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FARMS AND ACREAGE IRRIGATED, IRRIGATION WORKS, COST OF CONSTRUCTION, COST OF OPERATION AND MAINTENANCE, AND CROPS IRRIGATED

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INTRODUCTION.

This bulletin presents the larger part of the statistics of irrigation for Washington obtained in connection with the Thirteenth Census. These data, with additional information, will be embodied in a special report of the Census of Irrigation and in the final reports of the Thirteenth Census. The statistics of the number of farms and acreage irrigated, cost of operation and maintenance, and irrigated crops are for the calendar year 1909; those of irrigation works, cost of enterprises, acreage enterprises were capable of irrigating in 1910, and acreage included in projects are of the date July 1, 1910.

These statistics have been collected under the law of February 25, 1910, which contained the following clause relating to irrigation:

> Inquiries shall also be made as to the location and character of irrigation enterprises, quantity of land irrigated in the arid region of the United States and in each state and county in that section under state and Federal laws; the price at which these lands, including water rights, are obtainable; the character and value of crops produced on irrigated lands, the amount of water used per acre for said irrigation and whether it was obtainable from national, state, or private works; the location of the various projects and methods of construction, with facts as to their physical condition; the amount of capital invested in such irrigation works.

The information called for by this law which could be supplied by farm operators was obtained on supplemental schedules by the regular census enumerators as a part of the agricultural census. The remaining data, which were supplied by the owners or officials of irrigation enterprises, were obtained on special schedules by special agents. The data relating to number of farms irrigated and irrigated crops are taken from the supplemental schedules, while all data relating to acreage irrigated and to irrigation works and their construction and operation are taken from the special schedules.

In accordance with the law, the data collected have been classified primarily by the state and Federal laws by virtue of which the land was brought under irrigation. The results are presented in detail at the end of this bulletin and summarized in text tables.

Such of the terms used as are not self-explanatory are defined below.

Farms irrigated.—The number of "farms irrigated" is the number of farms on which irrigation is practiced and is equivalent to the term "number of irrigators" used in previous census reports.

Types of enterprise.—The types of enterprise under which the lands irrigated in 1909 are classified are as follows:

United States Reclamation Service enterprises, which operate under the Federal law of June 17, 1902, providing for the construction of irrigation works with the receipts from the sale of public lands.

United States Indian Service enterprises, which operate under various acts of Congress providing for the construction by that service of works for the irrigation of land in Indian reservations.

Carey Act enterprises, which operate under the Federal law of August 18, 1894, granting to each of the states in the arid region 1,000,000 acres of land on condition that the state provide for its irrigation, and under amendments to that law granting additional areas to Idaho and Wyoming.

Irrigation districts, which are public corporations that operate under state laws providing for their organization and management, and empowering them to issue bonds and levy and collect taxes with the object of obtaining funds for the purchase or construction, and for the operation and maintenance of irrigation works.

Cooperative enterprises, which are controlled by the water users under some organized form of cooperation. The most common form of organization is the stock company, the stock of which is owned by the water users.

Commercial enterprises, which supply water for compensation to parties who own no interest in the works. Persons obtaining water from such enterprises are usually required to pay for the right to receive water, and to pay, in addition, annual charges based in some instances on the acreage irrigated and in others on the quantity of water received.

Individual and partnership enterprises, which belong to individual farmers or to neighboring farmers, who control them without formal organization. It is not always possible to distinguish between partnership and cooperative enterprises, but as the difference is slight this is unimportant.

Source of water supply.—Of the terms used in the classification according to source of water supply, none requires explanation except "reservoirs." The only reservoirs which are treated as independent sources of supply are those filled by collecting storm water or from watercourses that are ordinarily dry. When reservoirs are filled from streams or wells, the primary source is considered the source of supply.

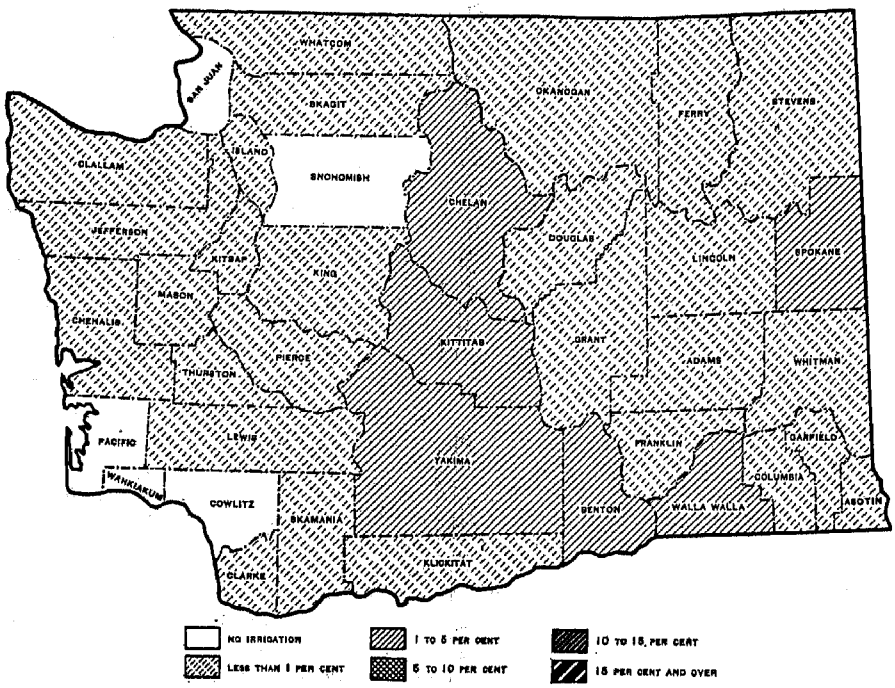
Acre-foot.—The "acre-foot," used to express the capacity of reservoirs, is the volume of water required to cover 1 acre to a depth of 1 foot, or 43,560 cubic feet.

Cost.—The cost of irrigation enterprises is that given by the owners. For the larger works the cost given is taken, in most cases, from the books of account and represents the actual cost. In the case of most of the private and partnership and many of the cooperative enterprises, however, the works were built by their owners without records of money or labor expended, and the cost given represents the owners' estimates. The cost reported for 1910 includes the cost of construction and of acquiring rights. The latter usually consists of filing fees only. In some instances it includes the purchase price of rights, but these cases are so rare that they are unimportant. The cost reported for 1899 is designated "cost of construction," but probably includes the cost of acquiring rights, as in 1910. The average cost per acre is based on the acreage enterprises were capable of irrigating in 1910 and the cost to July 1, 1910.

PER CENT OF TOTAL LAND AREA IRRIGATED, AND PER CENT OF NUMBER OF FARMS IRRIGATED, IN WASHINGTON, BY COUNTIES: 1909.

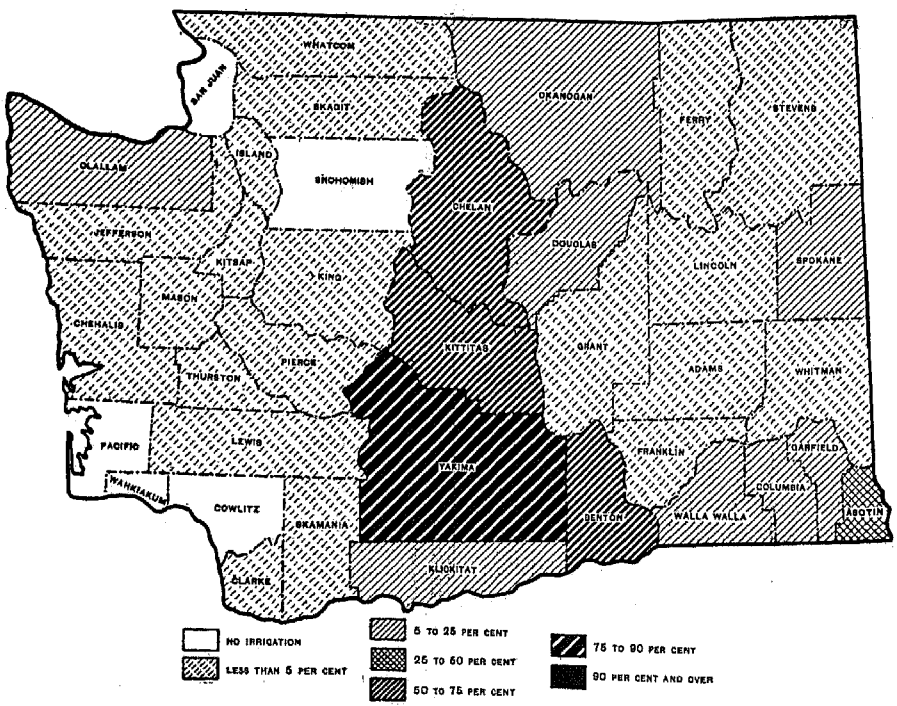
PER CENT OF TOTAL LAND AREA IRRIGATED.

[Per cent for the state, 0.8.]



PER CENT OF NUMBER OF FARMS IRRIGATED.

[Per cent for the state, 13.6.]



FARMS AND ACREAGE IRRIGATED.

Topographically, Washington is divided by the Cascade Mountains, which extend north and south across the state, into two parts which differ widely in climatic characteristics. West of the Cascades, the normal annual precipitation is heavy, and is ample in most sections for the maturing of crops without irrigation. East of the mountains, however, the climate is arid or semiarid, and it is in this portion of the state that irrigation is most widely practiced. Irrigation was reported in 1909 from all counties except 5, but 98.6 per cent of the total acreage irrigated in that year lies east of the Cascades. The location of the irrigated lands of the state is indicated in a general way by the accompanying maps, which show the class in which each county falls with reference to the percentage which irrigated land forms of the total land area and the percentage which irrigated farms represent of all farms.

The following table shows for the state as a whole the number of farms and the acreage irrigated in 1909, in comparison with the total number of farms, the total land area, the total land in farms, and the total acreage of improved land in farms in 1910, together with the areas not yet irrigated for which water has been or is being made available. Similar statistics for the census of 1900 are included as far as possible.

	CENSUS OF—		INCREASE.	
	1910	1900	Amount.	Per cent.
Number of all farms	[1] 56,192	[2] 33,202	22,990	69.2
Approximate land area of the state.....acres..	42,775,040	42,775,040	.....	.....
Land in farms.....acres..	[1] 11,712,235	[2] 8,499,297	3,212,938	37.8
Improved land in farms.....acres..	[1] 6,373,311	[2] 3,465,960	2,907,351	83.9
Number of farms irrigated	[3] 7,664	[4] 3,513	4,151	118.2
Acreage irrigated	[3] 334,378	[4] 135,470	198,908	146.8
Acreage enterprises were capable of irrigating	[5] 470,514	([6])	.....	.....
Acreage included in projects	[5] 817,032	([6])	.....	.....
Percentage irrigated of—				
Number of all farms	13.6	10.6	3.0	.....
Approximate land area of the state	0.8	0.3	0.5	.....
Land in farms	2.9	1.6	1.3	.....
Improved land in farms	5.2	3.9	1.3	.....
Excess of acreage enterprises were capable of irrigating in 1910 over acreage irrigated in 1909	136,136	.....	.....	.....
Excess of acreage included in projects over acreage irrigated in 1909	482,654	.....	.....	.....

[1] April 15. [2] June 1. [3] In 1909. [4] In 1899. [5] July 1. [6] Not reported.

Number of farms irrigated.—The number of farms irrigated is made up of the number reported on the supplemental schedules by the regular enumerators, together with an estimate of the number of farms covered by enterprises which were reported by special agents but not by the regular enumerators. This estimate was based upon the average acreage irrigated per farm shown by the supplemental schedules. According to the figures presented in the table, irrigation was practiced on slightly more than one-eighth (13.6 per cent) of the farms of the state in 1909. In 1899 the proportion of irrigated farms was 10.6 per cent, while in 1889 the proportion was 5.8 per cent. It is evident that between 1889 and 1899 the number of irrigated farms in the state increased much more rapidly than the number of unirrigated farms. During that period the rate of increase in the number of irrigated farms was more than three times as great as that in the number of unirrigated farms, while during the last decade irrigated farms increased almost twice as rapidly as unirrigated farms.

Of the 38 counties in the state, only 4 report as many as half their farms irrigated, 1 other county reports as many as 40 per cent, and 5 additional counties report more than 10 per cent of their farms irrigated. There are, however, 23 counties in which less than 10 per cent of the farms are reported as irrigated, and 5 counties from which irrigation is not reported. The last-mentioned counties are all in the western part of the state, whereas the counties in which the proportion of irrigated farms exceeds 50 per cent are in the central part. In 1 county the irrigated farms form more than 85 per cent of the whole number of farms, and in 2 others more than 70 per cent, the maximum proportion of irrigated farms being 88.3 per cent in Yakima County.

From 1899 to 1909 the increase in the number of farms irrigated was 118.2 per cent for the entire state. Four counties, the boundaries of which have not been changed since the Twelfth Census, show higher rates of gain. In addition the territory comprising Douglas County in 1900 and Douglas and Grant Counties in 1910 shows an increase of 254.5 per cent, while the territory comprising Klickitat and Yakima Counties in 1900 and Benton, Klickitat, and Yakima Counties in 1910 shows an increase of 166.7 per cent. The highest percentage of increase for any county in the state is 381.3 in Clallam County, which is the only western county reporting any considerable number of irrigated farms. In no county has the number of irrigated farms decreased.

Acreage irrigated.—The acreage irrigated is taken from the special schedules filled out by agents from information secured from owners or officials of irrigation enterprises and, in some instances, from public records. The acreage thus obtained is considerably larger than the irrigated acreage reported on the supplemental schedules filled out by the farm enumerators. This difference is due in a measure to the fact that the special agents found enterprises which were not reported on any schedules returned by the enumerators, indicating that the acreage reported on the supplemental schedules is short to some extent. There is, however, a natural tendency for the officials of irrigation enterprises to report as irrigated the entire area of farms of which only a part was irrigated. Furthermore, some farms are so situated as to receive water from more than one enterprise, and may be reported as irrigated by each, which results in duplication. Owing to the two causes last enumerated, it is probable that the acreage irrigated, as shown in this bulletin, is somewhat excessive; but the extent of this excess can not be determined. It is believed, however, to be less than 10 per cent for the state of Washington.

The total acreage reported as irrigated in 1909 was 334,378, against 135,470 in 1899 and 48,799 in 1889. The percentage of increase from 1889 to 1899 was 177.6, while from 1899 to 1909 it was 146.8. The absolute increase during the latter decade was the larger, however, amounting to 198,908 acres, compared with 86,671 acres during the earlier decade.

The percentage of increase between 1899 and 1909 in the acreage irrigated was considerably higher than the percentage of increase in the number of farms irrigated, the average acreage irrigated per farm increasing from 39 in 1899 to 44 in 1909. During the same period the average size of farms in the state decreased from 256 acres to 208 acres, which change, considered in connection with the increase in the acreage irrigated per farm, indicates that farmers are irrigating larger parts of their holdings than formerly. The same tendency is shown by the increase in the percentage irrigated of the total improved farm acreage. In 1899 this proportion was 3.9 per cent and in 1909 it was 5.2 per cent.

The percentage of the total land area of the state irrigated in 1909 was 0.8, as compared with 0.3 per cent in 1899 and 0.1 per cent in 1889.

In both 1899 and 1909 the greater part of the irrigated acreage reported for the state was situated in the valley of the Yakima River. The territory comprising Klickitat and Yakima Counties in 1900, and Benton, Klickitat, and Yakima Counties in 1910, together with Kittitas County, included in the former year 77.7 per cent and in the latter year 73.5 per cent of the total land irrigated in Washington, the acreages reported being, respectively, 105,219 and 245,640. In 1909 the irrigated area in Yakima County comprised 148,630 acres, or 44.4 per cent of the total for the state; that in Kittitas County 68,892, or 20.6 per cent; and that in Benton County 23,437, or 7 per cent. One other county, Chelan, reported an irrigated area in 1909 exceeding 20,000 acres, while three counties each had an irrigated area of between 10,000 and 20,000 acres.

In Kittitas and Yakima Counties the percentage which irrigated land formed of the total land area was the same, 4.6. In only one other county, Benton, was the proportion higher than 2 per cent, and in only three additional counties was it as high as 1 per cent.

Acreage included in projects.—The table shows that in 1910 existing enterprises were ready to supply water to 136,136 acres not irrigated in 1909. The acreage included in projects exceeds the acreage irrigated in 1909 by 482,654 acres, which is more than two and one-third times the acreage brought under irrigation in the last decade and nearly one and one-half times the total area irrigated in 1909. This acreage represents the area which will be available for the extension of irrigation in the next few years upon the completion of the projects now under construction. It indicates in a general way the area available for settlement, although much of this unirrigated land is in farms already settled.

Acreage irrigated, classified by character of enterprise.—The following table gives the distribution of the acreage irrigated in 1909 according to the character of the enterprise controlling the irrigation works. The state of Washington has never accepted the provisions of the Carey Act, and does not contain any irrigation districts.

CHARACTER OF ENTERPRISE.	ACREAGE IRRIGATED IN 1909.	
	Amount.	Per cent distribution.
All classes	334,378	100.0
U. S. Reclamation Service	55,690	16.7
U. S. Indian Service	35,000	10.5
Cooperative enterprises	81,122	24.3
Commercial enterprises	66,911	20.0
Individual and partnership enterprises	95,655	28.6

Cooperative enterprises, as well as individual and partnership enterprises, are controlled by the water users. These two classes supplied about 53 per cent of the acreage irrigated in 1909, while United States Reclamation Service enterprises, which are to be turned over to the water users, supplied 16.7 per cent. Thus less than one-third of the irrigated land is supplied by enterprises which are not either controlled by the water users or to be turned over to them ultimately. The cooperative enterprises, which supplied water for

24.3 per cent of the land irrigated, are principally stock companies, of which the stock is owned by the water users.

Acreage irrigated, classified by source of water supply.—The following table shows the distribution of the acreage irrigated in 1909 according to the source of water supply, with corresponding percentages. From this table it is apparent that up to the present time there has been little development of any source other than streams.

SOURCE OF WATER SUPPLY.	ACREAGE IRRIGATED IN 1909.	
	Amount.	Per cent distribution.
All sources	334,378	100.0
Streams	310,426	92.8
Lakes	10,782	3.2
Wells	8,664	2.6
Springs	4,207	1.3
Reservoirs	299	0.1

IRRIGATION WORKS.

The following statement summarizes the data collected relating to works for supplying water for irrigation in 1910:

	Amount.
Independent enterprises, number	1,934
Ditches, total length, miles	3,892
Main ditches, number	1,600
Length, miles	2,594
Capacity, cu. ft. per second	13,178
Lateral ditches, number	1,180
Length, miles	1,298
Reservoirs, number	156
Capacity, acre-feet	121,543
Flowing wells, number	55
Capacity, gals. per minute	18,926
Pumped wells, number	128
Capacity, gals. per minute	60,220
Pumping plants, number	391
Engine capacity, horsepower	13,847
Pump capacity, gals. per minute	365,411

The only item for which a figure from the earlier census is available for comparison is the length of main ditches, which for systems receiving water from streams in 1899 was 806 miles. As compared with this figure, the length of main ditches reported in 1910 represents an increase of 1,788 miles, or 221.8 per cent, which, however, is somewhat higher than the actual increase owing to the fact that the figures for 1910 cover enterprises receiving water from sources other than streams. Assuming that the enterprises in operation in 1909 were identical with those reported in 1910, the average number of acres irrigated per enterprise in 1909 was 172.9, and the acreage irrigated per mile of main ditch was 128.9. The acreage irrigated per mile of main ditch in 1899, exclusive of well systems, was 165.9.

There has been little utilization of underground water for irrigation up to this time. The table shows 55 flowing wells, which irrigated 3,227 acres in 1909; and 128 pumped wells, which irrigated 5,437 acres. Of the flowing wells, 40 are in Walla Walla and Yakima Counties, while more than half of the pumped wells are in Benton, Grant, and Spokane Counties.

Pumping for irrigation from either wells or streams has been but little practiced as yet, the total acreage supplied with pumped water in 1909 being only 20,606. Of this, 16,103 acres were reported from Benton, Grant, and Spokane Counties. The total engine capacity of the 391 pumping plants was 13,851 horsepower.

COST OF CONSTRUCTION, OPERATION, AND MAINTENANCE.

The table following shows the total cost of irrigation enterprises up to July 1, 1910, including construction of works and acquisition of rights but not operation and maintenance, with the average cost per acre, based on the acreage the enterprises were capable of irrigating in 1910; the estimated final cost of completed enterprises and those now under construction, with the average cost per acre, based on the acreage included in projects; and the total cost and average cost per acre of operation and maintenance in 1909. Data relating to the cost of the systems operated in 1899 are included for comparison.

The cost of operation and maintenance is not reported for individual and partnership enterprises, for the reason that farmers whose land is irrigated by such systems generally clean their own ditches at odd times without keeping any record of the time spent. In the case of the larger enterprises this cost represents a cash outlay by the farmers, while in the case of many of the smaller cooperative enterprises the cost is worked out by the farmers.

	CENSUS OF—		INCREASE.	
	1910	1900	Amount.	Per cent.
Cost of irrigation enterprises	[1] $16,219,149	[2] $1,722,369	$14,496,780	841.7
Average per acre	[3] $34.47	[4] $12.71	(5)	.....
Estimated final cost of existing enterprises	$22,322,856	(6)	.....	.....
Average per acre included in projects	$27.32	.....	.....	.....
Operation and maintenance:				
Acreage for which cost is reported	176,197	(6)	.....	.....
Total cost reported	[7] $543,312	(6)	.....	.....
Average cost per acre	$3.08	(6)	.....	.....

[1] Reported July 1, 1910.
[2] Cost of systems operated in 1899.
[3] Based on acreage enterprises were capable of irrigating in 1910.
[4] Based on acreage irrigated in 1899.
[5] Figures not comparable. (See explanation in text.)
[6] Not reported.
[7] For 1909.

