SIXTEENTH CENSUS OF THE UNITED STATES: 1940

IRRIGATION OF AGRICULTURAL LANDS


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Prepared under the supervision of
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LETTER OF TRANSMITTAL

DEPARTMENT OF COMMERCE
BUREAU OF THE CENSUS
Washington, D. C., November 5, 1940

SIR:

I transmit herewith the volume on Irrigation of Agricultural Lands of the Sixteenth Decennial Census. This report contains detailed statistics for drainage basins and counties with summaries for the States and the United States. State reports, contained in this volume, were first published as separate bulletins.

Provision for the 1940 Census of Irrigation was made in the Act providing for the Fifteenth Decennial Census which was approved on June 18, 1929. Through the medium of mail and field canvasses, returns were obtained from all types of irrigation enterprises, except enterprises of the United States Government which were reported directly to the Bureau of the Census.

The collection and compilation of these statistics and the preparation of this volume were made under the supervision of Z. R. Pettet, Chief Statistician for Agriculture, with the assistance of Sherman S. Slick, Assistant Chief Statistician, and Milo S. Williams, Principal Irrigation Engineer. Much helpful aid was furnished by other members of the Division of Agriculture. The graphic material was prepared under the supervision of Clarence E. Bateschef, Geographer of the Census.

Acknowledgment is made also of the assistance and cooperation of Paul A. Ewing, Irrigation Economist, U. S. Department of Agriculture, who acted in a consultant capacity; Wells A. Hutchins, Senior Irrigation Economist, Soil Conservation Service, U. S. Department of Agriculture; G. W. Lineweaver, Chief of Research Section, Bureau of Reclamation, Department of the Interior; and of the Division of Statistical Standards, Bureau of the Budget.

Respectfully,

J. C. CAPT,
Director of the Census

Hon. JESSE H. JONES,
Secretary of Commerce
REPORTS ON AGRICULTURE, IRRIGATION, AND DRAINAGE

Volume I.—Statistics by Counties for Farms, and Farm Property, with Related Information for Farms and Farm Operators; Livestock and Livestock Products; and Crops.

Part 1.—New England, Middle Atlantic, and East North Central States
Part 2.—West North Central States
Part 3.—South Atlantic States

Part 4.—East South Central States
Part 5.—West South Central States
Part 6.—Mountain and Pacific States

Volume II.—Statistics by Counties for Value of Farm Products, Farms Classified by Major Source of Income, and Farms Classified by Total Value of Products.

Part 1.—Northern States
Part 2.—Southern States
Part 3.—Western States


Chapter I.—Farms and Farm Property
Chapter II.—Size of Farms
Chapter III.—Color, Tenure, and Race of Farm Operators
Chapter IV.—Farm Mortgages and Farm Taxes
Chapter V.—Work Off Farm, Age, and Years on Farm
Chapter VI.—Cooperation, Labor, Expenditures, Machinery, Facilities, and Residence
Chapter VII.—Livestock and Livestock Products
Chapter VIII.—Field Crops and Vegetables
Chapter IX.—Fruits and Nuts and Horticultural Specialties
Chapter X.—Value of Farm Products

United States Summary Bulletin.—Statistics for the United States, Geographic Divisions and States in condensed form as follows:

First Series Summary—Number of Farms, Uses of Land, Values, Principal Classes of Livestock and Livestock Products; and Specified Crops Harvested.
Second Series Summary—Farms Mortgaged, Taxes, Labor, Expenditures, and Miscellaneous Farm Information; Goats and Mohair; and Fruits, Vegetables, and Minor Crops.
Third Series Summary—Value of Farm Products, Farms Classified by Major Source of Income, and Farms Classified by Total Value of Products.

Special Poultry Report.—Statistics by Geographic Divisions and States for Poultry of All Kinds on Hand and Raised; by Counties for Chickens and Chickens Egg Production by Number of Chickens on Hand; and by Counties for Farms Reporting Chickens and Turkeys Raised by Numbers Raised (one volume).

Cows Milked and Dairy Products—Number of Cows Milked, Milk Produced, Disposition of Dairy Products, and Number of Cows Kept Mainly for Milk Production, Classified by Number of Cows Milked, by Counties; with Related Data for Other Classes of Livestock and Livestock Products for the States and also for the United States.

Territories and Outlying Possessions.—Farms and Farm Property, Livestock and Livestock Products, and Crops (one volume).

(Territories: Alaska, Hawaii, Puerto Rico)

Outlying Possessions: American Samoa, Guam, Virgin Islands of the United States

Irrigation of Agricultural Lands.—Statistics by Drainage Basins and by Counties for 20 Irrigation States and a Summary for the United States (one volume).

Twenty Separate State Maps Showing Irrigation by Drainage Basins.
A Separate Composite Map Showing Irrigation by Drainage Basins.

Drainage of Agricultural Lands.—Statistics for 38 Drainage States with County Data for 38 States and a summary for the United States (one volume).

