	12 9	0.86	0.67	0.67	0.32	0.12	0.09	0.72	1.02	0.65	0.57	0.54	1.25	7.38
Burkes	3 0	0.10	0.68	0.18	0.11	0.07	T.	0.02	1.44	0.67	0.02	0.41	0.28	3.88	
Wickenburg	1,400	28 1	1.07	1.10	0.89	0.52	0.30	0.02	0.51	1.99	0.66	0.18	0.51	1.89	9.85
Pima county:															
Fort Lowell	2,480	210 5	1.14	1.15	0.63	0.28	0.10	0.30	2.47	2.79	1.38	0.45	0.52	0.96	12.37
Fort Buchanan	5,330	3 11	1.47	1.51	0.29	0.60	0.14	0.22	5.25	6.16	2.03	1.16	1.09	1.15	21.58
Camp Crittenden	2,000	4 10	0.65	1.09	0.65	0.26	0.05	0.31	6.01	4.70	0.85	1.10	0.28	1.67	16.51
Pinal county:															
Breeckenridge	3,800	28 10	1.90	0.76	0.45	1.21	0.10	0.50	4.04	4.08	1.95	0.08	1.19	1.09	17.03
Maricopa	1,190	13 8	0.44	0.48	0.69	0.14	0.07	0.08	0.40	0.81	0.47	0.34	0.35	0.84	3.17
Yavapai county:															
Camp Dato Creek	3,726	26 3	0.92	1.53	0.85	1.03	0.13	0.24	3.19	3.39	0.29	0.46	0.64	1.40	14.22
Whipple Barracks (Prescott)	5,389	23 11	1.45	1.78	1.68	0.98	0.58	0.17	3.03	2.88	1.18	0.66	0.82	1.85	17.06
Yuma county:															
Yuma	141	14 11	0.39	0.45	0.18	0.12	0.06	T.	0.13	0.40	0.13	0.21	0.35	0.64	3.06
Texas Hill	355	21 0	0.58	0.27	0.27	0.10	0.08	.....	0.08	0.45	0.84	0.81	0.28	0.48	8.47

a Record broken.

CONDITION OF IRRIGATION IN EACH COUNTY.

The following table gives some of the fundamental data of irrigation during the census year in each of the counties of the territory. Upon an examination of the figures it will be noticed that in general the value of products per acre increased as the average size of farm diminished. For example, in Maricopa county the average size, 108 acres, was the greatest in the territory, while the value of product, \$9.26 per acre, was the least. Next comes Yuma county, with 93 acres per farm and products averaging \$10.50 per acre, then Pinal, with 60 acres per farm and products of \$11.25 per acre. In other words, the large irrigated farms were not as closely tilled as were the smaller, and a lower priced crop resulted.

NUMBER OF IRRIGATORS, AREA IRRIGATED, FARMS, AND CROPS IN EACH COUNTY IN ARIZONA IN 1889.

COUNTIES.	Number of irrigators.	Area irrigated in acres.	Average size of irrigated farms in acres.	OWNERS OF FARMS. (a)		IRRIGATORS.		Area of county in acres.	FARM AREA.		Cereals in acres.	Alfalfa in acres.	AREA IRRIGATED.			Average value of products per acre.
				Total number.	Per cent of population.	Per cent of farm owners.	Per cent of population.		Acres.	Per cent improved.			Per cent of area of county.	Per cent of total farm area.	Per cent of land owned by irrigators.	
Total	1,075	65,821	61	1,420	2.39	75.39	1.80	72,268,800	1,297,003	8.03	22,701	19,945	0.09	5.07	40.21	\$18.92
Apache	182	5,545	30	253	6.01	71.94	4.25	13,478,400	1,085,535	0.78	3,693	850	0.04	0.51	32.50	13.39
Cochise	52	2,372	40	192	2.77	27.08	0.75	3,612,500	31,513	19.65	242	614	0.06	7.53	31.75	25.33
Gila	18	815	45	18	0.89	100.00	0.33	2,055,000	3,980	23.53	975	23	0.04	24.46	26.40	23.85
Graham	199	7,550	38	201	3.54	99.00	3.51	3,937,200	23,533	38.55	4,823	1,741	0.19	82.11	37.39	10.06
Maricopa	327	35,212	108	336	3.06	97.32	2.98	6,330,980	61,888	78.70	9,216	12,193	0.56	56.90	60.14	9.26
Mohave	.....	.....	.....	14	0.97	.....	.....	7,252,480	1,781	21.45	10	203	.....	.....	.....	.....
Pima	85	3,085	36	114	0.90	74.56	0.67	6,731,440	31,862	16.24	843	891	0.05	9.99	33.17	30.38
Pinal	115	6,919	60	124	2.92	92.74	2.71	3,392,000	20,804	40.39	2,666	1,634	0.20	33.20	37.09	11.25
Yavapai	91	3,762	41	161	1.86	58.52	1.05	16,711,040	32,417	53.34	1,028	1,716	0.02	11.61	26.29	31.90
Yuma	8	535	63	13	0.40	48.15	0.22	6,467,040	4,650	12.63	8	175	0.01	11.99	15.50	10.50