The cost of irrigation systems shows the largest increase of any item included in the census of irrigation, 841.7 per cent. In the average cost per acre there was an increase of 171.2 per cent. The average cost per acre shown for the census of 1900 is based on the acreage irrigated in 1899 instead of the acreage

under ditch, as in 1910, the latter acreage not being reported in 1900. If computed on the basis of the acreage irrigated in 1909, the average cost in 1910 would be $48.51, representing an increase of 281.7 per cent over the figure for the average cost at the census of 1900. The year 1899 was near the close of the period of private and cooperative construction, when most of the works were built by the water users themselves, with little or no expenditure of money, and near the beginning of the present period of large-scale construction by corporations and the Federal Government. This later construction is not only on a larger scale, but also more difficult and of a better type. Largely as a result of these influences the average cost per acre of irrigation has greatly increased. A number of large enterprises are under construction, and on these considerable expenditures have been made, while but little land is irrigated as yet. This condition tends to make the average cost shown higher than the true average. The average based on the estimated final cost and the acreage included in projects, $27.32 per acre, probably more truly represents the average cost per acre of irrigation in Washington.

The county showing the lowest average cost per acre—$4.29—is Clallam, which lies in the extreme western portion of the state, where the development of irrigation has been on a small scale. Of the counties east of the Cascade Mountains that are shown separately in the general table, Columbia, Ferry, Kittitas, and Klickitat show the lowest figures for cost per acre—$5.73, $8.78, $9.42, and $9.84, respectively. The highest average cost per acre—$309.50—is reported from Asotin County, where expensive development of orchard lands has recently been undertaken.

The acreage for which cost of operation and maintenance in 1909 was reported constitutes 52.7 per cent of the total acreage reported as irrigated in 1909, and 73.8 per cent of the acreage reported as irrigated by other than individual and partnership enterprises. The cost reported can be said, therefore, to represent fairly the average annual expense for all but individual and partnership enterprises.

CROPS.

As previously stated, the data relating to irrigated crops are taken from supplemental schedules filled out by the regular census enumerators. Since the special agents found enterprises which the enumerators had not reported, it is evident that the information relating to irrigated crops is incomplete to some extent. It shows, however, the relative importance of the different irrigated crops and is sufficiently complete to give reliable averages of yields.

The table following shows the acreage, yield, and value of the principal crops reported on the supplemental irrigation schedules as grown under irrigation in 1909, in comparison with totals for the same crops reported for the entire state. While small quantities of other crops are grown, both on irrigated and unirrigated land, the leading crops of the state, as well as the leading crops grown under irrigation, are represented in the table.

CROP.	ACREAGE.			YIELD.			VALUE.	
	Total for state.	Irrigated.		Unit.	Total for state.	On irrigated land.	Total for state.	For irrigated land.
		Amount.	Per cent of total.					
Cereals:								
Corn	26,033	2,464	9.5	Bushels	563,025	87,357	$404,307	$65,965
Oats	269,742	6,690	2.5	Bushels	13,228,003	330,587	5,870,857	103,948
Wheat	2,118,015	6,720	0.3	Bushels	40,920,390	188,855	35,102,370	173,221
Barley	171,888	1,738	1.0	Bushels	5,834,615	49,143	3,331,930	30,474
Hay and forage:								
Timothy alone	88,298	17,326	19.6	Tons	143,461	33,642	2,168,916	536,944
Timothy and clover mixed	120,890	7,704	6.4	Tons	253,194	20,991	3,635,626	325,758
Clover alone	10,897	794	7.3	Tons	21,923	2,136	293,948	25,684
Alfalfa	94,900	74,496	78.5	Tons	357,595	296,614	3,667,991	3,156,699
Other tame or cultivated grasses [1]	29,028	1,054	3.6	Tons	43,143	1,625	599,016	22,325
Wild, salt, or prairie grasses	28,168	2,800	9.9	Tons	30,563	4,891	298,016	65,124
Grains cut green	358,543	5,340	1.5	Tons	499,055	9,417	6,225,515	123,354
Coarse forage	10,328	537	5.2	Tons	26,005	1,188	103,814	10,355
Sundry crops:								
Potatoes	57,897	9,178	15.9	Bushels	7,667,171	1,532,915	2,993,737	505,887
Sugar beets	[2] 1,270	246	19.4	Tons	[2] 6,556	244	[2] 38,007	1,755
Orchard fruits and grapes	[3]	17,378					[2] 4,325,536	1,767,186
Small fruits	[2] 5,508	1,232	22.4				[2] 941,415	171,867

[1] Includes millet or Hungarian grass. [2] Preliminary tabulation, subject to correction. [3] Agricultural returns show number of trees, not acreage.

Acreage.—Of the entire acreage of the crops for which totals are presented in the table, slightly less than 5 per cent is irrigated. This is due to the fact that in a large part of the state the climate is humid and irrigation is unnecessary. The proportion irrigated, however, varies widely for the different crops.

Less than 1 per cent of the acreage in cereals in the state is irrigated. The highest percentage of acreage irrigated shown for any cereal, 9.5 per cent, is for corn, but its total acreage is small. Oats rank next, with 2.5 per cent, and barley follows with 1 per cent. Of the acreage in wheat, which covers more than 80

per cent of the total acreage in cereals, only 0.3 per cent is irrigated.

The hay and forage crops are more generally irrigated, but the percentage irrigated of the total acreage in these crops is only 14.9. Alfalfa is grown principally on irrigated land, irrigated acreage forming 78.5 per cent of the total for this crop. The only other hay and forage crop with more than 10 per cent of its acreage irrigated is timothy, for which the proportion is 19.6 per cent.

Of the acreage in potatoes, 15.9 per cent is irrigated, and of those in small fruits and sugar beets 22.4 per cent and 19.4 per cent, respectively. The relative importance of the irrigated orchard acreage can not be determined, because the total acreage of orchards in the state is not reported, but it will be observed that 40.9 per cent of the value of all orchard fruits and grapes produced in the state is that of products grown on irrigated land.

Of the crops shown in the table, alfalfa covers the largest irrigated acreage, representing 47.8 per cent of the total for the crops given. Orchard fruits and grapes are next, with 11.2 per cent of this total; timothy is next with 11.1 per cent; and potatoes follow with 5.9 per cent. No other single crop comprises as much as 5 per cent of the irrigated acreage shown.

While most of the irrigated crops are well distributed geographically, there is a tendency toward the concentration of certain crops in particular localities. This is shown by the following statement, which gives the counties having the largest acreages of the principal irrigated crops, with the proportions which they contain of the total irrigated acreages of these crops in the state. Yakima and Kittitas Counties contain about 65 per cent of the total irrigated land in the state, and, naturally, lead in the acreage of most irrigated crops.

Corn.—Yakima County, 55 per cent; Chelan, 18.8 per cent; Okanogan, 9.7 per cent.

Oats.—Kittitas County, 60.9 per cent; Yakima, 30.9 per cent; Klickitat, 3.5 per cent.

Wheat.—Yakima County, 49.1 per cent; Kittitas, 36.1 per cent; Lincoln, 5.4 per cent.

Barley.—Yakima County, 58.9 per cent; Kittitas, 30.7 per cent; Columbia, 6.3 per cent.

Timothy alone.—Kittitas County, 74.3 per cent; Yakima, 15.5 per cent; Stevens, 3.3 per cent.

Timothy and clover mixed.—Kittitas County, 60.4 per cent; Yakima, 14.7 per cent; Klickitat, 12.3 per cent.

Clover alone.—Yakima County, 35.8 per cent; Benton, 16.5 per cent; Clallam, 13.1 per cent.

Alfalfa.—Yakima County, 54.1 per cent; Kittitas, 22.4 per cent; Okanogan, 5.5 per cent.

Wild, salt, or prairie grasses.—Kittitas County, 63.5 per cent; Yakima, 19.4 per cent; Klickitat, 12.4 per cent.

Grains cut green.—Yakima County, 37.2 per cent; Kittitas, 18.4 per cent; Okanogan, 10.7 per cent.

Potatoes.—Yakima County, 67.1 per cent; Kittitas, 9 per cent; Benton, 6.3 per cent.

Sugar beets.—Spokane County, 81.7 per cent; Yakima, 18.3 per cent.

Orchard fruits and grapes.—Yakima County, 38.7 per cent; Chelan, 36.6 per cent; Walla Walla, 6.3 per cent.

Small fruits.—Yakima County, 30.8 per cent; Benton, 23.7 per cent; Walla Walla, 8.1 per cent.

Of the irrigated acreage of orchards not bearing in 1909, amounting to 30,505 acres, 47.4 per cent was in Yakima County, 17.8 per cent in Chelan County, and 14.1 per cent in Benton County.

Yield.—In the following table the average yields per acre of crops extensively grown, both with and without irrigation, are shown. The yields on unirrigated land are obtained by subtracting the totals for irrigated crops from the totals for the state:

CROP.	AVERAGE YIELD PER ACRE.		
	On unirrigated land.	On irrigated land.	
		Amount.	Per cent of excess over yield on unirrigated land.[1]
Corn.....bushels..	20.2	35.5	75.7
Oats.....bushels..	49.0	49.4	0.8
Wheat.....bushels..	19.3	28.1	45.7
Barley.....bushels..	34.0	28.3	—16.8
Timothy alone.....tons..	1.55	1.94	25.2
Timothy and clover mixed.....tons..	2.05	2.72	32.7
Clover alone.....tons..	1.96	2.69	37.2
Alfalfa.....tons..	2.99	3.98	33.1
Wild, salt, or prairie grasses.....tons..	1.01	1.75	73.3
Grains cut green.....tons..	1.39	1.76	26.6
Potatoes.....bushels..	125.9	167.0	32.6

[1] A minus sign (—) indicates that the yield on irrigated land is less than that on unirrigated land.

All the crops given in the table except barley show greater yields per acre in 1909 on irrigated land than on unirrigated land, and the excess shown in the average yield on irrigated land is more than 25 per cent for all except oats. The difference is greatest in the average production of corn, which, however, covers only a small acreage. In the case of alfalfa, which comprises nearly one-half of the total irrigated acreage, the yield on irrigated land is 33.1 per cent greater than that on unirrigated land. For timothy, the crop next in importance with respect to irrigated acreage of those for which comparisons are possible, an excess of 25.2 per cent is shown in the yield under irrigation.

In considering these comparisons it should be borne in mind that they are not comparisons of yields on irrigated and on unirrigated land in the same localities, but of yields under irrigation in localities where crops can not be grown to advantage without it, with yields in localities where irrigation is not necessary. They do not indicate, therefore, the relative advantages of farming with and without irrigation in a given community, but rather give one factor for determining the relative advantages of farming where irrigation is necessary and where it is not necessary for the successful growing of crops.

COUNTY TABLE.

The next table gives in detail, by counties, the data summarized above, except those relating to crops. For purposes of comparison the total number of farms in the state, the approximate land area of the state, the total land in farms, and the improved land in farms have been included in the table.

Five counties—Cowlitz, Pacific, San Juan, Snohomish, and Wahkiakum—did not report any irrigation in 1909, but as regards the items just mentioned the figures for these counties are included in the state totals and also in the totals shown under the head of "All other counties," in the last column of the table. The group of "All other counties" comprises for 1909 and 1910 all but one of the counties west of the Cascades, including in addition to the five counties named thirteen in which there was some irrigation, namely, Chehalis, Clarke, Island, Jefferson, King, Kitsap, Lewis, Mason, Pierce, Skagit, Skamania, Thurston, and Whatcom. In this section of the state, as already explained, irrigation is comparatively unimportant. The counties represented under the head of "All other counties" for 1899 in the Twelfth Census report were not named, but were practically all in the western part of the state.

In the tables in the Twelfth Census report showing the number of farms and acreage irrigated in 1899 the group designated "All other counties" included Franklin County, but not Clallam and King Counties, while in the table showing length of main ditches in 1899 and cost of systems operated in 1899 it included Clallam and King Counties, but not Franklin. In the present bulletin figures for farms and acreage irrigated in King County have been added to the totals shown under the head of "All other counties" for 1900, but for all the other items the figures are the same as were shown under this head in the 1900 report. The figure for average cost per acre irrigated in 1899 is based on the acreage irrigated from streams in the counties for which the cost in 1899 is included under the head of "All other counties."

Certain enterprises extend into more than one county, and in the case of some of these enterprises the reports do not segregate the data by counties. In such cases a distribution has been made according to the best estimates possible from all the information in the possession of the Bureau. It is believed that these estimates are approximately correct.

Change of boundaries.—In comparing the data secured in 1910 with those for 1900, the following changes in county boundaries should be considered: Benton County was organized from parts of Klickitat and Yakima Counties in 1905, and Grant County was organized from a part of Douglas County in 1909.

ACREAGE IRRIGATED, EXTENT AND COST OF IRRIGATION ENTERPRISES, AND COST OF OPERATION AND MAINTENANCE, BY COUNTIES: 1909 AND 1910.

[Comparative data for 1899 in italics.]

		The State.	Adams.	Asotin.	Benton.	Chelan.	Clallam.	Columbia.
1	Number of all farms in 1910	56,192	1,263	555	1,239	1,661	607	703
2	Number of farms irrigated in 1909	7,664	20	238	768	1,189	77	56
3	Per cent of all farms	13.6	1.6	42.9	62.0	71.6	12.7	8.0
4	*Number of farms irrigated in 1899*	*3,513*	*12*	*222*	(1)	*309*	*16*	*25*
5	Per cent of increase, 1899–1909	118.2	66.7	7.2	.....	284.8	381.3	124.0
	LAND AND FARM AREA							
6	Approximate land area, acres	42,775,040	1,223,680	387,840	1,069,440	1,856,000	1,104,640	549,120
7	Land in farms, acres	11,712,235	979,455	189,987	260,044	152,613	62,248	314,557
8	Improved land in farms, acres	6,373,311	747,778	79,265	186,397	42,251	16,708	180,562
9	Acreage irrigated in 1909	334,378	1,523	3,179	23,437	23,020	4,265	2,174
10	Per cent of total land area	0.8	0.1	0.8	2.2	1.3	0.4	0.4
11	Per cent of land in farms	2.9	0.2	1.7	9.0	15.5	6.9	0.7
12	Per cent of improved land in farms	5.2	0.2	4.0	12.6	55.9	25.5	1.2
13	*Acreage irrigated in 1899*	*135,470*	*423*	*1,698*	(1)	*6,406*	*127*	*440*
14	Per cent of increase, 1899–1909	146.8	260.0	87.2	.....	268.7	3,258.3	394.1
15	Acreage enterprises were capable of irrigating in 1910	470,514	1,655	5,373	50,653	27,979	4,405	2,797
16	Acreage included in projects	317,032	5,123	9,844	87,384	53,497	9,975	3,022
	ACREAGE IRRIGATED AND INCLUDED IN PROJECTS							
	Classified by Character of Enterprise.							
17	**U. S. Reclamation Service**, irrigated in 1909	55,690	.....	.....	5,777	.....	.....	.....
18	Enterprises were capable of irrigating in 1910	74,500	.....	.....	6,111	.....	.....	.....
19	Included in projects	143,096	.....	.....	10,955	.....	.....	.....
20	**U. S. Indian Service**, irrigated in 1909	35,000	.....	.....	.....	.....	.....	.....
21	Enterprises were capable of irrigating in 1910	50,000	.....	.....	.....	.....	.....	.....
22	Included in projects	100,000	.....	.....	.....	.....	.....	.....
23	**Carey Act enterprises**, irrigated in 1909	.....	.....	.....	.....	.....	.....	.....
24	Enterprises were capable of irrigating in 1910	.....	.....	.....	.....	.....	.....	.....
25	Included in projects	.....	.....	.....	.....	.....	.....	.....
26	**Irrigation districts**, irrigated in 1909	.....	.....	.....	.....	.....	.....	.....
27	Enterprises were capable of irrigating in 1910	.....	.....	.....	.....	.....	.....	.....
28	Included in projects	.....	.....	.....	.....	.....	.....	.....
29	**Cooperative enterprises**, irrigated in 1909	81,122	.....	400	152	5,830	4,100	165
30	Enterprises were capable of irrigating in 1910	90,805	.....	400	152	6,255	4,200	200
31	Included in projects	115,410	.....	700	312	7,170	9,600	290
32	**Commercial enterprises**, irrigated in 1909	66,911	1,000	2,125	16,180	10,226	.....	.....
33	Enterprises were capable of irrigating in 1910	138,064	1,000	4,300	41,974	11,930	.....	.....
34	Included in projects	266,216	4,000	8,300	72,264	31,260	.....	.....
35	**Individual and partnership enterprises**, irrigated in 1909	95,655	523	654	1,328	7,564	165	2,009
36	Enterprises were capable of irrigating in 1910	117,145	655	673	2,416	9,794	205	2,597
37	Included in projects	192,310	1,123	844	3,853	15,067	375	3,032
	ACREAGE IRRIGATED							
	Classified by Source of Water Supply.							
38	Supplied from streams	310,426	1,409	3,149	22,618	22,793	4,175	2,083
39	By gravity	301,341	1,379	3,147	17,769	22,329	4,175	2,072
40	By pumping	9,085	30	2	4,849	464	.....	11
41	Supplied from lakes	10,782	10	.....	.....	47	.....	.....
42	By gravity	4,098	.....	.....	.....	.....	.....	.....
43	By pumping	6,684	10	.....	.....	47	.....	.....
44	Supplied from wells	8,664	93	.....	807	94	.....	.....
45	Flowing	3,227	.....	.....	171	24	.....	.....
46	By pumping	5,437	93	.....	636	70	.....	.....
47	Supplied from springs	4,207	11	30	12	678	90	91
48	Supplied from reservoirs	299	.....	.....	.....	8	.....	.....
49	Total acreage supplied by pumping	20,606	133	2	5,485	581	.....	11
	IRRIGATION ENTERPRISES							
50	Independent enterprises, number	1,934	19	22	74	260	7	42
51	*Number in 1899*	(2)	.....	.....	.....	.....	.....	.....
52	Per cent of increase, 1899–1910	.....	.....	.....	.....	.....	.....	.....
53	Main ditches, number	1,600	12	18	50	227	7	43
54	*Number in 1899*	(2)	.....	.....	.....	.....	.....	.....
55	Per cent of increase, 1899–1910	.....	.....	.....	.....	.....	.....	.....
56	Length, miles	2,594	24	40	130	357	17	36
57	*Length in 1899* [3] , miles	*806*	*4*	*23*	(1)	*112*	(4)	*7*
58	Per cent of increase, 1899–1910	221.8	500.0	73.9	.....	218.8	.....	414.3
59	Capacity, cubic feet per second	13,178	185	76	1,099	1,219	281	211
60	Laterals, number	1,180	8	10	70	132	19	30
61	Length, miles	1,298	7	64	119	122	19	4
62	Reservoirs, number	156	1	3	2	36	.....	.....
63	Capacity, acre-feet	121,543	10,000	1,160	(5)	12,748	.....	.....
64	Flowing wells, number	55	.....	.....	4	.....	.....	.....
65	Capacity, gallons per minute	18,926	.....	.....	1,290	.....	.....	.....
66	Pumped wells, number	128	5	.....	31	8	.....	1
67	Capacity, gallons per minute	60,220	1,873	.....	10,158	564	.....	1,500
68	Pumping plants, number	391	8	1	84	54	.....	3
69	Engine capacity, horsepower	13,847	133	2	5,894	2,624	.....	58
70	Pump capacity, gallons per minute	365,411	3,223	42	147,059	14,777	.....	1,020
	COST							
71	Cost of enterprises up to July 1, 1910, dollars	16,219,149	171,946	1,662,958	3,211,493	889,152	18,900	16,027
72	*Cost in 1899* [6] , dollars	*1,722,369*	*1,293*	*82,089*	(1)	*84,252*	(4)	*1,668*
73	Per cent of increase, 1899–1910	841.7	13,198.2	1,925.8	.....	955.3	.....	860.9
74	Average cost per acre enterprises were capable of irrigating in 1910, dollars	34.47	103.89	309.50	63.40	31.78	4.29	5.73
75	*Average cost per acre irrigated in 1899* [6] , dollars	*12.71*	*3.06*	*48.34*	(1)	*13.16*	.....	*3.79*
76	Estimated final cost of existing enterprises, dollars	22,322,856	171,946	1,662,958	3,565,877	1,340,835	18,900	16,027
77	Average per acre included in projects, dollars	27.32	33.56	168.93	40.81	25.06	1.89	4.09
	OPERATION AND MAINTENANCE							
78	Acreage for which cost is reported	176,197	1,000	2,525	17,714	8,756	4,100	165
79	Total cost reported, dollars	543,312	2,000	92,216	274,253	14,702	1,000	400
80	Average per acre for which cost is reported, dollars	3.08	2.00	36.52	15.48	1.68	0.24	2.42
81	*Average cost per acre in 1899*	(2)	.....	.....	.....	.....	.....	.....
82	Per cent of increase, 1899–1909	.....	.....	.....	.....	.....	.....	.....

[1] Change of boundary. (See explanation at close of text.)
[2] Not reported in 1899.
[3] Figures relate only to systems obtaining water from streams.
[4] Not shown separately.
[5] Less than 1 acre-foot.
[6] State total includes $43,050 representing cost of well systems not distributed by counties, and also $197,000 reported for Spokane and Yakima Indian Reservations, not segregated, while county figures relate only to systems obtaining water from streams.

ACREAGE IRRIGATED, EXTENT AND COST OF IRRIGATION ENTERPRISES,

[Comparative data for 1899 in italics.]