A Separate Map of the United States Showing Location of Land in Drainage Enterprises for 38 States.
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Introduction

History of the Census of Irrigation.—Inquiries relating to irrigation were first made for the Eleventh Decennial Census taken in 1890 by the Bureau of the Census in 16 western States. These statistics were published in a separate report, "Agriculture by Irrigation in the Western Part of the United States." The Twelfth Decennial Census taken in 1900 included, as a part of the Census of Agriculture, irrigation inquiries in the same 16 States and those statistics were included in the State reports of the Census of Agriculture. A special Census of Irrigation was taken in 1902 and the statistics were published in Bulletin No. 16, of the Bureau of the Census, 1904. An irrigation census was taken as a part of the Census of Agriculture in the years of 1910, 1920, 1930, and 1940 and the data published for each Irrigation Census as separate reports. An inquiry relating to irrigated cropland harvested was also included in the middecennial Census of Agriculture in 1925, but these data were published in the Agriculture Reports for that year.

Presentation of statistics.—This volume presents statistics for irrigation in the United States collected by the Bureau of the Census in 1940 and shows some comparable data from the Irrigation Censuses of 1890, 1900, and 1910 and to a greater degree for 1920 and 1930.

Included are a summary for the United States and reprints of statistics for the 20 States where an Irrigation Census was taken on special schedules in 1940. These State reports were first presented in 18 separate bulletins (data for the States of Arkansas and Oklahoma were combined in one bulletin and those for North Dakota and South Dakota in another) entitled "Irrigation of Agricultural Lands." In addition to the statistics obtained on the special irrigation schedules, data are also shown for all States as obtained on the Farm and Ranch Schedule in the Agricultural Census.

Statistics for 17 western States and Arkansas and Louisiana are summarized as one group, and the less extensive statistics for the remaining 23 States are presented as a second group to represent the more humid portion of the United States. Although a special schedule was used for the 1940 Irrigation Census in Florida, the statistics for this State are summarized with the humid group as there are no historic data to present, comparable to the data for the 19 States in the western portion of the United States.

The following textual matter relates to the tabulations presented in this volume.

Method of collecting information.—The plan followed in both the Fifteenth and Sixteenth Decennial Censuses for the canvass of irrigation enterprises involved the use of two schedules designated as Irrigation-1 and Irrigation-2. The simpler of these schedules, or Irrigation-1, was used by the enumerators engaged in the canvass of population and agriculture to obtain reports of individual, partnership, and cooperative enterprises serving 1 to 4 farms. The more elaborate, or Irrigation-2, schedule was used in a preliminary canvass by mail, which was followed by a field canvass by special irrigation technicians. Through the medium of the mail and field canvasses reports were obtained from all types of irrigation enterprises serving 5 or more farms, except Government enterprises which were reported directly to the Bureau of the Census by the Commissioner of the Bureau of Reclamation and the Commissioner of the Office of Indian Affairs, the separate reports being prepared by local division or project engineers under the supervision of these officials.

Census dates.—The dates of the Sixteenth and Fifteenth Decennial Censuses were as of April 1, 1940 and 1930, respectively, while the date of the Fourteenth Decennial Census was as of January 1, 1920. The change of date did not affect the comparison interval of 10 years used in this report because, in general, the statistics of farms, areas irrigated, crops grown under irrigation, and amounts and costs of water related to the calendar years preceding the years of enumeration. The statistics of acreages to which existing works were capable of supplying water related to the year in which the enumeration was made, and the statistics of capital investment were as of December 31 of the preceding year, thus also retaining the comparative interval of exactly 10 years. Enterprises which began to operate after January 1, 1940 were not included in the Sixteenth Decennial Census enumeration.

Scope of the Census of Irrigation.—The basic inquiries in the irrigation census of 1940 were similar to those made in previous censuses; namely, (1) the type of irrigation enterprises as indicated by the character of their organizations, (2) the areas of irrigable lands in enterprises and under irrigation, (3) the physical structures used in diverting, lifting, storing, and distributing irrigation water to farms, and (4) the capital investment of irrigation enterprises. Supplemental inquiries were also made regarding other phases of irrigation, such as source of water supply, number of farms irrigated in 1939, type of water rights, drainage of irrigated lands, capacity of irrigation works and the annual cost of their maintenance and operation, quantity of water diverted and delivered, indebtedness of irrigation enterprises, pay roll, and employees. Inquiries made in connection with the Census of Agriculture made it possible to show the value of irrigated farms, and the tenure of the operators of these farms.

The 1940 separate Census of Irrigation was confined to 20 States, 10 of which comprised that portion of the United States in which irrigation is a recognized feature of agricultural practice; the other State, included for the first time, being Florida. The 19 States which comprised the areas covered in the 1930 and 1920 Irrigation Censuses are Arizona, Arkansas, California, Colorado, Idaho, Kansas, Louisiana, Mississippi, Nebraska, Nevada, New Mexico, North Dakota, Oklahoma, Oregon, South Dakota, Texas, Utah, Washington, and Wyoming. In the remaining 23 States, irrigation is practiced to a limited, though increasing, extent, to supplement uncertain rainfall. Therefore, some irrigation statistics have been obtained for these States in the 1940 and several prior Censuses of Agriculture. These data are presented in this summary together with more comprehensive 1940 figures for the State of Florida.