a Includes owned and hired farms, assuming one farmer to each.

APACHE COUNTY, located in the northeastern corner of Arizona, is second in size in the territory and sixth in the whole United States. The Navajo and Moqui Indian reservations cover the northern end of the county, and the White Mountain Indian reservation is located partly in the southern end, while between these are the railroad grants, leaving relatively little land open for settlement. The Little Colorado flows across the center of the county, and then turning northwesterly flows through narrow canyons to the Colorado. The principal towns are along the Little Colorado and its tributaries entering from the south, where there are areas of good agricultural lands. As a rule irrigation is required, although, especially at altitudes of 7,000 feet and upward, some dry farming

SAN PEDRO, AT DUDLEYVILLE, PINAL COUNTY, ARIZONA.

(Drainage area 2,819 square miles.)

MONTHS.	DISCHARGE IN SECOND- FEET.			Total for month in acre-feet.	RUN-OFF.		MONTHS.	DISCHARGE IN SECOND- FEET.			Total for month in acre-feet.	RUN-OFF.	
	Maxi- mum.	Mini- mum.	Mean.		Depth in inches.	Second- feet per square mile.		Maxi- mum.	Mini- mum.	Mean.		Depth in inches.	Second feet per square mile.
1890.							1890.						
April 9 to 30.....	21	5	14	833	0.005	0.005	July.....	225	1	13	800	0.005	0.005
May.....	9	5	6	309	0.002	0.002	August.....	507	102	295	18,140	0.121	0.105
June.....	5	1	3	170	0.001	0.001							

The necessity of water storage is perhaps as well appreciated in this county as in any part of the territory. During the census year there was unprecedented scarcity of water, due not only to a diminution of river flow, but to an increased diversion on the part of all the ditches, most of which had been gradually enlarged from time to time. Surveys have already demonstrated the feasibility of holding flood waters at various points, particularly in the valley above the Buttes, 15 miles from Florence.

The principal ditches on the north side of the Gila river are Moore, McLellan, Stiles, and Swiss; on the south side, Brash, the Florence canal, Montezuma, Holland, Alamo Amarilla, Brady, Adamsville, White, and Walker. Nearly all of these are owned by individuals, the principal exceptions being the Florence canal and the Montezuma and Alamo Amarilla ditches. The McLellan ditch heads about 10 miles above Florence, covering lands on the north side of the river. It is over 5 miles in length, 4 feet in width, and the cost was probably \$5,000. Work was begun in 1871, and the ditch was finished in 1872. Water is diverted by means of a dam composed of triangular cribs loaded down with rock and covered with brush and stone. There is generally an ample supply, but need of water is sometimes felt in June, July, and August. The first crop raised consists mainly of barley, wheat, beans, and early corn, and the second crop of beans, corn, sweet potatoes, pumpkins, watermelons, and sugar cane. Water is usually turned into the ditch in October and November, and used until the end of the spring floods. It is stated that the water in this part of the river has been diminishing for 6 years, owing probably to diversions from the San Pedro and from the Gila near Solomonsville and other towns. The Swiss ditch takes water from the north side of Gila river in the vicinity of Florence. It is about 4 miles long, 10 feet wide, and probably cost about \$2,500. It was begun in 1872 and used in the same year. The water supply at this point is often insufficient, generally on account of the fact that it is diverted at points above by other canals having prior rights. The need is felt most in May, June, and July, and sometimes in August. The principal crops irrigated are alfalfa and grain, the latter being cut sometimes for hay, and besides these, garden vegetables and fruit trees are watered regularly.