		Douglas.[1]	Ferry.	Franklin.	Garfield.	Grant.	Kittitas.	Klickitat.[1]	Lincoln.
1	Number of all farms in 1910	1,730	590	620	504	1,607	871	1,641	2,130
2	Number of farms irrigated in 1909	146	20	21	54	49	639	169	77
3	Per cent of all farms	8.4	3.4	3.4	10.7	3.0	73.4	10.3	3.6
4	*Number of farms irrigated in 1899*	*55*	*16*	(2)	*25*	(1)	*549*	*151*	*54*
5	Per cent of increase, 1899–1909	.....	25.0	.....	116.0	.....	16.4	.....	42.6
	LAND AND FARM AREA								
6	Approximate land area—acres	1,143,680	1,420,800	771,840	444,160	1,740,800	1,490,560	1,168,000	1,473,280
7	Land in farms—acres	711,831	101,050	387,832	314,009	647,999	262,605	530,291	1,209,910
8	Improved land in farms—acres	472,625	20,037	273,241	155,531	444,622	78,939	181,581	799,380
9	Acreage irrigated in 1909	3,317	397	330	1,316	3,230	68,892	4,681	2,217
10	Per cent of total land area	0.3	(3)	0.1	0.3	0.2	4.6	0.4	0.2
11	Per cent of land in farms	0.5	0.4	0.2	0.4	0.5	26.2	0.9	0.2
12	Per cent of improved land in farms	0.7	2.0	0.3	0.8	0.7	87.3	2.6	0.3
13	*Acreage irrigated in 1899*	*2,627*	*625*	(2)	*328*	(1)	*47,373*	*1,286*	*1,069*
14	Per cent of increase, 1899–1909	.....	36.5	.....	301.2	.....	45.4	.....	107.4
15	Acreage enterprises were capable of irrigating in 1910	8,365	4,258	1,276	1,728	8,501	72,348	7,461	2,404
16	Acreage included in projects	12,826	5,271	2,113	2,283	14,456	92,940	18,590	2,935
	ACREAGE IRRIGATED AND INCLUDED IN PROJECTS								
	CLASSIFIED BY CHARACTER OF ENTERPRISE.								
17	**U. S. Reclamation Service**, irrigated in 1909	.....	.....	.....	.....	.....	.....	.....	.....
18	Enterprises were capable of irrigating in 1910	.....	.....	.....	.....	.....	.....	.....	.....
19	Included in projects	.....	.....	.....	.....	.....	.....	.....	.....
20	**U. S. Indian Service**, irrigated in 1909	.....	.....	.....	.....	.....	.....	.....	.....
21	Enterprises were capable of irrigating in 1910	.....	.....	.....	.....	.....	.....	.....	.....
22	Included in projects	.....	.....	.....	.....	.....	.....	.....	.....
23	**Carey Act enterprises**, irrigated in 1909	.....	.....	.....	.....	.....	.....	.....	.....
24	Enterprises were capable of irrigating in 1910	.....	.....	.....	.....	.....	.....	.....	.....
25	Included in projects	.....	.....	.....	.....	.....	.....	.....	.....
26	**Irrigation districts**, irrigated in 1909	.....	.....	.....	.....	.....	.....	.....	.....
27	Enterprises were capable of irrigating in 1910	.....	.....	.....	.....	.....	.....	.....	.....
28	Included in projects	.....	.....	.....	.....	.....	.....	.....	.....
29	**Cooperative enterprises**, irrigated in 1909	.....	.....	.....	.....	.....	29,730	760	334
30	Enterprises were capable of irrigating in 1910	610	.....	.....	.....	.....	30,035	1,625	394
31	Included in projects	750	.....	.....	.....	.....	31,140	4,300	474
32	**Commercial enterprises**, irrigated in 1909	1,820	.....	.....	.....	1,400	9,200	207	.....
33	Enterprises were capable of irrigating in 1910	5,495	3,500	55	.....	5,400	10,200	685	.....
34	Included in projects	9,075	4,200	350	.....	5,560	15,200	3,560	.....
35	**Individual and partnership enterprises**, irrigated in 1909	1,497	397	330	1,316	1,330	29,962	3,714	1,883
36	*Enterprises were capable of irrigating in 1910*	*2,260*	*758*	*1,221*	*1,728*	*3,101*	*32,113*	*5,151*	*2,010*
37	Included in projects	3,001	1,071	1,763	2,283	8,896	46,600	10,730	2,461
	ACREAGE IRRIGATED								
	CLASSIFIED BY SOURCE OF WATER SUPPLY.								
38	Supplied from streams	2,699	372	747	1,183	1,205	68,084	4,174	2,166
39	By gravity	2,241	372	.....	1,058	735	67,729	4,126	1,986
40	By pumping	458	.....	747	125	470	355	48	180
41	Supplied from lakes	.....	.....	.....	.....	1,325	.....	40	.....
42	By gravity	.....	.....	.....	.....	65	.....	40	.....
43	By pumping	.....	.....	.....	.....	1,260	.....	.....	.....
44	Supplied from wells	26	13	53	.....	447	.....	39	51
45	Flowing	6	.....	.....	.....	3	.....	10	.....
46	By pumping	20	13	53	.....	444	.....	29	51
47	Supplied from springs	592	.....	30	133	133	808	428	.....
48	Supplied from reservoirs	.....	12	.....	.....	120	.....	.....	.....
49	Total acreage supplied by pumping	478	13	800	125	2,174	355	77	231
	IRRIGATION ENTERPRISES								
50	Independent enterprises—number	45	20	21	47	43	257	115	48
51	*Number in 1899*	.....	.....	.....	.....	.....	.....	.....	.....
52	Per cent of increase, 1899–1910	.....	.....	.....	.....	.....	.....	.....	.....
53	Main ditches—number	33	20	8	42	23	206	87	41
54	*Number in 1899*	.....	.....	.....	.....	.....	.....	.....	.....
55	Per cent of increase, 1899–1910	.....	.....	.....	.....	.....	.....	.....	.....
56	Length of main ditches—miles	31	24	7	41	41	387	108	31
57	*Length in 1899*[5]—miles	*22*	*8*	*1*	*3*	(1)	*118*	*16*	*9*
58	Per cent of increase, 1899–1910	.....	200.0	600.0	1,266.7	.....	228.0	.....	244.4
59	Capacity—cubic feet per second	49	129	44	120	87	1,530	596	92
60	Laterals—number	26	4	.....	5	22	143	65	24
61	Length—miles	8	1	.....	1	17	56	23	3
62	Reservoirs—number	4	1	.....	2	10	3	11	3
63	Capacity—acre-feet	39	700	.....	1	84	35,000	12	(6)
64	Flowing wells—number	2	.....	.....	.....	2	.....	1	.....
65	Capacity—gallons per minute	25	.....	.....	.....	7	.....	14	.....
66	Pumped wells—number	1	1	5	.....	14	.....	12	5
67	Capacity—gallons per minute	850	13	1,845	.....	2,606	.....	278	450
68	Pumping plants—number	18	2	22	5	26	3	19	8
69	Engine capacity—horsepower	406	12	298	90	417	207	45	184
70	Pump capacity—gallons per minute	12,713	278	12,335	2,660	23,785	11,700	919	3,170
	COST								
71	Cost of enterprises up to July 1, 1910—dollars	488,941	37,406	36,561	23,503	166,510	681,168	73,434	28,434
72	*Cost in 1899*[5]—dollars	*18,740*	*1,707*	*210*	*858*	(1)	*119,706*	*4,282*	*1,208*
73	*Per cent of increase, 1899–1910*—dollars	.....	2,091.3	17,310.0	2,639.3	.....	469.0	.....	2,090.6
74	Average cost per acre enterprises were capable of irrigating in 1910—dollars	58.45	8.78	28.65	13.60	19.59	9.42	9.84	11.83
75	*Average cost per acre irrigated in 1899*[5]—dollars	*7.19*	*2.73*	*6.18*	*3.24*	(1)	*2.53*	*3.85*	*1.21*
76	Estimated final cost of existing enterprises—dollars	488,941	37,406	36,561	23,503	191,510	681,168	89,434	28,434
77	Average cost per acre included in projects—dollars	38.12	7.10	17.30	10.29	13.25	7.33	4.81	9.69
	OPERATION AND MAINTENANCE								
78	Acreage for which cost is reported	320	.....	.....	.....	400	38,730	310	334
79	Total cost reported—dollars	1,550	.....	.....	.....	1,465	28,660	25	515
80	Average per acre for which cost is reported—dollars	4.84	.....	.....	.....	3.66	0.74	0.08	1.54
81	*Average cost per acre in 1899*	.....	.....	.....	.....	.....	.....	.....	.....
82	Per cent of increase, 1899–1909	.....	.....	.....	.....	.....	.....	.....	.....

[1] Change of boundary. (See explanation at close of text.)

[2] Not shown separately.

[3] Less than one-tenth of 1 per cent.

AND COST OF OPERATION AND MAINTENANCE, BY COUNTIES: 1909 AND 1910.

[Comparative data for 1899 in italics.]

		Okanogan.	Spokane.	Stevens.	Walla Walla.	Whitman.	Yakima.[1]	All other counties.
1	Number of all farms in 1910	2,173	3,947	3,196	1,383	3,096	3,341	23,326
2	Number of farms irrigated in 1909	397	287	126	273	46	2,951	61
3	Per cent of all farms	18.3	7.3	3.9	19.7	1.5	88.3	0.3
4	*Number of farms irrigated in 1899*	*251*	*74*	*104*	*231*	*44*	*1,807*	*68*
5	Per cent of increase, 1899–1909	58.2	287.8	21.2	18.2	4.5		
	LAND AND FARM AREA							
6	Approximate land area—acres	3,341,440	1,123,840	2,474,240	809,600	1,340,120	3,237,760	14,595,200
7	Land in farms—acres	379,766	682,330	521,259	739,699	1,187,966	320,921	1,755,263
8	Improved land in farms—acres	122,386	361,958	116,872	479,660	923,820	176,410	513,288
9	Acreage irrigated in 1909	15,238	12,143	3,510	10,008	1,377	148,630	394
10	Per cent of total land area	0.5	1.1	0.1	1.2	0.1	4.6	[2]
11	Per cent of land in farms	4.0	1.8	0.7	1.4	0.1	46.3	[2]
12	Per cent of improved land in farms	12.5	3.4	3.0	2.1	0.1	84.3	0.1
13	*Acreage irrigated in 1899*	*6,377*	*858*	*1,926*	*6,100*	*863*	*56,611*	384
14	Per cent of increase, 1899–1909	139.0	1,315.3	82.2	64.1	59.6		
15	Acreage enterprises were capable of irrigating in 1910	31,670	17,140	13,235	20,954	1,705	186,050	557
16	Acreage included in projects	*53,012*	*52,330*	*15,510*	*39,622*	*3,057*	*331,455*	*887*
	ACREAGE IRRIGATED AND INCLUDED IN PROJECTS							
	CLASSIFIED BY CHARACTER OF ENTERPRISE.							
17	**U. S. Reclamation Service,** irrigated in 1909	3,690					46,223	
18	Enterprises were capable of irrigating in 1910	9,500					58,880	
19	Included in projects	10,000					122,141	
20	**U. S. Indian Service,** irrigated in 1909						35,000	
21	Enterprises were capable of irrigating in 1910						50,000	
22	Included in projects						100,000	
23	**Carey Act enterprises,** irrigated in 1909							
24	Enterprises were capable of irrigating in 1910							
25	Included in projects							
26	**Irrigation districts,** irrigated in 1909							
27	Enterprises were capable of irrigating in 1910							
28	Included in projects							
29	**Cooperative enterprises,** irrigated in 1909	1,015	400	200	600		37,436	
30	Enterprises were capable of irrigating in 1910	1,705	450	300	870		43,609	
31	Included in projects	4,571	640	500	908		54,055	
32	**Commercial enterprises,** irrigated in 1909	1,943	11,120	230	4,660		6,800	
33	Enterprises were capable of irrigating in 1910	7,499	15,605	8,410	14,150		7,900	
34	Included in projects	14,890	49,647	8,760	30,150		9,000	
35	**Individual and partnership enterprises,** irrigated in 1909	8,590	623	3,080	4,748	1,377	23,171	394
36	Enterprises were capable of irrigating in 1910	13,005	1,085	4,525	5,934	1,705	25,652	557
37	Included in projects	23,551	2,043	6,250	8,564	3,057	46,259	887
	ACREAGE IRRIGATED							
	CLASSIFIED BY SOURCE OF WATER SUPPLY.							
38	Supplied from streams	12,834	1,166	3,102	8,077	1,199	146,876	315
39	By gravity	12,478	1,112	3,080	7,800	1,074	146,442	237
40	By pumping	356	54	22	277	125	434	78
41	Supplied from lakes	2,044	7,274	40				2
42	By gravity	2,029	2,524	40				
43	By pumping	15	4,750					2
44	Supplied from wells		3,642		1,832		1,547	20
45	Flowing		2		1,726		1,282	3
46	By pumping		3,640		106		265	17
47	Supplied from springs	201	61	368	99	178	207	57
48	Supplied from reservoirs	159						
49	Total acreage supplied by pumping	371	8,444	22	383	125	699	97
	IRRIGATION ENTERPRISES							
50	Independent enterprises—number	255	55	91	136	36	280	61
51	*Number in 1899*							
52	Per cent of increase, 1899–1910							
53	Main ditches—number	238	50	91	100	36	242	26
54	*Number in 1899*							
55	Per cent of increase, 1899–1910							
56	Length of main ditches—miles	321	124	133	140	30	564	8
57	*Length in 1899*[5]—miles	*76*	*10*	*27*	*33*	*15*	*318*	*4*
58	Per cent of increase, 1899–1910	322.4	1,140.0	392.6	324.2	100.0		
59	Capacity—cubic feet per second	1,845	625	374	913	68	3,615	20
60	Laterals—number	171	44	78	68	14	247	
61	Length—miles	96	93	10	105	4	540	
62	Reservoirs—number	38	18	3	10	2	2	7
63	Capacity—acre-feet	25,727	1,536	20	4	11	34,500	1
64	Flowing wells—number		5		13		27	1
65	Capacity—gallons per minute		1		12,502		5,069	18
66	Pumped wells—number	2	30		1		9	3
67	Capacity—gallons per minute	188	33,929		4,500		1,382	84
68	Pumping plants—number	25	32	2	30	6	18	19
69	Engine capacity—horsepower	299	1,033	23	1,452	63	270	37
70	Pump capacity—gallons per minute	9,983	42,046	275	62,987	2,179	11,812	1,248
	COST							
71	Cost of enterprises up to July 1, 1910—dollars	1,119,447	946,307	244,466	1,166,120	53,720	5,159,024	23,632
72	*Cost in 1899*[5]—dollars	*36,474*	*41,850*	*7,564*	*23,073*	*8,855*	*1,046,900*	*1,500*
73	Per cent of increase, 1899–1910	2,969.2	2,161.2	3,132.0	4,954.0	506.7		
74	Average cost per acre enterprises were capable of irrigating in 1910—dollars	35.35	55.21	18.47	55.65	31.51	27.73	42.43
75	*Average cost per acre irrigated in 1899*[5]—dollars	*5.73*	*62.37*	*3.93*	*3.87*	*11.68*	*22.56*	*3.78*
76	Estimate final cost of existing enterprises—dollars	1,220,118	946,307	244,466	1,393,370	53,720	10,078,743	23,632
77	Average cost per acre included in projects—dollars	23.19	18.08	15.76	35.17	17.57	30.41	26.64
	OPERATION AND MAINTENANCE							
78	Acreage for which cost is reported	6,228	8,420	200	350		86,645	
79	Total cost reported—dollars	8,495	29,252	300	442		88,037	
80	Average per acre for which cost is reported—dollars	1.36	3.47	1.50	1.26		1.02	
81	*Average cost per acre in 1899*							
82	Per cent of increase, 1899–1909							

[1] Decrease.

[5] Figures relate only to systems obtaining water from streams.

[6] Less than 1 acre-foot.

THIRTEENTH CENSUS OF THE UNITED STATES: 1910

DEPARTMENT OF COMMERCE AND LABOR

BULLETIN

BUREAU OF THE CENSUS
E. DANA DURAND, DIRECTOR

IRRIGATION : WYOMING

FARMS AND ACREAGE IRRIGATED, IRRIGATION WORKS, COST OF CONSTRUCTION, COST OF OPERATION AND MAINTENANCE, AND CROPS IRRIGATED

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INTRODUCTION.

This bulletin presents the larger part of the statistics of irrigation for Wyoming obtained in connection with the Thirteenth Census. These data, with additional information, will be embodied in a special report of the Census of Irrigation and in the final reports of the Thirteenth Census. The statistics of the number of farms and acreage irrigated, cost of operation and maintenance, and irrigated crops are for the calendar year 1909; those of irrigation works, cost of enterprises, acreage enterprises were capable of irrigating in 1910, and acreage included in projects are of the date July 1, 1910.

These statistics have been collected under the law of February 25, 1910, which contained the following clause relating to irrigation:

> Inquiries shall also be made as to the location and character of irrigation enterprises, quantity of land irrigated in the arid region of the United States and in each state and county in that section under state and Federal laws; the price at which these lands, including water rights, are obtainable; the character and value of crops produced on irrigated lands, the amount of water used per acre for said irrigation and whether it was obtainable from national, state, or private works; the location of the various projects and methods of construction, with facts as to their physical condition; the amount of capital invested in such irrigation works.

The information called for by this law which could be supplied by farm operators was obtained on supplemental schedules by the regular census enumerators as a part of the agricultural census. The remaining data, which were supplied by the owners or officials of irrigation enterprises, were obtained on special schedules by special agents. The data relating to number of farms irrigated and irrigated crops are taken from the supplemental schedules, while all data relating to acreage irrigated and to irrigation works and their construction and operation are taken from the special schedules.

In accordance with the law, the data collected have been classified primarily by the state and Federal laws by virtue of which the land was brought under irrigation. The results are presented in detail at the end of this bulletin and summarized in text tables.

Such of the terms used as are not self-explanatory are defined below.

Farms irrigated.—The number of "farms irrigated" is the number of farms on which irrigation is practiced and is equivalent to the term "number of irrigators" used in previous census reports.

Types of enterprise.—The types of enterprise under which the lands irrigated in 1909 are classified are as follows:

United States Reclamation Service enterprises, which operate under the Federal law of June 17, 1902, providing for the construction of irrigation works with the receipts from the sale of public lands.

United States Indian Service enterprises, which operate under various acts of Congress providing for the construction by that service of works for the irrigation of land in Indian reservations.

Carey Act enterprises, which operate under the Federal law of August 18, 1894, granting to each of the states in the arid region 1,000,000 acres of land on condition that the state provide for its irrigation, and under amendments to that law granting additional areas to Idaho and Wyoming.

Irrigation districts, which are public corporations that operate under state laws providing for their organization and management, and empowering them to issue bonds and levy and collect taxes with the object of obtaining funds for the purchase or construction, and for the operation and maintenance of irrigation works.

Cooperative enterprises, which are controlled by the water users under some organized form of cooperation. The most common form of organization is the stock company, the stock of which is owned by the water users.

Commercial enterprises, which supply water for compensation to parties who own no interest in the works. Persons obtaining water from such enterprises are usually required to pay for the right to receive water, and to pay, in addition, annual charges based in some instances on the acreage irrigated and in others on the quantity of water received.

Individual and partnership enterprises, which belong to individual farmers or to neighboring farmers, who control them without formal organization. It is not always possible to distinguish between partnership and cooperative enterprises, but as the difference is slight this is unimportant.

Source of water supply.—Of the terms used in the classification according to source of water supply, none requires explanation except "reservoirs." The only reservoirs which are treated as independent sources of supply are those filled by collecting storm water or from watercourses that are ordinarily dry. When reservoirs are filled from streams or wells, the primary source is considered the source of supply.

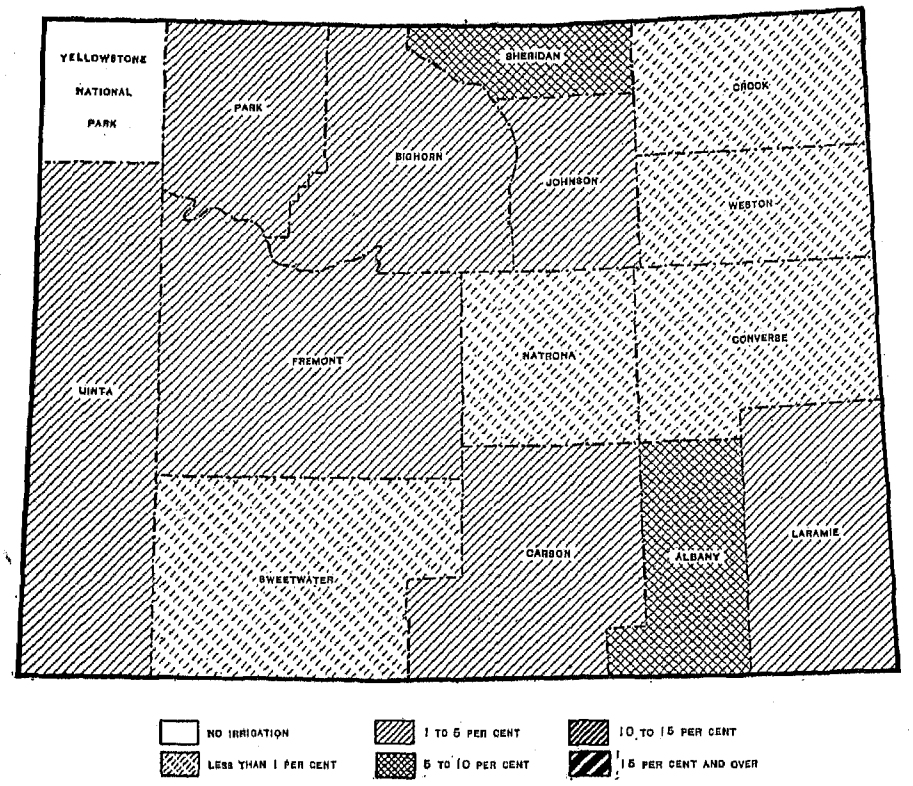
Acre-foot.—The "acre-foot," used to express the capacity of reservoirs, is the volume of water required to cover 1 acre to a depth of 1 foot, or 43,560 cubic feet.