The Florence canal heads about 12 miles above the town of that name and, coming out of the south side of the river, it is continued beyond the town in a southwesterly and southerly course nearly to the Southern Pacific railroad. The total length is reported to be upward of 50 miles, the average width 20 feet, and the cost was placed at \$400,000. Work was begun in 1886, and water was first used in 1888. The diverting dam is of brush and is replaced each year. The canal is owned by a corporation which sells water rights at the rate of \$8 per acre above the reservoir and \$12.50 per acre below the reservoir. The annual assessment is \$1.25 per acre. A reservoir has been constructed about 25 miles from the head of the canal, having an area of 1,800 acres and an estimated storage capacity of 6,000,000,000 gallons. Besides this it is proposed to construct another reservoir at the Buttes, about 3 miles above the head gates.

YAVAPAI COUNTY, the largest in the United States (a), comprises about one-fourth the area of Arizona. The county contains an exceedingly small proportion of irrigable land, since it includes that part of Arizona adjoining Utah which contains the greater portion of the grand canyons of the Colorado. These stupendous gorges cut the great plateau to the depth of from 3,000 to 6,000 feet. The minor lateral canyons, in which flow the tributaries of the Colorado, are also cut to a great depth, which decreases toward their head waters. Thus the water of the northern part of the territory, though large in amount, is wholly useless, lying as it does hundreds and thousands of feet below the level of the arable lands. It is only toward the southern portion of the county, where the great plateau begins to break off and the valleys are less deep and narrow, that agriculture has been seriously attempted. Along the line of the Atlantic and Pacific railroad, which crosses the county from east to west, at an elevation of from 5,000 to 7,000 feet, some crops, especially for forage, are raised without irrigation. For example, at Flagstaff, at an elevation of about 7,000 feet, corn, potatoes, and vegetables, as well as a little wheat, oats, and barley are thus cultivated, the cereals being generally cut for forage purposes. The same is true of Prescott, although near that place irrigation has been employed wherever practicable. On the head waters of the Agua Fria, at an elevation of about 4,500 feet, there is also a little dry farming.

a Since 1890 Yavapai county has been divided, the northern portion, with Flagstaff as the county seat, being set off under the name of Coconino.

The principal bodies of irrigated lands are along the Verde river and its tributaries, Oak, Clear, Beaver, and other creeks, both above and below Camp Verde, where a number of small ditches have been built by farm owners. On Walnut creek, which heads west of Prescott and flows northerly into Big Chino valley, and on Granite creek to the east, all the available waters are utilized and the irrigators are discussing the feasibility of water storage. On the head waters of Hassayampa river, a short distance southerly from Prescott, two dams have been built, mainly for the purpose of supplying water for hydraulic mining. The upper of these, that at Oro Fino, was built about 1885, the height being about 20 feet. It is located near the mouth of the upper canyon, below which is the farming land of Walnut Grove valley. This is about 7 miles in length and from 1 to 3 miles in width. At the foot of this valley the Walnut Grove Water Storage Company built the dam the destruction of which by a great flood in February, 1890, caused large loss of life and property. This dam was 420 feet long on top, 138 feet wide at bottom, 15 feet wide at top, and 110 feet in greatest height. It was planned to use the water both for placer mining and purposes of stock raising on the plains of the valleys below.

YUMA COUNTY, occupying the southwestern corner of the territory, comprises lands having the lowest altitude and the hottest climate of Arizona. In these respects it is surpassed by the desert regions of San Bernardino and San Diego counties, California, portions of which are far below sea level. This area possesses the advantage of having a fair water supply from the Gila, which flows westerly through it into the Colorado, which forms the boundary between Arizona and California. Along the Gila are several places where water can be brought out by means of canals, and the lands thus irrigated are capable of producing semitropical fruits. The Colorado itself, as previously stated, probably can not be used to any great extent for irrigation in this territory, owing to the almost insurmountable difficulties of diverting water. Small bodies of land are being brought under irrigation by means of pumps, raising water to lands upon or above the flood plains. This method of obtaining the water supply, although expensive, can probably be made profitable, owing to the value of the fruits produced.

Along the Gila the principal canals projected or constructed are, on the north side, the Farmers, Purdy, and Mohawk, and on the south side the South Gila, Contreras, South Mohawk or Saunders, and Antelope, the relative location of these being shown on the map. (a) The Saunders is probably the oldest canal along this part of the river, having been used first about 1868, but not completed until 1884. It is 10 miles long, 8 feet wide, and has cost \$25,000. It is owned by a company which uses the water upon its own land. The annual cost for water is about 50 cents per acre. The principal crops are alfalfa and barley, for the former of which almost constant irrigation is considered necessary.

a Some of these schemes for diverting water were abandoned or modified, owing to the disastrous flood of 1891, which carried away much of the preliminary work along the banks.