Cost.—The cost of irrigation enterprises is that given by the owners. For the larger works the cost given is taken, in most cases, from the books of account and represents the actual cost. In the case of most of the private and partnership and many of the cooperative enterprises, however, the works were built by their owners without records of money or labor expended, and the cost given represents the owners' estimates. The cost reported for 1910 includes the cost of construction and of acquiring rights. The latter usually consists of filing fees only. In some instances it includes the purchase price of rights, but these cases are so rare that they are unimportant. The cost reported for 1899 is designated "cost of construction," but probably includes the cost of acquiring rights, as in 1910. The average cost per acre is based on the acreage enterprises were capable of irrigating in 1910 and the cost to July 1, 1910.

PER CENT OF TOTAL LAND AREA IRRIGATED, AND PER CENT OF NUMBER OF FARMS IRRIGATED, IN WYOMING, BY COUNTIES: 1909.

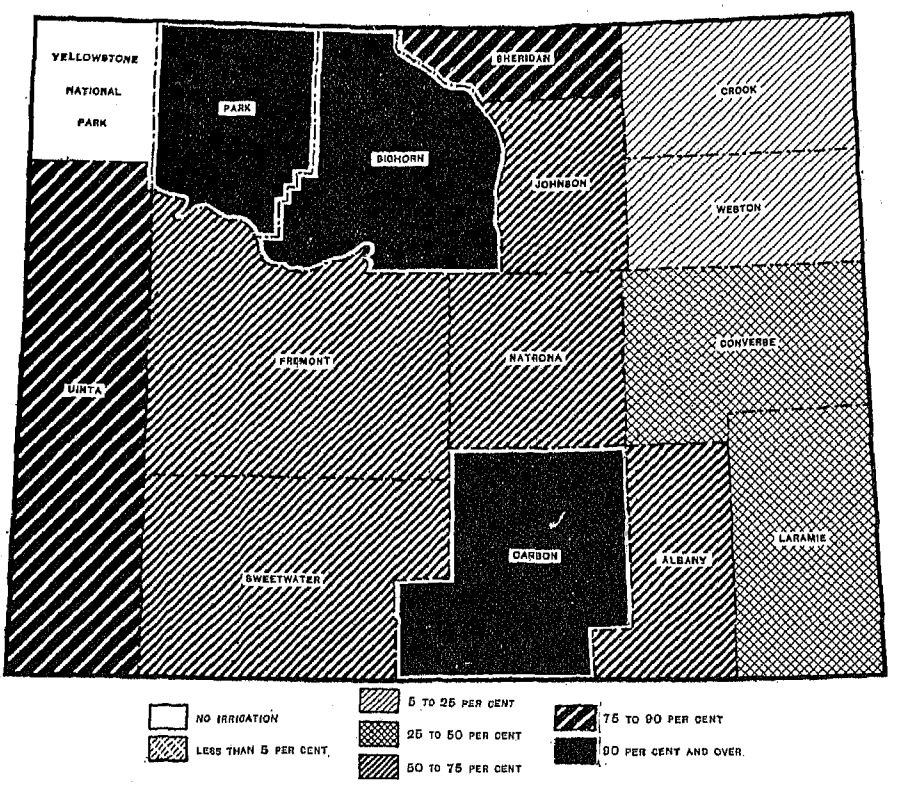
PER CENT OF TOTAL LAND AREA IRRIGATED.

[Per cent for the state, 1.8.]



PER CENT OF NUMBER OF FARMS IRRIGATED.

[*Per cent for the state, 57.3.*]



FARMS AND ACREAGE IRRIGATED.

Irrigation is reported from every county in Wyoming, the irrigated lands being well distributed throughout the state, except in the northeast corner. The main range of the Rocky Mountains crosses the western part of the state, shorter ranges occupy most of the central part, and the Black Hills extend into the northeast corner. The agricultural lands, which are on high plateaus and in mountain valleys, are found in nearly all sections of the state. The location of the irrigated lands of the state is indicated in a general way by the accompanying maps, which show the class in which each county falls with reference to the percentage which irrigated land forms of the total land area and the percentage which irrigated farms represent of all farms.

The following table shows for the state as a whole the number of farms and acreage irrigated in 1909, in comparison with the total number of farms, the total land area, the total land in farms, and the total acreage of improved land in farms in 1910, together with the areas not yet irrigated for which water has been or is being made available. Comparative figures for the census of 1900 are included as far as possible. The figures in respect to number of farms and acreage irrigated in 1899 do not include Indian reservations, which were not shown in the irrigation report for Wyoming for that year, and therefore they are not strictly comparable with those for the total number of farms and total farm acreage in 1900, as shown in this table. Since the irrigated land and farms on reservations represented only small proportions of the corresponding totals for the state in 1909, however, comparisons between the two censuses are but little affected by the omission in the 1900 report.

	CENSUS OF—		INCREASE.[1]	
	1910	1900	Amount.	Per cent.
Number of all farms	[2] 10,987	[3] 6,095	4,892	80.3
Approximate land area of the state.....acres.	[4] 62,460,160	[4] 62,460,160	.....	.....
Land in farms.....acres.	[2] 8,543,010	[3] 8,124,536	418,474	5.2
Improved land in farms.....acres.	[2] 1,256,160	[3] 792,332	463,828	58.5
Number of farms irrigated	[5] 6,297	[6] 3,721	2,576	69.2
Acreage irrigated	[5] 1,133,302	[6] 605,878	527,424	87.1
Acreage enterprises were capable of irrigating	[7] 1,639,510	([8])	.....	.....
Acreage included in projects	[7] 2,224,298	([8])	.....	.....
Percentage irrigated of—				
Number of all farms	57.3	61.1	−3.8	.....
Approximate land area of the state	1.8	1.0	0.8	.....
Land in farms	13.3	7.5	5.8	.....
Improved land in farms	90.2	76.5	13.7	.....
Excess of acreage enterprises were capable of irrigating in 1910 over acreage irrigated in 1909	506,208	.....	.....	.....
Excess of acreage included in projects over acreage irrigated in 1909	1,090,996	.....	.....	.....

[1] A minus sign (−) denotes a decrease.
[2] April 15.
[3] June 1.
[4] Includes 1,868,560 acres in Yellowstone National Park.
[5] In 1909.
[6] In 1899.
[7] July 1.
[8] Not reported.

Number of farms irrigated.—The number of farms irrigated is made up of the number reported on the supplemental schedules by the regular enumerators, together with an estimate of the number of farms covered by enterprises which were reported by special agents but not by the regular enumerators. This estimate was based upon the average acreage irrigated per farm as shown by the supplemental schedules. According to the figures presented in the table, irrigation was practiced on slightly less than three-fifths (57.3 per cent) of the farms of the state in 1909. In 1899 the proportion of irrigated farms was slightly higher, 61.1 per cent, while in 1889 it was 61.3 per cent. It is evident that between 1889 and 1899 the number of unirrigated farms in the state increased at about the same rate as the number of irrigated farms. During the last decade, however, the relative increase in the number of irrigated farms has been considerably smaller than that in the number of unirrigated farms.

In 10 out of the 14 counties in the state more than half the farms are irrigated, in 2 the proportion is approximately 30 per cent, while in the remaining 2 counties it is about 6 per cent. The last mentioned counties, Crook and Weston, are in the northeast corner of the state, where crops are very generally grown without irrigation. The largest proportion of irrigated farms, 96.5 per cent, is reported for Park County. In 2 other counties the irrigated farms form more than 90 per cent of the total number of farms, and in 2 the proportion is between 80 and 90 per cent.

From 1899 to 1909 the increase in the number of farms irrigated for the state as a whole was 69.2 per cent. Only 3 counties—Fremont, Natrona, and Sweetwater—show a higher rate of gain, the percentages being 127.6, 88.7, and 87.5, respectively. One county, Weston, shows a decrease of 2 in the number of farms irrigated, notwithstanding the fact that it reports an increase in the acreage irrigated.

Acreage irrigated.—The acreage irrigated is taken from special schedules filled out by agents from information secured from owners or officials of irriga-

tion enterprises and, in some instances, from public records. The acreage thus obtained is considerably larger than the irrigated acreage reported on the supplemental schedules filled out by the farm enumerators. This difference is due in a measure to the fact that the special agents found enterprises which were not reported on any schedules returned by the enumerators, indicating that the irrigated acreage reported on the supplemental schedules is under the true figure. There is, however, a natural tendency for the officials of irrigation enterprises to report as irrigated the entire area of farms of which only a part was irrigated. Furthermore, some farms are so situated as to receive water from more than one enterprise, and may be reported as irrigated by each, which results in duplication. Owing to the two causes last enumerated, it is probable that the acreage irrigated, as shown in this bulletin, is somewhat excessive, but the extent of this excess can not be determined. It is believed, however, to be less than 10 per cent for the state of Wyoming.

The total acreage reported as irrigated in 1909 was 1,133,302 acres, as against 605,878 acres in 1899 and 229,676 acres in 1889. The acreage given for 1909 includes land lying in Indian reservations, while the acreages for 1889 and 1899 do not, but the acreage irrigated in reservations is so small as not to change the general effect of the comparison. The percentage of increase from 1889 to 1899 was 163.8, while that from 1899 to 1909 was 87.1. The absolute increase during the latter decade was the larger, however, amounting to 527,424 acres, as against only 376,202 acres in the earlier decade.

The percentage of increase between 1899 and 1909 in the acreage irrigated was considerably higher than the percentage of increase in the number of farms irrigated, the acreage irrigated per farm increasing from 163 to 180 in the decade. As a decrease from 1,333 to 778 acres in the average size of the farms of the state was reported for the same period, it is probable that farmers are irrigating larger parts of their holdings than formerly. It is not possible, however, to determine how far this is actually the case, as the higher average size shown for 1900 was due to a considerable extent to the inclusion of large tracts of land used for grazing, which in 1910 were not reported as farm land, and to the inclusion as farm land of the entire acreage of the Shoshone Indian Reservation, only a part of which was so reported in 1910. In the ratio of the acreage irrigated to the total farm acreage reported as improved there has been an increase from 76.5 per cent in 1899 to 90.2 per cent in 1909. The latter figure, however, does not represent the actual percentage of improved land irrigated, but is considerably higher, owing to the fact that irrigated land as reported at the Thirteenth Census includes wild grass land used for pasture, while improved land does not.

The percentage of the total land area of the state irrigated in 1909 was 1.8, as compared with 1 per cent in 1899 and 0.4 per cent in 1889.

In both 1909 and 1899 the county for which the largest area of irrigated land was reported was Uinta, with an irrigated acreage of 260,020 and 128,940 at the respective censuses. Three other counties show areas of irrigated lands exceeding 100,000 acres in 1909, while in five counties the irrigated area was between 50,000 and 100,000 acres.

The county in which irrigated land formed the highest percentage of the total in 1909 was Sheridan, where 5.7 per cent of the land area was irrigated. In only one other county, Albany, was the proportion higher than 4 per cent, while in five counties it was less than 1 per cent.

Acreage included in projects.—The preceding table shows that in 1910 existing enterprises were ready to supply water to 506,208 acres more than were irrigated in 1909. After allowance is made for an increase in the area irrigated in 1910 over that in 1909, it is probable that there remained at the close of 1910 more than three-fourths as much land under ditch but not irrigated as had been brought under irrigation in the 10 years from 1899 to 1909. The acreage included in projects exceeds the acreage irrigated in 1909 by 1,090,996 acres, which is about double the acreage brought under irrigation during the last decade. This acreage represents the area which will be available for the extension of irrigation in the next few years upon the completion of the projects now under construction. It indicates in a general way the area available for settlement, although much of this unirrigated land is in farms already settled.

Acreage irrigated, classified by character of enterprise.—The following table gives the distribution of the acreage irrigated in 1909 according to the character of the enterprise controlling the irrigation works:

CHARACTER OF ENTERPRISE.	ACREAGE IRRIGATED IN 1909.	
	Amount.	Per cent distribution.
All classes	1,133,302	100.0
U. S. Reclamation Service	12,905	1.1
U. S. Indian Service	4,270	0.4
Carey Act enterprises	86,252	7.6
Irrigation districts	11,800	1.0
Cooperative enterprises	116,317	10.3
Commercial enterprises	87,935	7.8
Individual and partnership enterprises	813,823	71.8

Irrigation districts, cooperative enterprises, and individual and partnership enterprises are all controlled by the water users. These supply about 83 per cent of the acreage irrigated, while United States Reclamation Service and Carey Act enterprises, which are to be turned over to the water users, supply about 9 per cent. Thus only a very small percentage of the irrigated land is supplied by works which are not either controlled by the water users or to be turned

over to them ultimately. The cooperative enterprises, which supplied water for 10.3 per cent of the land irrigated in 1909, are principally stock companies, of which the stock is owned by the water users.

Acreage irrigated, classified by source of water supply.—The next table shows the distribution of the acreage irrigated in 1909 according to the source of water supply.

From this table it is apparent that to the present time there has been little development of any source of supply other than streams.

SOURCE OF WATER SUPPLY.	ACREAGE IRRIGATED IN 1909.	
	Amount.	Per cent distribution.
All sources	**1,133,302**	**100.0**
Streams	1,113,774	98.3
Lakes	120	(1)
Wells	139	(1)
Springs	5,008	0.4
Reservoirs	14,261	1.3

[1] Less than one-tenth of 1 per cent.

IRRIGATION WORKS.

The following table summarizes the data collected relating to works for supplying water for irrigation in 1910 and 1900, Indian reservations, as already noted, not being represented in the figures for 1900. As only two of the items reported in 1910 were reported in 1900—the number of independent enterprises and the length of main ditches—there is little opportunity for comparison between the two censuses. The figures shown for the earlier census relate only to those systems which received water from streams in 1899, but the other systems represented in the Twelfth Census report, which obtained water from wells, supplied only 646 acres of the total area reported as irrigated in 1899.

Assuming that the enterprises in operation in 1909 were identical with those reported in 1910, the average acreage irrigated per enterprise in 1909 was 203, and the acreage irrigated per mile of main ditch was 104. For the enterprises shown for 1900, which, as explained above, are exclusive of the systems that received water from wells, the average acreage irrigated per enterprise in 1899 was 230, and the average per mile of main ditch was 136.

There has been little utilization of underground water for irrigation up to this time. The table shows 2 flowing wells, which irrigated 64 acres, and 3 pumped wells, which irrigated 75 acres.

Pumping for irrigation from either wells or streams has been but little practiced as yet, the total area irrigated with pumped water in 1909 being only 1,615 acres.

IRRIGATION WORKS.	CENSUS OF—		INCREASE.	
	1910	1900 [1]	Amount.	Per cent.
Independent enterprises.....number..	5,577	2,629	2,948	112.1
Ditches, total length.....miles..	13,231	(2)	.....	.....
Main ditches.....number..	5,593	(2)	.....	.....
Length.....miles..	10,933	4,454	6,479	145.5
Capacity.....cu. ft. per second..	42,630	(2)	.....	.....
Lateral ditches.....number..	2,340	(2)	.....	.....
Length.....miles..	2,298	(2)	.....	.....
Reservoirs.....number..	414	(2)	.....	.....
Capacity.....acre-feet..	2,550,937	(2)	.....	.....
Flowing wells.....number..	2	(2)	.....	.....
Capacity.....gals. per minute..	250	(2)	.....	.....
Pumped wells.....number..	3	(2)	.....	.....
Capacity.....gals. per minute..	835	(2)	.....	.....
Pumping plants.....number..	34	(2)	.....	.....
Engine capacity.....horsepower..	705	(2)	.....	.....
Pump capacity.....gals. per minute..	142,529	(2)	.....	.....

[1] Figures relate only to systems receiving water from streams. [2] Not reported.

COST OF CONSTRUCTION, OPERATION, AND MAINTENANCE.

The table following shows the total cost of irrigation enterprises up to July 1, 1910, including construction of works and acquisition of rights but not operation and maintenance, together with the average cost per acre, based on the acreage the enterprises were capable of irrigating in 1910; the estimated final cost of enterprises completed and those now under construction, with the average cost per acre, based on the acreage included in projects; and the total cost and average cost per acre of operation and maintenance in 1909. Data relating to the cost of construction and maintenance of systems operated in 1899 are included for comparison. The figure for average cost per acre of operation and maintenance in 1899 does not cover the cost of systems receiving water from wells, but, as indicated above, these are comparatively unimportant, having supplied only 646 acres in that year. Indian reservations, as previously stated, are not covered by the figures for 1900.

The cost of operation and maintenance is not reported for individual and partnership enterprises, for the reason that farmers whose land is irrigated by such systems generally clean their own ditches at odd times without keeping any record of the time spent. In the case of the larger enterprises this cost represents a cash outlay by the farmers, while in the case of many of the smaller cooperative ones the cost is worked out by the farmers.

	CENSUS OF—		INCREASE.	
	1910	1900	Amount.	Per cent.
Cost of irrigation enterprises.....	[1] $17,700,980	[2] $3,973,165	$13,727,815	345.5
Average per acre.....	[3] $10.80	[4] $6.56	(5)	.....
Estimated final cost of existing enterprises.....	$20,425,890	(6)	.....	.....
Average per acre included in projects.....	$9.18	(6)	.....	.....
Operation and maintenance:				
Acreage for which cost is reported.....	221,875	(6)	.....	.....
Total cost reported.....	[7] $190,648	(6)	.....	.....
Average cost per acre.....	$0.86	[8] $0.16	$0.70	437.5

[1] Reported July 1.
[2] Cost of systems operated in 1899.
[3] Based on acreage enterprises were capable of irrigating in 1910.
[4] Based on acreage irrigated in 1899.
[5] Figures not comparable. (See explanation in text.)
[6] Not reported.
[7] For 1909.
[8] Exclusive of systems receiving water from wells.

The cost of irrigation systems shows an increase of 345.5 per cent, while the average cost per acre shows an increase of 64.6 per cent. The average cost per acre shown for 1910 is based on the acreage under ditch in that year, but since the corresponding acreage for 1900 was not reported, the figure for average cost at the earlier census is based on the acreage irrigated in 1899. If computed on the basis of the acreage irrigated in 1909, the average cost in 1910 would be $15.62, representing an increase of 138.1 per cent over the figure for the average cost at the census of 1900. The year 1899 was near the close of the period of private and cooperative construction, when most of the works were built by the water users themselves with little or no expenditure of money, and near the beginning of the present period of large scale construction by corporations and the Federal Government. This later construction is not only on a larger scale, but also more difficult and of a better type. Largely as a result of these changed conditions the average cost per acre has greatly increased. A number of large enterprises are under construction, and on these considerable expenditures have been made, while but little land is irrigated as yet. This condition tends to make the average cost shown higher than the true average. The average based on the estimated final cost and the acreage included in projects, $9.18 per acre, probably more truly represents the average cost per acre of irrigation in Wyoming.

The county showing the lowest average cost to July 1, 1910—$2.86 per acre—is Uinta, which has the largest irrigated acreage. The highest average cost per acre is $39.03 in Park County, and the next highest is $33.15 in Converse County.

The acreage for which cost of operation and maintenance in 1909 was reported constitutes 19.6 per cent of the total acreage reported as irrigated in 1909 and 69.4 per cent of the acreage reported as irrigated by other than individual and partnership enterprises. The cost reported can be said, therefore, to represent fairly the average annual expense for all but individual and partnership enterprises.

CROPS.

As previously stated, the data relating to irrigated crops are taken from supplemental schedules filled out by the regular census enumerators. Since the special agents found enterprises which the enumerators had not reported, it is evident that the information relating to irrigated crops is incomplete to some extent. It shows, however, the relative importance of the different irrigated crops and is sufficiently complete to give reliable averages of yields.

The table following shows the acreage, yield, and value of the principal crops reported as grown under irrigation in 1909 in comparison with totals for the same crops reported for the entire state. While small quantities of other crops are grown both on irrigated and unirrigated land, the leading crops of the state, as well as the leading crops grown under irrigation, are represented in the table. In the reports of the agricultural census the acreages of seed crops are not generally given, but since the growing of these crops, especially alfalfa seed, is coming to be an important industry in the irrigated sections of the country, statistics for certain of these crops are presented here.

CROP.	ACREAGE.			YIELD.			VALUE.	
	Total for state.	Irrigated.		Unit.	Total for state.	On irrigated land.	Total for state.	For irrigated land.
		Amount.	Per cent of total.					
Cereals:								
Corn	9,268	1,176	12.7	Bushels	176,354	25,297	$101,465	$15,118
Oats	124,036	76,302	61.5	Bushels	3,361,425	2,175,203	1,828,711	1,302,033
Wheat	41,968	26,326	62.7	Bushels	738,698	490,400	644,251	440,491
Emmer and spelt	1,521	443	29.1	Bushels	35,677	11,546	22,918	7,065
Barley	8,561	4,982	58.2	Bushels	189,057	112,609	130,392	89,215
Rye	1,516	375	24.7	Bushels	20,479	6,121	14,791	4,999
Other seed crops:								
Alfalfa seed	2,995	2,171	72.5	Bushels	8,396	5,188	75,671	50,837
Timothy seed	313	145	46.3	Bushels	1,776	668	3,855	1,688
Hay and forage:								
Timothy alone	29,433	18,265	62.1	Tons	44,655	28,136	341,700	208,307
Timothy and clover mixed	8,066	4,086	50.7	Tons	16,328	8,149	132,786	71,810
Clover alone	360	242	67.2	Tons	808	586	5,472	2,996
Alfalfa	170,431	162,447	95.3	Tons	397,669	379,033	2,630,457	2,526,657
Other tame or cultivated grasses [1]	111,221	83,456	75.0	Tons	136,109	97,849	942,284	608,658
Wild, salt, or prairie grasses	242,706	189,271	78.0	Tons	228,066	182,033	1,782,230	1,384,269
Grains cut green	19,548	4,930	25.2	Tons	23,813	5,835	200,007	52,741
Coarse forage	3,442	379	11.0	Tons	4,709	740	34,738	5,678
Sundry crops:								
Potatoes	8,333	4,768	57.2	Bushels	932,162	620,667	524,480	350,072
Sugar beets	[2] 1,181	1,100	93.1	Tons	13,234	11,198	60,374	51,779
Orchard fruits and grapes	[3]	209					39,806	20,814
Small fruits	[2] 106	56	52.8				13,984	7,808

[1] Includes millet or Hungarian grass. [2] Preliminary tabulation, subject to correction. [3] Agricultural returns show number of trees and not acreage.

Acreage.—Of the entire acreage of the crops for which totals are presented in the table, about 74 per cent is irrigated. The proportion irrigated varies widely for the different crops.

Of the acreage covered by the cereals presented in the table, about 59 per cent is irrigated. The highest percentage of acreage irrigated shown for any cereal, 62.7, is reported for wheat and the next highest, 61.5, for oats, the acreage of which exceeds that of any other cereal raised in the state. The proportion for barley is 58.2 per cent and those for emmer and spelt and for rye, which cover only small areas, are 29.1 and 24.7 per cent, respectively, while the lowest percentage, 12.7, is shown for corn.

The hay and forage crops are more generally raised on irrigated land, the irrigated acreage of such crops given in the table forming about 79 per cent of their total acreage. In the case of all of these except coarse forage and grains cut green, more than half of the total acreage is irrigated. Very little alfalfa is grown without irrigation, the irrigated area forming 95.3 per cent of the total for this crop. The percentages for "wild, salt, or prairie grasses" and "other tame or cultivated grasses" are 78 and 75, respectively.

Of the entire acreage in potatoes, 57.2 per cent is irrigated, and of that in small fruits, 52.8 per cent. The sugar-beet area in Wyoming is for the most part irrigated, the percentage being 93.1. The relative importance of the irrigated orchard acreage can not be determined, because the total acreage of orchards in the state is not reported, but it will be observed that more than one-half of the value of all orchard fruits and grapes produced in the state is that of products grown on irrigated land.

Of the total acreage in the irrigated crops shown in the table, about 80 per cent is devoted to hay and forage crops. The single crop comprising the largest acreage is "wild, salt, or prairie grasses," representing 32.6 per cent of the total acreage of the irrigated crops given. In addition to the acreage shown in the table for this crop, a large area of wild grass used for pasture is irrigated. Alfalfa is next in order with respect to irrigated acreage, with 28 per cent of the total for the crops given, followed by "other tame or cultivated grasses," with 14.4 per cent, and oats with 13.1 per cent. No other single crop covers as much as 5 per cent of the total acreage shown for irrigated crops.

While most of the crops irrigated are well distributed geographically, there is a tendency toward the concentration of certain crops in particular localities. This is shown by the following statement, which gives the counties reporting the largest acreages of the principal irrigated crops, with the proportions which they contain of the total irrigated acreages of these crops in the state.

Oats.—Laramie County, 16.1 per cent; Bighorn, 13.3 per cent; Uinta, 12.3 per cent.

Wheat.—Sheridan County, 26.5 per cent; Bighorn, 21.9 per cent; Park, 16.7 per cent.

Barley.—Uinta County, 21.3 per cent; Sheridan, 18.5 per cent; Bighorn, 13.8 per cent.

Alfalfa seed.—Bighorn County, 45.4 per cent; Johnson, 23.1 per cent; Park, 9.4 per cent.

Timothy.—Uinta County, 34.4 per cent; Sheridan, 21.9 per cent; Carbon, 10.1 per cent.

Alfalfa.—Bighorn County, 19.5 per cent; Laramie, 12.6 per cent; Johnson, 12.6 per cent.

Other tame or cultivated grasses.—Uinta County, 38 per cent; Albany, 28.2 per cent; Carbon, 27.2 per cent.

Wild, salt, or prairie grasses.—Uinta County, 30.9 per cent; Albany, 19.1 per cent; Laramie, 17.2 per cent.

Potatoes.—Laramie County, 21.6 per cent; Sheridan, 13.1 per cent; Bighorn, 11.7 per cent.

Sugar beets.—Bighorn County, 68.5 per cent; Park, 22.6 per cent; Sheridan, 8.4 per cent.

Yield.—In the following table the average yields per acre of crops extensively grown both with and without irrigation are shown. The yields on unirrigated land are obtained by subtracting the totals for irrigated crops from the totals for the state:

CROP.	AVERAGE YIELD PER ACRE.		
	On unirrigated land.	On irrigated land.	
		Amount.	Per cent of excess over yield on unirrigated land.[1]
Oats.....bushels..	24.9	28.5	14.5
Wheat.....bushels..	15.9	18.6	17.0
Barley.....bushels..	21.3	22.6	6.1
Timothy alone.....tons..	1.48	1.54	4.1
Alfalfa.....tons..	2.22	2.34	5.4
Other tame or cultivated grasses.....tons..	1.38	1.17	−15.2
Wild, salt, or prairie grasses.....tons..	0.86	0.96	11.6
Potatoes.....bushels..	87.4	130.2	49.0

[1] A minus sign (−) indicates that the yield on irrigated land is less than that on unirrigated land.

In the case of each of the crops in the table, except "other tame or cultivated grasses," the average yield on irrigated land was greater than that on unirrigated land. The difference is not great, however, except in the case of potatoes, the average yield of which was 49 per cent greater on irrigated than on unirrigated land.

In considering these comparisons it should be borne in mind that they are not comparisons of yields on irrigated and on unirrigated land in the same localities, but of yields under irrigation in localities where crops can not be grown successfully without it with yields in localities where irrigation is not necessary. They do not indicate, therefore, the relative advantages of farming with and without irrigation in a given community, but rather give one factor for determining the relative advantages of farming where irrigation is necessary and where it is not necessary for the successful growing of crops.

COUNTY TABLE.

The next table gives in detail, by counties, the data summarized above, except those relating to crops. For purposes of comparison the total number of farms in the state, the approximate land area of the state, the total land in farms, and the improved land in farms have been included in the table. The figure for the approximate land area of the state includes 1,858,560 acres in Yellowstone National Park, not elsewhere shown.

Attention is again directed to the fact that the totals for 1899 do not cover Indian reservations, no report as to irrigation on reservations in Wyoming having been made at the Twelfth Census. Since, however, the figures for the present census show that the irrigation operations conducted on reservations were unimportant relatively to those in the state as a whole, it is believed that the shortage is not of material consequence as concerns comparisons between the two censuses. For this reason the percentages of increase have been computed without attempt to estimate the extent of Indian Service irrigation in 1899, and without the elimination from the 1909 and 1910 totals of figures representing irrigation on reservations.

Certain enterprises extend into more than one county, and in the cases of some of these enterprises the reports do not segregate the data by counties. In such cases a distribution has been made according to the best estimates possible from all the information in the possession of the bureau. It is believed that these estimates are approximately correct.

Change of boundaries.—In comparing the data secured in 1910 with those for 1900, it should be borne in mind that Park County was organized from a part of Bighorn County in 1909.

ACREAGE IRRIGATED, EXTENT AND COST OF IRRIGATION ENTERPRISES, AND COST OF OPERATION AND MAINTENANCE, BY COUNTIES: 1909 AND 1910.

[Comparative data for 1899 in italics.]

		The State.	Albany.	Bighorn.[1]	Carbon.	Converse.	Crook.	Fremont.
1	Number of all farms in 1910	10,087	453	1,078	486	684	1,341	846
2	Number of farms irrigated in 1909	6,297	339	1,018	442	219	80	610
3	Per cent of all farms	57.3	74.8	94.4	90.9	32.0	6.0	72.1
4	*Number of farms irrigated in 1899*	*3,721*	*313*	*518*	*350*	*219*	*65*	*268*
5	Per cent of increase, 1899–1909	69.2	8.3	.....	26.3	.....	23.1	127.6
	LAND AND FARM AREA							
6	Approximate land area—acres	[2] 62,460,160	2,816,640	4,331,520	5,138,560	4,313,600	3,482,240	8,101,760
7	Land in farms—acres	8,543,010	1,069,782	253,570	1,707,961	551,370	648,834	320,502
8	Improved land in farms—acres	1,256,160	107,315	89,689	140,987	48,232	104,175	76,059
9	Acreage irrigated in 1909	1,133,302	151,026	93,779	131,749	40,607	6,712	78,783
10	Per cent of total land area	1.8	5.4	2.2	2.6	0.9	0.2	1.0
11	Per cent of land in farms	13.3	14.2	37.0	7.7	7.4	1.0	24.6
12	Per cent of improved land in farms	90.2	[3] 141.6	[3] 104.5	93.4	84.2	6.4	[3] 103.6
13	*Acreage irrigated in 1899*	*605,378*	*104,260*	*50,465*	*108,806*	*18,015*	*3,208*	*26,620*
14	Per cent of increase, 1899–1909	87.1	45.7	.....	21.1	125.4	109.2	196.0
15	Acreage enterprises were capable of irrigating in 1910	1,639,510	221,225	195,094	163,394	52,159	8,017	170,946
16	Acreage included in projects	2,224,298	355,033	237,003	191,486	85,713	11,038	211,834
	ACREAGE IRRIGATED AND INCLUDED IN PROJECTS							
	CLASSIFIED BY CHARACTER OF ENTERPRISE.							
17	**U. S. Reclamation Service**, irrigated in 1909	12,905	.....	.....	.....	.....	.....	.....
18	Enterprises were capable of irrigating in 1910	34,869	.....	.....	.....	.....	.....	.....
19	Included in projects	167,880	.....	.....	.....	.....	.....	.....
20	**U. S. Indian Service**, irrigated in 1909	4,270	.....	.....	.....	.....	.....	4,270
21	Enterprises were capable of irrigating in 1910	48,699	.....	.....	.....	.....	.....	48,699
22	Included in projects	63,657	.....	.....	.....	.....	.....	63,657
23	**Carey Act enterprises**, irrigated in 1909	86,252	28,700	20,125	.....	5,000	.....	925
24	Enterprises were capable of irrigating in 1910	265,074	52,100	81,400	.....	5,000	.....	8,600
25	Included in projects	426,472	126,100	111,128	.....	34,335	.....	14,127
26	**Irrigation districts**, irrigated in 1909	11,800	11,800	.....	.....	.....	.....	.....
27	Enterprises were capable of irrigating in 1910	27,050	27,050	.....	.....	.....	.....	.....
28	Included in projects	27,050	27,050	.....	.....	.....	.....	.....
29	**Cooperative enterprises**, irrigated in 1909	116,317	1,800	14,278	3,110	.....	.....	11,416
30	Enterprises were capable of irrigating in 1910	165,476	2,414	24,085	4,266	.....	.....	17,592
31	Included in projects	189,894	2,414	31,828	4,516	.....	.....	21,801
32	**Commercial enterprises**, irrigated in 1909	87,935	18,940	.....	16,646	.....	.....	5,443
33	Enterprises were capable of irrigating in 1910	133,305	33,000	.....	16,646	.....	.....	15,183
34	Included in projects	195,967	80,797	.....	16,746	.....	.....	25,583
35	**Individual and partnership enterprises**, irrigated in 1909	813,823	90,686	59,376	111,993	35,607	6,712	56,729
36	Enterprises were capable of irrigating in 1910	1,024,137	106,661	89,609	142,482	47,159	8,017	80,872
37	Included in projects	1,153,378	118,672	94,047	170,224	51,378	11,038	86,666
	ACREAGE IRRIGATED							
	CLASSIFIED BY SOURCE OF WATER SUPPLY.							
38	Supplied from streams	1,113,774	150,421	92,525	131,231	40,557	5,629	78,640
39	By gravity	1,112,234	150,421	92,431	131,129	40,407	5,629	78,640
40	By pumping	1,540	.....	94	102	150	.....	.....
41	Supplied from lakes	120	100	.....	.....	.....	20	.....
42	By gravity	120	100	.....	.....	.....	20	.....
43	By pumping	.....	.....	.....	.....	.....	.....	.....
44	Supplied from wells	139	.....	.....	60	.....	.....	45
45	Flowing	64	.....	.....	60	.....	.....	.....
46	By pumping	75	.....	.....	.....	.....	.....	45
47	Supplied from springs	5,008	1,269	494	58	15	120	98
48	Supplied from reservoirs	14,261	136	760	400	35	943	.....
49	Total acreage supplied by pumping	1,615	.....	94	102	150	.....	45
	IRRIGATION ENTERPRISES							
50	Independent enterprises—number	5,577	436	430	629	336	94	396
51	*Number in 1899*[4]	*2,029*	*329*	*299*	*302*	*172*	*24*	*249*
52	Per cent of increase, 1899–1910	112.1	32.5	.....	108.3	95.3	291.7	59.0
53	Main ditches—number	5,593	487	418	640	336	80	384
54	*Number in 1899*	(5)	.....	.....	.....	.....	.....	.....
55	Per cent of increase, 1899–1910	.....	.....	.....	.....	.....	.....	.....
56	Length—miles	10,933	1,037	1,388	1,005	485	91	892
57	*Length in 1899*[4]—miles	*4,454*	*504*	*515*	*824*	*269*	*43*	*283*
58	Per cent of increase, 1899–1910	145.5	105.8	.....	22.0	80.3	111.6	215.2
59	Capacity—cubic feet per second	42,630	6,831	5,124	3,801	1,364	257	3,449
60	Laterals—number	2,340	290	100	173	87	73	136
61	Length—miles	2,298	588	140	142	62	28	250
62	Reservoirs—number	414	33	15	36	23	52	10
63	Capacity—acre-feet	2,550,937	372,888	1,060	38,973	37,353	1,916	2,168
64	Flowing wells—number	2	.....	.....	1	.....	.....	.....
65	Capacity—gallons per minute	250	.....	.....	100	.....	.....	.....
66	Pumped wells—number	3	.....	.....	.....	.....	.....	1
67	Capacity—gallons per minute	835	.....	.....	.....	.....	.....	120
68	Pumping plants—number	34	.....	9	2	2	1	2
69	Engine capacity—horsepower	705	.....	143	21	312	1	13
70	Pump capacity—gallons per minute	142,529	.....	6,690	1,500	123,560	7	340
	COST							
71	Cost of enterprises up to July 1, 1910—dollars	17,700,980	2,682,679	2,310,660	737,851	1,729,146	86,578	1,099,026
72	*Cost in 1899*[6]—dollars	*8,973,165*	*164,299*	*676,405*	*1,047,803*	*127,906*	*25,969*	*125,090*
73	Per cent of increase, 1899–1910	345.5	1,538.6	.....	[7] 29.6	1,251.9	233.4	778.6
74	Average cost per acre enterprises were capable of irrigating in 1910—dollars	10.80	12.13	11.84	4.52	33.15	10.80	6.43
75	*Average cost per acre irrigated in 1899*[4]—dollars	*6.56*	*1.48*	*13.39*	*9.63*	*7.10*	*8.10*	*4.70*
76	Estimated final cost of existing enterprises—dollars	20,425,890	4,114,507	2,370,603	738,776	2,264,508	86,578	1,122,491
77	Average per acre included in projects—dollars	9.18	11.59	10.00	3.86	26.42	7.84	5.30
	OPERATION AND MAINTENANCE							
78	Acreage for which cost is reported	221,875	17,500	15,915	4,006	5,000	.....	15,602
79	Total cost reported—dollars	190,648	15,680	21,334	4,233	551	.....	7,938
80	Average per acre for which cost is reported—dollars	0.86	0.90	1.34	1.06	0.11	.....	0.51
81	*Average cost per acre in 1899*[4]—dollars	*0.16*	*0.20*	*0.20*	*0.14*	*0.33*	*0.21*	*0.26*
82	Per cent of increase, 1899–1909	437.5	350.0	.....	657.1	[7] 66.7	.....	96.2

[1] Change of boundary. (See explanation at close of text.)
[2] Includes 1,858,560 acres in Yellowstone National Park.
[3] Irrigated acreage includes wild grass, while improved land does not.
[4] Figures relate only to systems obtaining water from streams.
[5] Not reported in 1899.
[6] State total includes $16,473, representing the cost of well systems, not shown by counties. County figures relate only to systems obtaining water from streams.
[7] Decrease.

ACREAGE IRRIGATED, EXTENT AND COST OF IRRIGATION ENTERPRISES, AND COST OF OPERATION AND MAINTENANCE, BY COUNTIES: 1909 AND 1910—Continued.

[Comparative data for 1899 in italics.]

		Johnson.	Laramie.	Natrona.	Park.	Sheridan.	Sweetwater.	Uinta.	Weston.
1	Number of all farms in 1910	338	1,933	269	624	799	203	1,286	647
2	Number of farms irrigated in 1909	247	577	183	602	679	135	1,123	43
3	Per cent of all farms	73.1	29.8	68.0	96.5	85.0	66.5	87.3	6.6
4	*Number of farms irrigated in 1899*	*104*	*370*	*97*	(1)	*469*	*72*	*741*	*45*
5	Per cent of increase, 1899–1909	27.3	55.9	88.7		44.8	87.5	51.6	[2] 4.4
	LAND AND FARM AREA								
6	Approximate land area—acres	2,672,000	4,474,880	3,425,920	3,468,800	1,648,000	6,720,000	7,068,160	2,939,520
7	Land in farms—acres	322,094	1,082,032	260,045	253,394	421,543	122,790	574,528	354,565
8	Improved land in farms—acres	53,471	210,992	16,579	59,295	95,368	10,013	202,866	41,119
9	Acreage irrigated in 1909	54,838	122,021	22,498	58,853	94,141	10,798	260,020	6,577
10	Per cent of total land area	2.1	2.7	0.7	1.7	5.7	0.2	3.7	0.2
11	Per cent of land in farms	17.0	7.3	8.7	23.2	22.3	8.8	45.3	1.9
12	Per cent of improved land in farms	[3] 102.6	57.8	[3] 135.7	99.3	98.7	[3] 107.8	[3] 128.2	16.0
13	*Acreage irrigated in 1899*	*25,217*	*64,901*	*17,601*	(1)	*49,263*	*5,110*	*128,940*	*3,472*
14	Per cent of increase, 1899–1909	117.5	88.0	27.8		91.1	111.3	101.7	89.4
15	Acreage enterprises were capable of irrigating in 1910	75,301	166,909	29,255	108,478	114,285	22,667	303,704	8,076
16	Acreage included in projects	104,492	177,252	36,837	265,255	117,503	90,614	330,103	10,075
	ACREAGE IRRIGATED AND INCLUDED IN PROJECTS								
	CLASSIFIED BY CHARACTER OF ENTERPRISE.								
17	**U. S. Reclamation Service,** irrigated in 1909		3,880		9,025				
18	Enterprises were capable of irrigating in 1910		3,880		30,980				
19	Included in projects		3,880		164,000				
20	**U. S. Indian Service,** irrigated in 1909								
21	Enterprises were capable of irrigating in 1910								
22	Included in projects								
23	**Carey Act enterprises,** irrigated in 1909	3,000	17,874		9,500		1,128		
24	Enterprises were capable of irrigating in 1910	6,000	17,874		23,000		12,000		
25	Included in projects	10,550	17,874		36,700		75,658		
26	**Irrigation districts,** irrigated in 1909								
27	Enterprises were capable of irrigating in 1910								
28	Included in projects								
29	**Cooperative enterprises,** irrigated in 1909	14,710	9,150		3,634	37,459	766	19,994	
30	Enterprises were capable of irrigating in 1910	20,736	11,590		6,334	51,928	770	25,761	
31	Included in projects	26,133	12,070		8,344	52,658	850	29,280	
32	**Commercial enterprises,** irrigated in 1909	500	35,000					11,406	
33	Enterprises were capable of irrigating in 1910	1,000	56,000					11,476	
34	Included in projects	1,285	60,000					11,556	
35	**Individual and partnership enterprises,** irrigated in 1909	36,628	56,117	22,498	36,694	56,682	8,904	228,620	6,577
36	Enterprises were capable of irrigating in 1910	47,565	77,565	29,255	48,155	62,357	9,897	266,467	8,076
37	Included in projects	66,524	83,428	36,837	56,211	64,905	14,106	289,267	10,075
	ACREAGE IRRIGATED								
	CLASSIFIED BY SOURCE OF WATER SUPPLY.								
38	Supplied from streams	54,683	116,154	21,237	57,037	90,658	9,948	258,407	5,747
39	By gravity	54,549	115,658	20,932	57,036	90,458	9,898	258,404	5,742
40	By pumping	134	496	305	1	200	50	3	5
41	Supplied from lakes								
42	By gravity								
43	By pumping								
44	Supplied from wells					20	10	4	
45	Flowing							4	
46	By pumping					20	10		
47	Supplied from springs		150	648	166	10	363	1,529	88
48	Supplied from reservoirs	155	5,717	613	750	3,453	477	80	742
49	Total acreage supplied by pumping	134	496	305	1	220	60	3	5
	IRRIGATION ENTERPRISES								
50	Independent enterprises—number	221	462	273	313	526	107	1,306	48
51	*Number in 1899* [4]	*41*	*318*	*41*	(1)	*69*	*69*	*701*	*50*
52	Per cent of increase, 1899–1910	439.0	47.6	565.9		662.3	81.4	86.3	60.0
53	Main ditches—number	224	459	277	302	537	102	1,296	51
54	*Number in 1899*								
55	Per cent of increase, 1899–1910								
56	Length—miles	529	827	334	813	939	151	2,369	73
57	*Length in 1899* [4]—miles	*140*	*624*	*118*	(1)	*379*	*77*	*608*	*75*
58	Per cent of increase, 1899–1910	277.9	32.5	195.6		147.8	96.1	289.6	[2] 2.7
59	Capacity—cubic feet per second	2,050	5,852	1,049	3,870	2,111	1,269	5,381	222
60	Laterals—number	39	200	230	77	252	15	634	34
61	Length—miles	31	270	114	103	240	5	316	9
62	Reservoirs—number	6	60	52	12	78	13	7	17
63	Capacity—acre-feet	5,125	1,196,215	6,119	461,020	2,361	24,716	400,099	924
64	Flowing wells—number							1	
65	Capacity—gallons per minute							150	
66	Pumped wells—number					1	1		
67	Capacity—gallons per minute					660	55		
68	Pumping plants—number	3	3	5	1	2	2	1	1
69	Engine capacity—horsepower	31	66	76	1	18	16	1	6
70	Pump capacity—gallons per minute	1,455	3,278	3,211	6	1,360	855	17	250
	COST								
71	Cost of enterprises up to July 1, 1910—dollars	552,515	2,467,260	201,416	4,233,566	550,599	129,949	867,634	52,101
72	*Cost in 1899* [4]—dollars	*117,511*	*978,028*	*67,907*	(1)	*264,344*	*14,972*	*347,377*	*19,582*
73	Per cent of increase, 1899–1910	370.1	152.2	247.8		108.3	767.9	149.4	166.1
74	Average cost per acre enterprises were capable of irrigating in 1910—dollars	7.34	14.78	6.88	39.03	4.82	5.73	2.86	6.45
75	*Average cost per acre irrigated in 1899* [4]—dollars	*4.66*	*15.07*	*3.29*	(1)	*5.37*	*2.93*	*2.70*	*5.64*
76	Estimated final cost of existing enterprises—dollars	552,515	3,139,090	201,416	4,233,566	550,599	129,949	869,101	52,101
77	Average per acre included in projects—dollars	5.29	17.71	5.47	15.96	4.68	1.43	2.63	5.17
	OPERATION AND MAINTENANCE								
78	Acreage for which cost is reported	16,410	65,904		22,159	36,919		22,460	
79	Total cost reported—dollars	3,082	81,910		37,228	15,982		2,710	
80	Average per acre for which cost is reported—dollars	0.19	1.24		1.68	0.43		0.12	
81	*Average cost per acre in 1899* [4]—dollars	*0.11*	*0.17*	*0.06*	(1)	*0.20*	*0.17*	*0.08*	*0.10*
82	Per cent of increase, 1899–1909	72.7	629.4			115.0		50.0	

[1] Change of boundary. (See explanation at close of text.)
[2] Decrease.
[3] Irrigated acreage includes wild grass, while improved land does not.
[4] Figures relate only to systems obtaining water from streams.

THIRTEENTH CENSUS OF THE UNITED STATES: 1910

DEPARTMENT OF COMMERCE AND LABOR

BULLETIN

BUREAU OF THE CENSUS
E. DANA DURAND, DIRECTOR

IRRIGATION : UNITED STATES

ABSTRACT—FARMS AND ACREAGE IRRIGATED, IRRIGATION WORKS, COST OF CONSTRUCTION, COST OF OPERATION AND MAINTENANCE, AND CROPS GROWN UNDER IRRIGATION

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[Reprint of Chapter 14, pages 421-432 of the Abstract of the Thirteenth Census.]

INTRODUCTION.

This chapter contains, in condensed form, the principal data regarding irrigation derived from the Thirteenth Decennial Census, taken in the year 1910.

An amendment to the Thirteenth Census act, approved February 25, 1910, contained the following clause relating to irrigation:

> Inquiries shall also be made as to the location and character of irrigation enterprises, quantity of land irrigated in the arid region of the United States and in each state and county in that section under state and Federal laws; the price at which these lands, including water rights, are obtainable; the character and value of crops produced on irrigated lands, the amount of water used per acre for said irrigation and whether it was obtainable from national, state, or private works; the location of the various projects and methods of construction, with facts as to their physical condition; the amount of capital invested in such irrigation works.

As the Office of Experiment Stations of the United States Department of Agriculture employs a corps of state irrigation agents, an arrangement was made by which these state irrigation agents cooperated in the supervision in their respective states of the work of the special agents of the Bureau of the Census in collecting statistics of irrigation.

The information called for by this law which could be supplied by farm operators was obtained on supplemental schedules by the regular census enumerators as a part of the agricultural census. The remaining data, which were supplied by the owners or officials of irrigation enterprises, were obtained on special schedules by the special agents. The data relating to crops presented here were taken from the supplemental schedules filled out by the agricultural enumerators. With the exception of the statistics as to the number of farms irrigated, which were obtained as explained on the following page, all the other data presented here were taken from the special schedules.

The law relating to the special irrigation census, quoted above, provided that the inquiry should cover the "arid region of the United States." For the purposes of this report the "arid region" has been held to include all sections of the United States where irrigation is generally practiced in the growing of farm crops.

As defined in this way, the "arid region" includes the western parts of the tier of states formed by the Dakotas, Nebraska, Kansas, Oklahoma, and Texas, and all of the states between these and the Pacific Ocean. In parts of this great territory there is abundant rainfall; but in each of the states comprised in it there are considerable sections, and in some very extensive areas, where farming is largely dependent upon irrigation.

The special inquiry was also extended to the rice growing districts of Louisiana, Texas, and Arkansas, but the rice district has been treated separately in this report. (See p. 431.)

In accordance with the law, the enterprises have been classified primarily according to their legal status—that is, according to the state or Federal laws by virtue of which they were created, or according to other features of their legal and economic form. The types of enterprises distinguished are as follows:

United States Reclamation Service enterprises, established under the Federal law of June 17, 1902, providing for the construction of irrigation works with the receipts from the sale of public lands.

United States Indian Service enterprises, established under various acts of Congress providing for the construction by that service of works for the irrigation of land in Indian reservations.

Carey Act enterprises, established under the Federal law of August 18, 1894, granting to each of the states in the arid region 1,000,000 acres of land on condition that the state provide for its irrigation, and under amendments to that law granting additional areas to Idaho and Wyoming.

Irrigation districts, which are public corporations established under state laws and empowered to issue bonds and levy and collect taxes for the purchase or construction of irrigation works.

Cooperative enterprises, which are controlled by the water users combined in some organized form of cooperation under state laws. The most common form of organization is the stock company, the stock of which is owned by the water users. In Arizona and New Mexico many of the cooperative enterprises are operated under laws regulating "community" ditches.

Individual and partnership enterprises, which belong to individual farmers, or to groups of farmers associated without formal organization. It is not always possible to distinguish between partnership and cooperative enterprises; but as the difference is slight this is unimportant.

Commercial enterprises, incorporated or otherwise, which supply water for compensation to parties who own no interest in the works. Persons obtaining water from such enterprises are usually required to pay for the right to receive water and to pay, in addition, annual charges based in some instances on the acreage irrigated and in others on the quantity of water received.

THE ARID REGION AS A WHOLE.

Summary.—Table 1 summarizes the principal data for the arid region as a whole as returned at the census of 1910, and includes corresponding data for the preceding census as far as available. Unless otherwise indicated the figures relate to the year in which the census was taken. In the reports of the censuses of 1900 and 1890 data relating to irrigation on Indian reservations were excluded from the totals for the arid region, but for the later census they are included. Since the acreage which was irrigated on Indian reservations in 1909 was only 172,912, or 1.3 per cent of the total acreage reported as irrigated, it has not been deemed advisable to eliminate the figures for Indian reservations in making comparisons between the different censuses. The general agricultural statistics given in the table for purposes of comparison cover the entire areas of the states included in the arid region, as defined on the preceding page, although in some of the states the territory which requires no irrigation vastly exceeds the irrigated territory.

The number of farms irrigated is the number of farms on which irrigation is practiced, regardless of the extent of such irrigation, and is equivalent to the term "number of irrigators" used in previous census reports. The number given for 1909 is made up of the number reported on the supplemental agricultural schedules by the regular enumerators, together with an estimate of the number of farms served by enterprises which were reported by special agents but not by the regular enumerators. The reports of the special agents stated only the acreage supplied by such enterprises, and the number of farms was estimated on the basis of the average acreage irrigated per farm, as shown by the supplemental schedules.

The acreage irrigated in 1909 is that reported by the special agents from information secured from owners or officials of irrigation enterprises or, in some instances, from public records. This acreage is probably in some measure an overstatement. There is a natural tendency for the officials of irrigation enterprises to report as irrigated the entire areas of farms of which only a part is irrigated. Furthermore, some farms receive water from more than one enterprise, and may be reported as irrigated by each, which results in duplication. It is believed, however, that the acreage given is within 10 per cent of the correct figure. In addition to information as to the acreage irrigated in 1909 data were collected as to the acreage the enterprises were capable of supplying with water in 1910 and the total acreage which enterprises completed or under way in 1910 were designed to supply ultimately (designated as "acreage included in projects").

Table 1

	CENSUS OF—		INCREASE.	
	1910	1900	Amount.	Per cent.
Number of farms [1]	1,440,822	1,095,675	345,147	31.5
Approximate land area [1] ..... acres	1,161,385,600	1,161,385,600		
Land in farms [1] ..... acres	388,606,991	348,780,221	39,826,770	11.4
Improved land in farms [1] ..... acres	173,433,957	119,709,592	53,724,365	44.9
Number of farms irrigated	[2] 158,713	[3] 107,489	51,224	47.7
Acreage irrigated	[2] 13,738,485	[3] 7,518,527	6,219,958	82.7
Acreage enterprises were capable of irrigating	19,334,697	[4]		
Acreage included in projects	31,111,142	[4]		
Number of enterprises	54,700	[4]		
Total length of ditches ..... miles	125,591	[4]		
Length of main ditches ..... miles	87,529	[4]		
Length of lateral ditches ..... miles	38,062	[4]		
Number of reservoirs	6,812	[4]		
Capacity of reservoirs ..... acre-feet	12,581,129	[4]		
Number of flowing wells	5,070	[4]		
Number of pumped wells	14,558	[4]		
Number of pumping plants	13,906	[4]		
Capacity of power plants ..... horsepower	243,435	[4]		
Acreage irrigated with pumped water	[2] 477,625	[4]		
Acreage irrigated from flowing wells	[2] 144,400	[4]		
Cost of irrigation enterprises	$307,866,369	[5] $66,962,275	$240,904,094	359.8
Average cost per acre	[6] $15.92	[7] $8.91	[8]	
Average cost of operation and maintenance, per acre	[2] $1.07	[3] $0.38	$0.69	181.6

[1] Figures relate to entire areas of states in the arid region, the figures for 1900 including Indian Territory.
[2] In 1909.
[3] In 1899.
[4] Not reported.
[5] Cost of systems operated in 1899.
[6] Based on cost to July 1, 1910, and acreage enterprises were capable of irrigating in 1910.
[7] Based on acreage irrigated in 1899.
[8] Figures not comparable. (See explanation in text.)

The number of farms on which irrigation was practiced, for purposes other than rice growing, in 1909 in the states of the arid region was 158,713, or 11 per cent of the total number of farms in the same states

While the total number of farms in this region, including the entire area of states in which irrigation is practiced in the western part, increased 31.5 per cent between 1900 and 1910, the number of farms on

which irrigation was practiced increased 47.7 per cent between 1899 and 1909, the irrigated farms forming a larger percentage of all farms in 1909 than in 1899. The acreage reported as irrigated in 1909 was 13,738,485, which constitutes 1.2 per cent of the total land area of the same states, 3.5 per cent of the total land in farms, and 7.9 per cent of the improved land in farms. There was an increase of 82.7 per cent in such acreage between 1899 and 1909, a rate of increase much higher than that in the number of farms irrigated, the average irrigated acreage per farm being greater for 1909 than for 1899.

The acreage to which enterprises were ready to supply water in 1910 was 19,334,697, or 5,596,212 acres in excess of the acreage irrigated in 1909, while the acreage included in all projects in 1910, whether completed or in process of development, was 31,111,142, or 17,372,657 acres greater than the acreage reported as irrigated in 1909.

The total length of ditches used for irrigation in 1910 was 125,591 miles. There were 6,812 reservoirs having a combined capacity of 12,581,129 acre-feet, or nearly 1 acre-foot of reservoir capacity for each acre irrigated from any source in 1909. The number of pumping plants reported was 13,906 and the acreage supplied by them 477,625.

The total cost of irrigation enterprises to July 1, 1910, was $307,866,369, or $15.92 per acre of the land which these enterprises were capable of supplying with water in 1910. The increases in the items relating to cost are the most conspicuous shown. The total cost of irrigation enterprises increased between 1900 and 1910 by 359.8 per cent, and the average cost per acre covered increased also, although much less in degree. (As to the comparability of the figures for this item, however, see the discussion of this subject following Table 12.) The average cost of operation and maintenance per acre of land irrigated for the year 1909 shows also a large increase—181.6 per cent—over the cost shown for 1899. It is believed, however, that the cost shown for 1899 is not properly comparable with that for 1909.

FARMS AND ACREAGE IRRIGATED.

Number of farms irrigated.—Table 2 gives, by states, the number of farms irrigated in 1909, 1899, and 1889, together with the decennial rates of increase.

Table 2

STATE.	FARMS IRRIGATED.					
				Increase.[1]		
	1909	1899	1889	1899–1909		1889–1899
				Number.	Per cent.	Per cent.
Total	**158,713**	**107,489**	**54,136**	**51,224**	**47.7**	**98.6**
Arizona	4,841	2,981	1,075	1,860	62.4	177.3
California	39,352	25,611	13,732	13,741	53.7	86.5
Colorado	25,857	17,613	9,059	8,244	46.8	82.3
Idaho	16,439	8,987	4,323	7,452	82.9	107.9
Kansas	1,006	929	519	77	8.3	79.0
Montana	8,970	8,043	3,706	927	11.5	117.0
Nebraska	1,852	1,932	214	−80	−4.1	802.8
Nevada	2,406	1,906	1,167	500	26.2	63.3
New Mexico	12,795	7,884	3,085	4,911	62.3	155.6
North Dakota	69	54	7	15	(2)	(2)
Oklahoma	137	124	.....	13	10.5	.....
Oregon	6,669	4,636	3,150	2,033	43.9	47.2
South Dakota	500	606	189	−106	−17.5	220.6
Texas [3]	4,150	1,252	623	2,898	231.5	101.0
Utah	19,709	17,924	9,724	1,785	10.0	84.3
Washington	7,664	3,286	1,046	4,378	133.2	214.1
Wyoming	6,297	3,721	1,917	2,576	69.2	94.1

[1] A minus sign (−) denotes decrease.
[2] Per cent not calculated when base is less than 100.
[3] Exclusive of farms irrigated for rice growing.

The total number of farms on which irrigation was practiced in 1909 was 158,713. California contained the largest number of such farms, having about one-fourth (24.8 per cent) of the total number, and Colorado the next largest number, nearly one-sixth (16.3 per cent) of the total, while Utah ranked third in this respect, with about one-eighth (12.4 per cent) of the total.

The percentage of increase between 1889 and 1899 in the number of farms irrigated was more than double that during the succeeding decade, but the absolute increases during the two decades were approximately equal. Nebraska showed the largest percentage of increase during the former period and Texas during the latter period, but in neither state is the actual number of irrigated farms large. In Nebraska and South Dakota there were decreases between 1899 and 1909. The largest absolute increase in both decades was in California. In the period 1899 to 1909 the next largest increase was in Colorado, and in the period 1889 to 1899 in Utah.

Acreage irrigated.—Table 3 gives, by states, the acreage irrigated in the arid region in 1909, 1899, and 1889, respectively, with the percentage of increase in each decade.

Table 3

STATE.	ACREAGE IRRIGATED.					
				Increase.		
	1909	1899	1889	1899–1909		1889–1899
				Amount.	Per cent.	Per cent.
Total	**13,738,485**	**7,518,527**	**3,631,381**	**6,219,958**	**82.7**	**107.0**
Arizona	320,051	185,396	65,821	134,655	72.6	181.7
California	2,664,104	1,445,872	1,004,233	1,218,232	84.3	44.0
Colorado	2,792,032	1,611,271	890,735	1,180,761	73.3	80.9
Idaho	1,430,848	602,568	217,005	828,280	137.5	177.7
Kansas	37,479	23,620	20,818	13,859	58.7	13.5
Montana	1,679,084	951,154	350,582	727,930	76.5	171.3
Nebraska	255,950	148,538	11,744	107,412	72.3	1,164.8
Nevada	701,833	504,168	224,403	197,665	39.2	124.7
New Mexico	461,718	203,893	91,745	257,825	126.5	122.2
North Dakota	10,248	4,872	445	5,376	110.3	994.8
Oklahoma	4,388	2,759	.....	1,629	59.0	.....
Oregon	686,129	388,310	177,944	297,819	76.7	118.2
South Dakota	63,248	43,676	15,717	19,572	44.8	177.9
Texas [1]	164,283	40,952	18,241	123,331	301.2	124.5
Utah	999,410	629,293	263,473	370,117	58.8	138.8
Washington	334,378	126,307	48,799	208,071	164.7	158.8
Wyoming	1,133,302	605,878	229,676	527,424	87.1	163.8

[1] Exclusive of land irrigated for rice growing.

The total acreage reported as irrigated in 1909 was 13,738,485, an increase of 6,219,958 acres, or 82.7 per cent, as compared with 1899. The increase in the preceding decade was 3,887,146 acres, or 107 per cent.

In total acreage irrigated California ranked first in 1889, Colorado second, and Montana third. In both 1899 and 1909 Colorado reported the largest irrigated acreage, while California and Montana were second and third, respectively. Idaho followed closely in 1909. From 1899 to 1909 California showed the largest absolute increase, followed by Colorado, Idaho, and Montana in the order named. In percentage of increase for this decade, however, Texas ranked first, Washington second, Idaho third, and New Mexico fourth.

Acreage irrigated in 1909, acreage enterprises were capable of irrigating in 1910, and acreage included in projects.—In Table 4 data as to the acreage irrigated in 1909, the acreage enterprises were capable of irrigating in 1910, and the acreage included in projects are presented, with classification according to the type of enterprise.

Table 4

STATE.	ALL CLASSES OF ENTERPRISES.			U. S. RECLAMATION SERVICE.			U. S. INDIAN SERVICE.			CAREY ACT ENTERPRISES.		
	Acreage irrigated in 1909.	Acreage enterprises were capable of irrigating in 1910.	Acreage included in projects.	Acreage irrigated in 1909.	Acreage enterprises were capable of irrigating in 1910.	Acreage included in projects.	Acreage irrigated in 1909.	Acreage enterprises were capable of irrigating in 1910.	Acreage included in projects.	Acreage irrigated in 1909.	Acreage enterprises were capable of irrigating in 1910.	Acreage included in projects.
Total	**13,738,485**	**19,334,697**	**31,111,142**	**395,646**	**786,190**	**1,973,016**	**172,912**	**376,576**	**879,068**	**288,553**	**1,089,677**	**2,573,374**
Arizona	320,051	337,655	944,090	138,364	164,500	370,000	19,386	20,974	36,017			
California	2,664,104	3,619,378	5,490,360	400	1,200	14,200	3,490	3,490	3,800			
Colorado	2,792,032	3,990,166	5,917,457	16,600	30,000	193,000	1,020	2,020	20,020	485	6,085	59,480
Idaho	1,430,848	2,388,959	3,549,573	47,500	113,000	295,000	3,426	21,540	51,540	162,418	742,618	1,098,661
Kansas	37,479	139,995	161,300	6,953		10,677						
Montana	1,679,084	2,205,155	3,515,602	14,077	85,245	113,744	67,417	114,340	440,940	9,648	49,500	306,997
Nebraska	255,950	429,225	680,133	30,536	66,241	107,520	300	300	600			
Nevada	701,833	840,962	1,232,142	30,000	90,185	216,185	2,597	3,381	18,060			
New Mexico	461,718	644,970	1,102,297	13,398	21,467	30,267	24,007	24,743	37,455			16,000
North Dakota	10,248	21,917	38,173	1,610	12,096	24,480						
Oklahoma	4,388	6,397	8,528									
Oregon	686,129	830,526	2,527,208	22,000	45,310	185,000	429	439	879	24,750	65,500	623,264
South Dakota	63,248	128,431	201,625	5,613	47,568	101,967	50	50	100			
Texas [1]	164,283	340,641	753,099									
Utah	999,410	1,250,246	1,947,625				11,520	86,600	106,000	5,000	20,000	43,000
Washington	334,378	470,514	817,032	55,600	74,500	143,096	35,000	50,000	100,000			
Wyoming	1,133,302	1,639,510	2,224,208	12,905	34,869	167,880	4,270	48,699	63,657	86,252	205,974	426,472

STATE	IRRIGATION DISTRICTS.			COOPERATIVE ENTERPRISES.			INDIVIDUAL AND PARTNERSHIP ENTERPRISES.			COMMERCIAL ENTERPRISES.		
	Acreage irrigated in 1909.	Acreage enterprises were capable of irrigating in 1910.	Acreage included in projects.	Acreage irrigated in 1909.	Acreage enterprises were capable of irrigating in 1910.	Acreage included in projects.	Acreage irrigated in 1909.	Acreage enterprises were capable of irrigating in 1910.	Acreage included in projects.	Acreage irrigated in 1909.	Acreage enterprises were capable of irrigating in 1910.	Acreage included in projects.
Total	**528,642**	**800,451**	**1,581,465**	**4,643,539**	**6,191,577**	**8,830,197**	**6,257,387**	**7,666,110**	**10,153,545**	**1,451,806**	**2,424,116**	**5,119,977**
Arizona				101,025	120,559	360,639	61,196	81,422	175,834	80	200	1,800
California	173,793	294,108	606,351	779,020	984,570	1,388,435	961,136	1,131,951	1,512,511	746,265	1,204,059	1,965,063
Colorado	115,304	207,570	487,370	1,273,141	1,870,447	2,436,367	1,226,025	1,581,941	2,039,533	159,457	292,103	681,687
Idaho	140,930	177,900	329,796	628,102	782,603	993,746	403,600	483,946	676,508	44,872	67,352	104,322
Kansas				27,372	135,200	144,200	3,154	4,705	6,423			
Montana	412	6,640	6,640	333,926	373,022	518,209	1,191,060	1,495,513	1,982,220	62,544	80,895	146,852
Nebraska	76,448	77,228	91,076	78,605	168,260	240,009	45,227	64,472	86,305	24,834	52,724	154,623
Nevada				78,966	88,255	129,269	581,406	649,841	844,128	8,864	9,300	24,500
New Mexico			16,400	251,911	355,327	482,054	144,212	185,283	295,171	28,190	58,150	224,950
North Dakota							8,638	9,821	13,693			
Oklahoma				2,000	3,000	3,500	2,388	3,397	5,028			
Oregon	1,500	1,500	5,980	149,985	169,944	399,632	410,078	454,074	619,986	77,387	93,750	692,467
South Dakota				13,601	18,243	22,687	37,084	55,820	69,971	6,300	6,800	6,900
Texas [1]				41,186	75,011	146,795	49,657	65,286	104,044	73,440	200,344	502,860
Utah	8,455	8,455	10,802	687,260	790,855	1,259,351	222,448	257,266	376,502	64,727	87,070	151,970
Washington				81,122	90,805	115,410	95,655	117,145	192,310	66,911	138,064	266,216
Wyoming	11,800	27,050	27,050	116,317	165,476	189,894	813,823	1,024,137	1,153,378	87,935	133,305	195,967

[1] Exclusive of land irrigated for rice growing.

The enterprises were reported in 1910 as capable of irrigating 19,334,697 acres, which is 5,596,212 acres in excess of the acreage actually irrigated in 1909. This excess shows the extent to which the irrigated area can be enlarged without the construction of additional works. It does not, however, represent land available for settlement in the latter year, as much of the land that was under ditch in 1910 but not irrigated in 1909 was already taken up, being in farms not completely under cultivation. The excess acreage lies principally in Colorado, Idaho, California, Montana, and Wyoming, these states ranking in the order named in this respect.

The acreage included in projects which were either completed or under way July 1, 1910, as reported by the various enterprises—31,111,142—was 17,372,657

acres greater than the acreage irrigated in 1909. The figure would indicate the amount by which the irrigated acreage may be extended upon the completion of existing enterprises, were it not probable that the owners of these enterprises in some cases have overestimated what they can accomplish. It is certain, however, that much additional land will later be provided with a water supply by works that were in process of construction in 1910. The amount of excess of the acreage included in projects over that irrigated in 1909 is also greatest in the states named in the preceding paragraph and in Oregon.

Table 5 shows by percentages the relative importance of the several classes of enterprises as judged by acreage.

Table 5

CLASS OF ENTERPRISE.	PER CENT OF TOTAL FOR ARID REGION.		
	Acreage irrigated in 1909.	Acreage enterprises were capable of irrigating in 1910.	Acreage included in projects.
All classes	100.0	100.0	100.0
U. S. Reclamation Service	2.9	4.1	6.3
U. S. Indian Service	1.3	1.9	2.8
Carey Act enterprises	2.1	5.0	8.3
Irrigation districts	3.8	4.1	5.1
Cooperative enterprises	33.8	32.0	28.4
Individual and partnership enterprises	45.5	39.6	32.6
Commercial enterprises	10.6	12.5	16.5

Nearly one-half (45.5 per cent) of the acreage irrigated in 1909 was served by individual and partnership enterprises, and about one-third (33.8 per cent) by cooperative enterprises, which are controlled by the water users. Irrigation districts, which served 3.8 per cent, are also controlled by the water users. Thus about 83 per cent of the acreage irrigated in 1909 received a water supply from works controlled by the water users. United States Reclamation Service and Carey Act enterprises, which irrigated 2.9 per cent and 2.1 per cent, respectively, of this total acreage, are to be turned over to the water users when the rights are paid for, and many of the commercial enterprises are operating under a similar arrangement.

Acreage irrigated, classified by source of water supply.—In Table 6 the acreage irrigated in the arid region in 1909 is classified according to the source of the water supply. Where a supply is received from more than one source, the land is classified under the source from which the principal supply is derived. In the aggregate considerable areas are supplied with water from more than one source. Thus, in California, large areas receive water both by gravity diversion from streams and by pumping from wells, while in Texas some of the newer canals on the Rio Grande receive water by gravity when the river is high and by pumping when the river is low. In both instances most of this land is classed with the acreage that received water by gravity from streams. The only reservoirs which are treated as independent sources of supply are those filled by collecting storm water or from watercourses which are ordinarily dry. When reservoirs are filled from streams or wells, the primary source is considered the source of supply.

Table 6

STATE.	ACREAGE IRRIGATED IN 1909.									
	Total.	Supplied from—								Total irrigated with pumped water.
		Streams.		Wells.		Reservoirs.	Lakes.		Springs.	
		By gravity.	By pumping.	Flowing.	By pumping.		By gravity.	By pumping.		
Total	13,738,485	12,763,797	157,775	144,400	307,496	98,193	58,284	12,354	196,186	477,625
Arizona	320,051	300,067	7,711	1,489	6,096	487	570	.....	3,631	13,807
California	2,664,104	2,216,757	29,965	74,128	276,595	16,410	15,896	2,574	31,779	309,134
Colorado	2,792,032	2,745,035	13,248	5,171	3,111	16,091	422	634	8,320	16,993
Idaho	1,430,848	1,383,718	18,685	1,172	705	732	4,622	1,535	19,679	20,925
Kansas	37,479	35,469	20	2	1,959	2	.....	.....	27	1,979
Montana	1,679,084	1,624,656	7,963	207	55	22,614	5,617	5	17,967	8,023
Nebraska	255,950	254,105	18	.....	130	1,002	.....	.....	686	157
Nevada	701,833	661,299	463	150	37	138	500	406	38,840	993
New Mexico	461,718	397,059	1,533	48,877	5,952	1,272	862	.....	6,163	7,485
North Dakota	10,248	7,153	1,614	.....	1	1,280	.....	.....	200	1,615
Oklahoma	4,388	4,205	50	.....	69	20	28	.....	16	119
Oregon	686,129	643,281	3,585	655	805	3,279	22,915	821	10,788	5,211
South Dakota	63,248	47,122	540	1,448	8	13,535	200	.....	395	548
Texas[1]	164,283	75,496	59,196	3,710	6,152	6,203	163	295	13,068	65,643
Utah	999,410	954,800	2,559	4,100	300	568	1,671	.....	35,412	2,859
Washington	334,378	301,341	9,085	3,227	5,437	299	4,698	6,084	4,207	20,606
Wyoming	1,133,302	1,112,234	1,540	64	75	14,261	120	.....	5,008	1,615

[1] Exclusive of land irrigated for rice growing.

More than nine-tenths (92.9 per cent) of the acreage irrigated in 1909 was supplied with water by gravity diversion from streams, and, including cases where water was pumped, streams constituted the source of supply for 94.1 per cent of the total acreage irrigated. Wells supplied the next largest acreage, 3.3 per cent of the total, about one-third of this acreage being watered by flowing wells. Springs furnished the supply for 1.4 per cent of the total acreage irrigated, and reservoirs and lakes each for less than 1 per cent. Of the total acreage irrigated from wells, California contained 77.6 per cent, and New Mexico 12.1 per cent. In the case of the other sources of supply the acreage irrigated was more generally distributed among the states.

IRRIGATION WORKS.

Number of enterprises and number and length of ditches.—Table 7 shows the number of irrigation enterprises, and the number and length of main and lateral ditches, respectively, reported in 1910. It should be borne in mind that some lateral ditches are much larger than some main ditches, and that the distinction is more or less arbitrary.

Table 7

STATE.	Number of enterprises.	DITCHES. Number. Total.	Main ditches.	Laterals.	Length (miles). Total.	Main ditches.	Laterals.
Total	**54,700**	**81,837**	**45,720**	**36,117**	**125,591**	**87,529**	**38,062**
Arizona	1,269	1,204	891	313	2,597	1,727	870
California	13,970	14,733	8,590	6,143	21,129	12,620	8,509
Colorado	9,065	14,017	8,405	5,612	22,570	17,564	5,006
Idaho	3,092	6,568	3,209	3,359	12,759	7,662	5,097
Kansas	716	128	89	39	316	274	42
Montana	5,534	14,980	6,673	8,307	18,934	12,990	5,944
Nebraska	474	1,458	420	1,038	2,728	1,459	1,269
Nevada	1,347	2,525	994	1,531	3,151	1,938	1,213
New Mexico	2,786	3,381	2,101	1,280	5,854	4,664	1,190
North Dakota	49	93	47	46	126	52	74
Oklahoma	114	153	47	106	85	54	31
Oregon	3,745	6,100	3,582	2,518	7,591	5,539	2,052
South Dakota	395	680	348	332	1,256	631	625
Texas [1]	2,161	1,252	636	616	1,663	941	722
Utah	2,472	3,852	2,495	1,357	7,709	5,887	1,822
Washington	1,934	2,780	1,600	1,180	3,892	2,594	1,298
Wyoming	5,577	7,933	5,593	2,340	13,231	10,933	2,298

[1] Exclusive of enterprises supplying water for the irrigation of rice.

Reservoirs.—Table 8 gives, by states, the number and capacity of reservoirs used for irrigation in 1910. The acre-foot, used to express capacity, is the quantity of water required to cover 1 acre to the depth of 1 foot, or 43,560 cubic feet. Most of these reservoirs are filled from streams during flood season and in the winter, the stored water being used in the late summer on land which receives its earlier supply by gravity diversion from streams. Some, however, store storm water flowing in drainage channels which are ordinarily dry.

Table 8

STATE.	RESERVOIRS. Number.	Capacity (acre-feet).
Total	**6,812**	**12,581,129**
Arizona	402	1,349,938
California	1,583	743,269
Colorado	1,084	2,646,593
Idaho	243	1,742,303
Kansas	42	31,024
Montana	827	580,261
Nebraska	44	2,098
Nevada	109	325,953
New Mexico	522	464,162
North Dakota	22	132,187
Oklahoma	11	22
Oregon	271	1,024,266
South Dakota	314	216,205
Texas [1]	288	72,051
Utah	480	588,317
Washington	156	121,543
Wyoming	414	2,550,937

[1] Exclusive of reservoirs supplying water for the irrigation of rice.

Wells.—Table 9 shows the number and capacity of flowing and pumped wells used for irrigation in 1910. The capacities reported are estimates made by the owners, and are often not very accurate, as few well owners have facilities for measuring the discharge of wells. In the case of pumped wells many of the statements of capacity are based on the estimated pump capacity, the capacity of the wells themselves never having been tested.

Table 9

STATE.	WELLS. Flowing. Number.	Capacity (gallons per minute).	Pumped. Number.	Capacity (gallons per minute).
Total	**5,070**	**1,345,596**	**14,558**	**5,426,139**
Arizona	214	9,953	470	765,921
California	2,361	477,343	10,724	4,119,575
Colorado	313	41,989	121	53,564
Idaho	62	7,200	24	2,826
Kansas	3	30	939	73,362
Montana	15	22,185	10	5,263
Nebraska	.....	.....	66	3,363
Nevada	19	1,302	6	1,349
New Mexico	673	669,268	466	190,690
North Dakota	.....	.....	1	15
Oklahoma	.....	.....	65	1,791
Oregon	51	3,035	92	20,883
South Dakota	42	14,382	4	24
Texas [1]	122	36,939	1,412	121,631
Utah	1,133	42,794	27	4,827
Washington	*55*	*18,926*	*128*	*60,220*
Wyoming	2	250	3	835

[1] Exclusive of wells supplying water for the irrigation of rice.

Pumping plants.—Table 10 gives the number of pumping plants used for irrigation in 1910, with the capacities of power plants and pumps. The capacities are given as reported by the owners, and in most cases represent the rated capacities claimed by the manufacturers of the apparatus, which are probably in excess of the capacities obtained in use under ordinary field conditions.

Table 10

STATE.	PUMPING PLANTS. Number.	Capacity of power plants (horsepower).	Capacity of pumps (gallons per minute).
Total	**13,906**	**243,435**	**9,947,909**
Arizona	429	37,258	851,873
California	9,297	128,143	5,276,298
Colorado	206	7,969	296,937
Idaho	58	7,065	278,569
Kansas	698	1,517	128,276
Montana	125	3,511	281,199
Nebraska	75	140	5,366
Nevada	18	693	24,295
New Mexico	413	14,226	216,355
North Dakota	*4*	*2,038*	*132,115*
Oklahoma	68	107	4,541
Oregon	229	3,095	118,514
South Dakota	8	63	5,289
Texas [1]	1,784	20,915	1,455,285
Utah	69	2,143	315,057
Washington	391	13,847	365,411
Wyoming	34	705	*142,529*

[1] Exclusive of plants supplying water for the irrigation of rice.

COST.

Table 11 gives, by states, the total cost of irrigation enterprises in the arid region as reported at the Eleventh, Twelfth, and Thirteenth Censuses, and also the estimated final cost of enterprises which were either completed or under way on July 1, 1910, the date of the census of irrigation of 1910.

Table 11

STATE.	COST OF IRRIGATION ENTERPRISES.						
	1910		1899	1889	Increase.		
					1899–1910[1]		1889–1899
	Estimated final cost.	Cost to July 1.			Amount.	Per cent.	Per cent.
Total	**$424,281,186**	**$307,866,369**	**$66,962,275**	**[2] $29,611,000**	**$240,904,094**	**359.8**	**126.1**
Arizona	24,828,868	17,677,966	4,438,352	465,000	13,239,614	298.3	854.5
California	84,392,344	72,580,030	19,181,610	13,005,000	53,398,420	278.4	47.5
Colorado	76,443,239	56,636,443	11,758,703	6,369,000	44,877,740	381.7	84.6
Idaho	58,451,106	40,977,688	5,120,399	1,029,000	35,857,289	700.3	397.6
Kansas	1,365,563	1,365,563	529,755	(3)	835,808	157.8	.....
Montana	32,382,077	22,970,958	4,683,073	1,023,000	18,287,885	390.5	188.5
Nebraska	9,485,231	7,708,310	1,310,698	(3)	6,487,612	495.0	.....
Nevada	12,188,756	6,721,924	1,537,559	1,251,000	5,184,365	337.2	22.9
New Mexico	11,640,091	9,154,897	4,165,312	512,000	4,989,585	119.8	713.5
North Dakota	836,482	836,482	16,980	(3)	819,502	4,826.3	.....
Oklahoma	47,200	47,200	21,872	.....	25,328	115.8	.....
Oregon	39,216,619	12,760,214	1,843,771	826,000	10,916,443	592.1	123.2
South Dakota	3,800,556	3,043,140	284,747	(3)	2,758,393	968.7	.....
Texas [4]	8,613,533	7,346,708	705,608	(3)	6,641,100	941.2	.....
Utah	17,840,775	14,028,717	5,865,302	2,780,000	8,163,415	139.2	111.0
Washington	22,322,856	16,219,149	1,525,369	197,000	14,693,780	963.3	674.3
Wyoming	20,425,890	17,700,980	3,973,165	1,281,000	13,727,815	345.5	210.2

[1] Increase computed on the basis of the cost to July 1, 1910.
[2] Includes $273,000 for Kansas, Nebraska, North Dakota, South Dakota, and Texas, which are not shown separately in the report of the census of 1890, these five states being grouped under the designation of "subhumid region."
[3] Separate figures not available.
[4] Exclusive of enterprises supplying water for the irrigation of rice.

The cost of irrigation enterprises up to July 1, 1910, as reported at the Thirteenth Census, includes the cost of construction, the cost of acquiring rights, and any added costs incident to construction, such as the purchase of land for rights of way, the building of structures for use in operation and maintenance, and engineering and legal expenses. For all of the larger enterprises the cost is that given by the owners, but it is probable that in many cases this is estimated rather than taken from actual accounts. For some of the smaller enterprises the cost was estimated by the special agents of the Census Bureau, and in the case of some schedules received by mail the cost has been estimated in the bureau on the basis of the average cost per acre for other enterprises of the same class in the same vicinity. Many of the smaller ditches were built a number of years ago by their owners without the expenditure of much, if any, money, and many of these have since changed hands. In such cases the cost given by the present owners is only a rough estimate. The data as to cost reported for 1899 and 1889 are probably somewhat less accurate than those for 1910. The figure for cost given in the Twelfth Census report is designated as the "cost of construction of systems operated in 1899." The figure for cost at the Eleventh Census is an estimate consisting of the sum of the amounts obtained by multiplying the acreage irrigated by the average first cost per acre of obtaining water, or of water rights, as given by the irrigators. Although not specifically stated in the reports for the previous censuses, it is probable that the figures there given include the same items represented in the figure for cost in 1910.

The total cost of irrigation enterprises up to July 1, 1910, was reported as $307,866,369, which represents an increase of $240,904,094, or 359.8 per cent over the cost reported at the census of 1900. In no state in the arid region was the increase in cost for this period less than 100 per cent, the highest percentage of increase being in North Dakota and the lowest in Oklahoma. With respect to absolute increase California ranked first, Colorado second, Idaho third, and Montana fourth. The year 1910 was in the midst of a period of great activity in the construction of irrigation works, and on July 1, 1910, a large number of works were incomplete. The "estimated final cost" reported, $424,281,186, is the sum of the cost up to July 1 and the estimated cost of completing these unfinished works.

Average cost per acre.—Table 12 gives the average cost of irrigation enterprises per acre. The averages for 1889 and 1899 are, with one exception, for the acreage actually irrigated in the respective years. These averages are probably considerably higher than if they had been calculated on the basis of the acreage the enterprises were capable of irrigating. At the Thirteenth Census the average cost per acre has been computed by dividing the cost to July 1, 1910, by the acreage which enterprises were capable of irrigating in 1910. Averages based on the acreage irrigated in 1909 and the cost

to July 1, 1910, are, however, also presented as a rough basis for comparison with the averages for the previous censuses. In addition, averages based on the estimated final cost of enterprises and the acreage which their owners expect finally to be able to supply with water are given. These latter averages would represent most accurately the true cost of providing works to supply water for irrigation, were it not for a more or less general tendency to underestimate cost and overestimate the acreage it will be possible to serve.

Table 12 AVERAGE COST OF IRRIGATION ENTERPRISES PER ACRE.

STATE.	1910			1899	1889
	Based on cost to July 1, 1910, and acreage enterprises were capable of irrigating in 1910.	Based on cost to July 1, 1910, and acreage irrigated in 1909.	Based on estimated final cost and acreage included in projects.		
Total	**$15.92**	**$22.41**	**$13.64**	**$8.91**	**$8.15**
Arizona	45.60	55.23	26.30	23.94	7.07
California	20.05	27.24	15.37	13.27	12.95
Colorado	14.19	20.29	12.92	7.30	7.15
Idaho	17.15	28.64	16.47	[1] 3.79	4.74
Kansas	9.75	36.44	8.47	22.43	[2]
Montana	10.42	13.68	9.21	4.92	4.63
Nebraska	18.17	30.47	13.95	8.82	[2]
Nevada	7.99	9.58	9.89	3.05	7.58
New Mexico	14.19	19.83	10.56	20.43	5.58
North Dakota	38.17	81.62	21.01	3.49	[2]
Oklahoma	7.38	10.76	5.53	7.93	.....
Oregon	15.36	18.60	15.52	4.75	4.64
South Dakota	23.69	48.11	18.85	6.52	[2]
Texas [3]	21.57	44.72	11.43	17.23	[2]
Utah	11.22	14.04	9.16	9.32	10.55
Washington	34.47	48.51	27.32	[1] 12.08	4.03
Wyoming	10.80	15.62	9.18	6.6	3.62

[1] Based on acreage under ditch in 1899.
[2] Figures for Kansas, Nebraska, North Dakota, South Dakota, and Texas are not shown separately in the report of the census of 1890, these five states being grouped under the designation of "subhumid region." The average for the subhumid region was $4.07.
[3] Exclusive of land irrigated for rice growing.

The average cost per acre based on the acreage irrigated in 1909 was $22.41; that based on the acreage enterprises were capable of irrigating in 1910 was $15.92; and that based on the estimated total cost and the acreage included in projects was $13.64.

Between 1889 and 1899 there was no marked increase in the average cost of irrigation enterprises per acre of land irrigated, but in 1910 the average cost per acre was very much higher. The chief reason for this is the fact that, naturally, irrigation enterprises were first undertaken where water could be most easily secured and engineering difficulties were least serious. The enterprises undertaken during more recent years have been of necessity on a much larger scale than those built formerly, and, in most cases, of a better and more permanent type of construction. Indeed, much of the cost incurred between 1899 and 1910 was for the improvement of existing works, especially by the addition of reservoirs, which did not provide water for new lands, but rather provided a better supply for land already irrigated.

Average cost per acre, by type of enterprise.—Table 13 gives the average cost of irrigation enterprises per acre in 1910, computed in the three ways just shown, for each class of enterprises.

Table 13 AVERAGE COST OF IRRIGATION ENTERPRISES PER ACRE.

CLASS OF ENTERPRISE.	Based on cost to July 1, 1910, and acreage enterprises were capable of irrigating in 1910.	Based on cost to July 1, 1910, and acreage irrigated in 1909.	Based on estimated final cost and acreage included in projects.
All classes	**$15.92**	**$22.41**	**$13.64**
U. S. Reclamation Service	67.52	134.17	48.14
U. S. Indian Service	12.78	27.83	13.33
Carey Act enterprises	30.53	115.30	21.75
Irrigation districts	27.37	41.44	20.33
Cooperative enterprises	12.89	17.19	10.07
Individual and partnership enterprises	7.09	8.69	5.22
Commercial enterprises	24.98	41.71	16.79

The highest average cost per acre on each basis is shown for the United States Reclamation Service enterprises, and the next highest in each case for Carey Act enterprises. Irrigation districts ranked third and commercial enterprises fourth, except in one case where the order is reversed. These four classes comprise the large enterprises which are now engaged in developing new lands, and most of their work is of recent date. The works built by individuals or cooperative enterprises, which are smaller and were for the most part built at an earlier period, naturally utilized the sources from which water could be most readily diverted and transported to the land to be irrigated. The larger works of recent date serve land farther from the streams and involve better, more expensive, and more permanent construction, and as a result the average cost per acre is higher than that for the small works.

Average cost per acre, by size groups.—The average cost of irrigation works per acre for enterprises classified by size is shown in Table 14. The classification is based on the acreage intended ultimately to be irrigated.

It will be noted that in general the cost per acre irrigated increases with the size of enterprises. This condition is due at least in a considerable measure to the fact already noted that most of the larger enterprises, which are mainly of recent date, have had to seek water more difficult to obtain than that secured by the smaller enterprises, and that they represent a better type of work.

Table 14

	Total.	ENTERPRISES CONTAINING—				
		Less than 25,000 acres.	25,000 to 50,000 acres.	50,000 to 75,000 acres.	75,000 to 100,000 acres.	100,000 acres and over.
Number of enterprises	54,700	54,548	74	28	16	34
Acreage:						
Irrigated in 1909	13,738,485	11,395,874	832,024	412,685	264,096	833,806
Enterprises were capable of irrigating in 1910	19,334,697	14,789,465	1,281,145	728,795	493,514	2,041,778
Included in projects	31,111,142	20,632,614	2,420,289	1,623,348	1,309,247	5,125,644
Cost:						
To July 1, 1910	$307,866,369	$175,308,121	$23,411,977	$19,524,778	$14,420,824	$75,200,669
Estimated final	$424,281,186	$207,068,121	$33,154,836	$33,537,574	$21,368,421	$129,152,234
Average cost per acre based on:						
Acreage irrigated in 1909 and cost to July 1, 1910	$22.41	$15.38	$28.14	$47.31	$54.60	$90.19
Acreage enterprises were capable of irrigating in 1910 and cost to July 1, 1910	$15.92	$11.85	$18.27	$26.79	$29.22	$36.83
Acreage included in projects and estimated final cost	$13.64	$10.04	$13.70	$20.66	$16.32	$25.20

Operation and maintenance.—Table 15 gives the average cost per acre for the operation and maintenance of irrigation enterprises in 1909. The inquiry as to this item was not extended to individual and partnership enterprises, for the reason that farmers owning their own ditches usually clean and repair them at odd times without keeping any record of the time or money expended. In the case of some enterprises of other classes, no reports were received. The statistics for cost of operation reported at the two previous censuses, for various reasons, are not fairly comparable with those for 1909, and consequently are not shown in the table.

For the arid region as a whole, the average cost of operation and maintenance per acre irrigated was $1.07. The abnormal cost shown for North Dakota ($28.40) relates almost entirely to a single large project which supplied water in 1909 to only a small part of the acreage which it is designed to serve. The lowest average is for Oklahoma ($0.51 per acre).

Table 15

STATE.	Acreage irrigated in 1909 by enterprises for which cost of operation and maintenance was reported.	REPORTED COST OF OPERATION AND MAINTENANCE IN 1909.	
		Amount.	Average per acre for which cost was reported.
Total	**6,379,955**	**$6,828,433**	**$1.07**
Arizona	230,429	214,358	0.93
California	1,368,247	2,109,431	1.54
Colorado	1,401,670	1,046,208	0.75
Idaho	883,098	560,032	0.63
Kansas	34,255	54,595	1.59
Montana	394,507	349,662	0.89
Nebraska	209,023	227,385	1.09
Nevada	88,976	86,110	0.97
New Mexico	278,439	377,972	1.36
North Dakota	1,610	45,718	28.40
Oklahoma	1,969	1,000	0.51
Oregon	263,855	198,111	0.75
South Dakota	25,514	16,288	0.64
Texas [1]	109,697	356,260	3.25
Utah	689,994	451,283	0.65
Washington	176,197	543,312	3.08
Wyoming	221,875	190,648	0.86

[1] Exclusive of enterprises supplying water for the irrigation of rice.

CROPS.

The returns of crops grown on irrigated land, which were made by the regular enumerators of population and agriculture, are somewhat incomplete, for the reason that, owing to the late date at which the provisions of law regarding the irrigation census were passed, the enumerators could not be as carefully instructed regarding the special irrigation schedules as regarding the regular agricultural schedules. On many of the schedules the agricultural enumerators reported land as irrigated but failed to return separately the crops grown on such land. The total acreage of crops reported as raised on irrigated land formed 52.7 per cent of the total acreage irrigated in 1909; and while part of the remainder was doubtless in pasture, it is evident that part was in crops not reported as grown under irrigation and a part was probably in crops not harvested. Although the totals are thus incomplete, the returns are sufficiently accurate to afford reliable averages of yields and values and to show the relative importance of the various crops.

Table 16 gives, by states, the total acreage and total value of crops reported as irrigated in 1909, with the average value per acre.

Table 16

STATE.	CROPS IRRIGATED IN 1909.		
	Acreage.	Value.	
		Total.	Average per acre.
Total	**7,241,561**	**$181,617,396**	**$25.08**
Arizona	171,302	4,718,100	27.54
California	1,196,767	52,057,007	43.50
Colorado	1,650,356	39,478,994	23.92
Idaho	772,684	16,582,213	21.46
Kansas	22,118	477,025	21.57
Montana	909,342	14,535,960	15.99
Nebraska	137,211	1,973,860	14.39
Nevada	356,079	5,339,475	15.00
New Mexico	230,034	5,705,922	24.80
North Dakota	3,273	56,215	17.18
Oklahoma	2,806	51,995	18.53
Oregon	368,911	7,489,255	20.30
South Dakota	38,438	505,684	13.16
Texas [1]	58,227	2,645,385	45.43
Utah	579,744	14,642,792	25.26
Washington	160,483	7,994,531	49.82
Wyoming	583,786	7,362,983	12.61

[1] Exclusive of rice.

The table shows for all crops reported as irrigated an average value per acre of $25.08.

The highest average value per acre for crops raised on irrigated land is that for Washington, $49.82, which

is followed by that for Texas, $45.43 (exclusive of rice), and that for California, $43.50. Wyoming showed the lowest average value per acre, $12.61. As is to be expected, the average value per acre is highest in the states with large areas of fruits, vegetables, and other specialized crops raised by means of irrigation, while in those where forage crops and grains predominate the average is lower. Fruit crops comprised about 12 per cent of the total acreage of irrigated crops in Washington in 1909 and about 21 per cent of the total in California, and vegetables and other special crops about 21 per cent of the total acreage of irrigated crops in Texas, exclusive of rice. In Wyoming, on the other hand, more than 32 per cent of the total acreage of irrigated crops in 1909 was in wild grass, and irrigated fruit crops were insignificant.

Table 17 shows the reported acreage and value of each important irrigated crop in the arid region as a whole, with the percentage of the total represented by each.

Table 17

CROP.	CROPS IRRIGATED IN 1909.			
	Acreage.		Value.	
	Amount.	Per cent of total.	Amount.	Per cent of total.
Total reported	7,241,561	100.0	$181,617,396	100.0
Alfalfa	2,216,628	30.6	50,850,533	28.0
Wild, salt, or prairie grasses	1,530,669	21.1	11,734,258	6.5
Oats	739,632	10.2	14,055,424	7.7
Wheat	548,173	7.6	12,826,982	7.1
Barley	240,117	3.3	4,309,445	2.4
Orchard fruits and grapes	236,385	3.3	18,245,182	10.0
Other tame or cultivated grasses	219,701	3.0	2,571,297	1.4
Grains cut green	209,363	2.9	2,992,570	1.6
Timothy alone	202,817	2.8	3,211,651	1.8
Sugar beets	183,467	2.5	10,511,467	5.8
Timothy and clover mixed	183,308	2.5	3,071,935	1.7
Potatoes	168,014	2.3	10,085,692	5.6
Corn	133,673	1.8	2,423,507	1.3
Tropical and subtropical fruits	99,431	1.4	15,344,375	8.4
All other	330,183	4.6	19,293,078	10.6

In acreage alfalfa ranked first, with 30.6 per cent of the total reported; "wild, salt, or prairie grasses" second, with 21.1 per cent; and oats third, with 10.2 per cent. Forage crops, taken together, occupied about 63 per cent of the total reported acreage, cereals about 23 per cent, sugar beets 2.5 per cent, potatoes 2.3 per cent, fruit crops about 5 per cent, and the crops such as vegetables, root forage, cotton, buckwheat, and others (grouped under the head "all other") 4.6 per cent.

In value also alfalfa was most important, representing 28 per cent of the total amount reported; but orchard fruits and grapes ranked second in this respect among the crops shown separately and tropical fruits third, notwithstanding the relatively small acreages in these crops.

Average yields per acre.—Table 18 shows for each of the leading crops grown on irrigated land the average yield per acre in comparison with the average yield of the same crop on unirrigated land in the United States as a whole. Yields for fruit crops are not given because of the large variety of units in which these yields were expressed and because the general agricultural schedules do not show the acreage in these crops.

Table 18

CROP.	AVERAGE YIELD PER ACRE.		EXCESS OF AVERAGE YIELD ON IRRIGATED LAND OVER THAT ON UNIRRIGATED LAND.[1]	
	On irrigated land, arid region.	On unirrigated land, entire United States.	Amount.	Per cent.
Cereals:				
Corn.....bushels..	23.7	25.9	−2.2	−8.5
Oats.....bushels..	36.8	28.5	8.3	29.1
Wheat.....bushels..	25.6	15.3	10.3	67.3
Barley.....bushels..	29.1	22.3	6.8	30.5
Hay and forage:				
Alfalfa.....tons..	2.94	2.14	0.80	37.4
Timothy alone.....tons..	1.73	1.22	0.51	41.8
Timothy and clover mixed.....tons..	1.82	1.26	0.56	44.4
Other tame or cultivated grasses[2].tons..	1.53	1.05	0.48	45.7
Wild, salt, or prairie grasses.....tons..	1.06	1.07	−0.01	−0.9
Grains cut green.....tons..	1.46	1.23	0.23	18.7
Sundry crops:				
Potatoes.....bushels..	153.6	103.8	49.8	48.0
Sugar beets.....tons..	11.89	9.73	2.16	22.2

[1] A minus sign (−) indicates that the yield on irrigated land is less than that on unirrigated land.
[2] Includes millet or Hungarian grass.

For each of the crops presented in the table except corn and "wild, salt, or prairie grasses," the average yield on irrigated land exceeds that on unirrigated land, the percentages of excess ranging from 18.7 for grains cut green to 67.3 per cent for wheat. As climatic conditions in the arid region are not favorable to corn, it is not grown to a large extent there. In the case of "wild, salt, or prairie grasses" the average yields on irrigated and unirrigated land are practically equal. A large part of the unirrigated wild grass is cut on river bottom lands where the soil is likely to be wet, even without irrigation, and consequently a difference in favor of irrigated land is not to be expected.

A combined average for all the crops listed in Table 18, each being given a weight corresponding to its acreage, shows an excess yield of 28.6 per cent for the crops grown on irrigated land over those grown on unirrigated land. It is, of course, obvious that this difference in no way represents the advantage of irrigation over nonirrigation. In some sections where rainfall is plentiful irrigation would add little to the yield, but in arid sections often little or nothing can be raised without irrigation.

Average values per acre.—The average values per acre of the leading irrigated crops reported for the arid region are shown in Table 19 in comparison with averages for the same crops grown on unirrigated land for the United States as a whole, so far as acreage figures are available for these.

Among crops grown on irrigated land in 1909, tropical fruits led in average value per acre by a wide margin, orchard fruits and grapes ranking second. Potatoes followed the fruit crops, with an average value of $60.03, and sugar beets were next of the

crops shown separately, the average value being $57.29 per acre. Alfalfa, the most important irrigated crop, had an average value per acre of $22.94. In comparing the average values per acre for different crops it should be borne in mind that the crops with higher average values often require more expensive methods of cultivation than those with lower average values.

Table 19

CROP.	AVERAGE VALUE PER ACRE.		EXCESS OF AVERAGE VALUE FOR IRRIGATED LAND OVER THAT FOR UNIRRIGATED LAND.	
	On irrigated land, arid region.	On unirrigated land, entire United States.	Amount.	Per cent.
Tropical and subtropical fruits	$154.32	(1)	.....	.....
Orchard fruits and grapes	77.18	(1)	.....	.....
Potatoes	60.03	$44.66	$15.37	34.4
Sugar beets	57.29	51.90	5.39	10.4
Wheat	23.40	14.75	8.65	58.6
Alfalfa	22.94	16.97	5.97	35.2
Oats	19.00	11.64	7.36	63.2
Barley	18.32	11.81	6.51	55.1
Corn	18.13	14.62	3.51	24.0
Timothy and clover mixed	16.76	13.13	3.63	27.6
Timothy alone	15.84	12.76	3.08	24.1
Grains cut green	14.29	14.26	0.03	0.2
Other tame or cultivated grasses [2]	11.70	10.35	1.35	13.0
Wild, salt, or prairie grasses	7.67	5.06	2.61	51.6
All other	58.43	(3)	.....	.....

[1] Acreage not reported. [2] Includes millet or Hungarian grass.
[3] Comparable figure not available.

Each of the crops shown in the table for which comparisons are made had a higher average value per acre for irrigated land than is shown for the same crop grown on unirrigated land for the United States. The excess in favor of the products raised on irrigated land, for the crops included in the comparison, ranged from 0.2 per cent for grains cut green to 63.2 per cent for oats. The average excess for irrigated crops for the crops for which comparative figures are given in the table, based on the total acreages and total values, is about 43 per cent. It should be noted that the comparison just made does not include the crops with the highest average values per acre, such as fruits and vegetables.

Comparison with preceding census.—According to the reports of the Twelfth Census the total acreage of irrigated crops in the arid and semiarid states was 5,932,557, while the acreage of such crops reported at the present census of irrigation was 7,241,561, which represents an increase of 22.1 per cent. The fact that this increase is much smaller than the increase in the acreage reported as irrigated (82.7 per cent) is a further indication that the crop reports of the census of irrigation for 1910 are incomplete. Because of this incompleteness, the crop figures of the two censuses are not compared directly, but in Table 20 the percentage which the acreage in each irrigated crop formed of the total acreage reported in such crops is shown for the two censuses.

Table 20

CROP.	ACREAGE OF IRRIGATED CROPS.			
	1909		1899	
	Acreage.	Per cent of total.	Acreage.	Per cent of total.
Total reported	7,241,561	100.0	5,932,557	100.0
Alfalfa	2,216,628	30.6	1,517,883	25.6
Wild, salt, or prairie grasses	1,530,669	21.1	997,438	16.8
Oats	739,632	10.2	332,365	5.6
Wheat	548,173	7.6	775,991	13.1
Barley	240,117	3.3	172,228	2.9
Other tame or cultivated grasses [1]	219,701	3.0	306,298	5.2
Grains cut green	209,363	2.9	200,639	3.4
Sugar beets	183,467	2.5	9,074	0.2
Potatoes	168,014	2.3	90,991	1.5
Corn	133,673	1.8	149,799	2.5
Tropical and subtropical fruits	99,431	1.4	87,071	1.5
Rye	6,054	0.1	7,096	0.1
All other	946,639	13.1	1,285,679	21.7

[1] Includes millet or Hungarian grass.

From Table 20 it appears that at both censuses alfalfa was the leading crop grown under irrigation, but that it occupied a considerably larger proportion of the total acreage reported for irrigated crops in 1909 than in 1899. The crop next in importance in respect to acreage in both years was "wild, salt, or prairie grasses," which likewise comprised a larger percentage of the total in 1909 than in 1899. Oats was third in acreage in 1909, followed by wheat, while in 1899 wheat ranked third and oats fourth. Oats covered a much larger percentage of the total acreage of irrigated crops in 1909 than in 1899 and wheat a much smaller percentage in the later than in the earlier year.

The most notable relative increase was for sugar beets, the growing of this crop in the irrigated region being largely a development of the last decade. Potatoes also showed a marked increase in relative importance. Tropical and subtropical fruits occupied about the same place in the two censuses. From a comparison of Table 20 with Table 19, it will be seen that, with the exception of "wild, salt, or prairie grasses," the irrigated crops which are increasing in acreage most rapidly are all among the crops with relatively high values per acre.

IRRIGATION FOR RICE GROWING.

As previously stated, the special inquiry into irrigation for rice growing was confined to the rice growing districts of Louisiana, Texas, and Arkansas. The data collected, except those relating to crops, are summarized in Table 21.

The number of farms reporting irrigation for rice growing and the acreage irrigated, as reported at the census of 1910, cover the year 1909, while all other data for that census relate to the year 1910. The reports of the agricultural census of 1910 show that 95.5 per cent of the entire acreage of rice harvested in 1909 was in the three states included in the special irrigation inquiry, and that in all the other states a marked decrease occurred between 1899 and 1909

in the acreage in rice. The figures given in the table for the census of 1910 represent, therefore, in a fairly adequate measure, the extent of irrigation for rice growing in the United States.

The acreage reported on the special irrigation schedules as irrigated for rice growing in 1909 is greater than the total acreage of rice reported in that year on the agricultural schedules for the territory covered. This difference is due principally to the fact that the irrigation schedules show the total acreage watered, while the agricultural schedules show only the acreage harvested. A considerable acreage planted in rice in 1909 was not harvested because of poor stand, shortage of water, and damage by storms.

Table 21

	Total for specified states.	Louisiana.	Texas.	Arkansas.
Number of farms reporting irrigation for rice growing	4,010	2,690	1,088	232
Acreage irrigated for rice growing	694,800	380,200	286,847	27,753
Acreage enterprises were capable of irrigating in 1910	950,706	553,220	350,350	47,136
Acreage included in projects	1,134,322	581,065	499,474	52,883
Number of enterprises	2,158	1,237	611	310
Total length of ditches...miles	2,339	1,168	1,040	131
Length of main ditches...miles	1,398	729	538	131
Length of lateral ditches...miles	941	439	502	.....
Reservoirs:				
Number	144	104	21	19
Capacity...acre-feet	21,795	19,482	2,310	3
Flowing wells:				
Number	1	.....	1	.....
Capacity...gals. per min.	80	.....	80	.....
Pumped wells:				
Number	1,413	606	500	307
Capacity...gals. per min.	1,822,560	1,108,230	445,495	268,829
Pumping plants:				
Number	1,897	1,007	575	315
Capacity of power plants, horsepower	113,045	57,426	48,179	12,440
Capacity of pumps, gals. per min.	9,407,955	5,064,173	3,907,380	436,402
Cost of irrigation enterprises to July 1, 1910	$13,587,639	$6,859,166	$6,140,639	$587,834
Average cost per acre [1]	$14.29	$12.40	$17.53	$12.47
Estimated final cost of existing enterprises	$13,667,639	$6,914,166	$6,140,639	$612,834
Average cost per acre [2]	$12.05	$11.88	$12.29	$11.59

[1] Based on acreage enterprises were capable of irrigating in 1910.
[2] Based on acreage included in projects.

The total acreage irrigated for rice growing in the three states in 1909 was 694,800, of which 54.7 per cent was in Louisiana, 41.3 per cent in Texas, and 4 per cent in Arkansas. The enterprises which were completed or under way in 1910 were reported as capable of irrigating 950,706 acres in that year and of serving ultimately a total of 1,134,322 acres.

The total cost of irrigation enterprises to July 1, 1910, was $13,587,639, or an average of $14.29 per acre for the land to which they were capable of supplying water in 1910. Upon the basis of the acreage irrigated in 1909, the average cost per acre was $19.56. The estimated total cost of enterprises completed or under way in 1910 was $13,667,639, or $12.05 per acre for the land included in these enterprises. From these figures it appears that the works for supplying water for rice irrigation which were under construction in 1910 were relatively insignificant.

In the report on irrigation for the Twelfth Census no information relating to the irrigation of rice in Arkansas is given, because the rice growing industry in that state was insignificant in 1900.

In Table 22 comparisons are made for Louisiana and Texas for the few items that were reported at both censuses. The figures for the Twelfth Census relate to the year 1899.

Table 22

	Louisiana. Census of—		Louisiana. Per cent of increase. (1)	Texas. Census of—		Texas. Per cent of increase.
	1910	1900		1910	1900	
Farms reporting irrigation for rice growing	2,690	4,531	−40.6	1,088	73	(2)
Acreage irrigated	380,200	201,685	88.5	286,847	8,700	3,197.1
Enterprises...number	1,237	596	107.6	611	(3)	.....
Length of main ditches, (miles)	729	386	88.9	538	(3)	.....
Cost of irrigation enterprises	$6,859,166	$2,529,319	171.2	$6,140,639	[4] $322,000	1,807.0
Average cost per acre	[5] $12.40	[6] $12.54	(7)	$17.53	$37.01	(7)

[1] A minus sign (−) denotes decrease.
[2] Per cent not calculated when base is less than 100.
[3] Not reported.
[4] Estimated.
[5] Based on cost to July 1, 1910, and acreage enterprises were capable of irrigating in 1910.
[6] Based on cost of systems operated in 1899, and acreage irrigated in that year.
[7] Figures not comparable. (See explanation in text.)

In Louisiana considerable increases have taken place since the census of 1900 in all the items shown in the table except number of farms. The large decrease in the number of farms reporting the irrigation of rice is probably due to the abandonment of rice growing on farms where only small acreages were planted, and an extension of the industry in sections where rice is grown on a larger scale. In Texas almost the entire development has taken place since 1899.

As the figures for average cost of irrigation enterprises per acre at the two censuses are not computed on the same basis, they are not comparable.

Although the crop returns for irrigated rice are not complete, they are sufficiently so to afford reliable averages of the yield and value per acre. These are shown in Table 23.

Table 23

State.	Rice grown on irrigated land in 1909. Average yield per acre (bushels).	Average value per acre.
Louisiana	34.6	$25.70
Texas	38.7	28.54
Arkansas	45.9	41.56

Continuous cropping in rice exhausts the soil, and the districts of Louisiana, where the land has been used for a longer time than in other sections, show the lowest average yield, while Arkansas, where the growing of rice is of comparatively recent date, shows the highest average yield.