Relative completeness and accuracy

The 1940 Census of Agriculture included questions as to the 1939 acreage of irrigated crops harvested and of irrigated land in all States. A duplication of inquiries relating to numbers of farms and areas irrigated was thus involved in the 1940 Farm and Ranch Schedule and the schedules used in the irrigation census. Since the larger irrigation enterprises were canvassed independently, complete harmony between the results of the two enumerations could not be expected. Although the questions on the Irrigation Schedules calling for number of farms were accompanied with the Census definition of a farm, quoted later, and specific instructions were given to base answers on that definition, it is apparent that many enterprises were unable to furnish the exact number of farms conforming to the Census definition. Instead, they gave the numbers of ownerships on their assessment rolls, or estimates,
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Which in some cases may have included small plots, town lots, or other irrigated units not properly considered as farm under the definition. The units reported on the Irrigation Schedules were shown as "irrigated farms" in the 1940 Census of Irrigation State bulletins; however, that designation has been changed to "irrigated units" in the summary tables to more closely approximate the statistics and improve the means of the data that the figures presented may or may not represent actual farms in the meaning of that term as defined for the 1940 Census of Agriculture.

In some instances where large irrigation enterprises were known by the enumerators to have reported their irrigation operations on their irrigation Schedules, they failed to answer the irrigated-areas and irrigated-crop questions on the Farm and Ranch Schedules. When filling out the Farm and Ranch Schedule, some enumerators indicated irrigation by individual or other small systems, but failed to obtain Irrigation Schedules. Efforts were made to obtain missing data by correspondence or other means but not always with success.

The irrigation questions on the Farm and Ranch Schedule asked for acreages of irrigated cropland harvested and irrigated pasture, while the question on the Irrigation Schedules asked for the total irrigated area broken down into irrigated cropland harvested, irrigated pasture, and irrigated area upon which crops failed. In numerous cases the total irrigated land reported on Irrigation Schedules included irrigated land fallowed in preparation for fall planting, land in vegetative alfalfa, and land irrigated for erosion control, from all of which no crops were harvested, failed, or were used for pasture. These lands were not to be included in the answers to the irrigation questions on the Farm and Ranch Schedule; however, they were retained in the irrigation census statistics to show a more nearly complete use of land and water.

Farms or units and areas. — As with previous census figures, it is apparent that while the owners of the small individual and partnership irrigation enterprises were likely to have accurate knowledge of the areas irrigated in 1939 because they were also the users of the water, the officials of many large enterprises were not so likely to know the exact areas irrigated since their records show, generally, only the areas for which the water users were entitled to receive or did receive water, and not what was done with the water delivered. In the larger enterprises farmers usually obtain rights to water for their entire farms, but it was by no means uniformly the case that a farmer actually applied the allotted quantity to the farm, even though he was assessed and paid for water on that basis. Again, some enterprises, where water was not appurtenant to the lands served, kept records only of the quantity of water delivered to users and had no means of knowing the exact number of farms or acreages irrigated; therefore, the reports of these enterprises were approximations which may not always harmonize with the Farm Census reports. However, increasing numbers of the larger enterprises conduct annual crop surveys, which has tended to make their statements of areas irrigated in 1939 more accurate than those made in previous censuses.

In irrigation census enumerations, several types of duplication have to be guarded against. Many farms receive water from more than one enterprise and may be included in the irrigated areas reported by all the enterprises from which they receive water; some enterprises extend across county lines and may be reported completely more than once; and some enterprises may be known by more than one name and may be reported under each. Many differences appearing in the comparison of 1940 and 1930 statistics are attributed to the incorrect distribution of the statistics of 1940 for extensive irrigations, intercounty lines, and intercounty projects.

The likelihood of omissions was indicated by the occasional absence of Irrigation Schedules for Farm and Ranch Schedules reporting irrigation. The two sets of schedules were carefully compared, and when irrigation reports appeared to be missing they were checked up. There was also a showing of service by extensive enterprises for which reports had been received, and many farmers returned schedules describing small systems not previously reported. Of those who did not reply at all, it is impossible to estimate the proportion who operated unreported systems. Relative to the total, however, the unreported enterprises did not involve large numbers, acreages, works, or investments.

The irrigable area in enterprises is probably greater, in many cases, than the area to which the reporting enterprises will ultimately be able to supply water. However, since 1932, many of the larger enterprises, especially those which have undergone financial reorganization, have carefully surveyed and scrutinized their lands, in order to ascertain the practical extent of their irrigability, considering topography, quality of soils, and quantity of water normally available or expected to be made available.

The figures for the area enterprises were capable of supplying with water in 1940 are based on the extent and condition of the physical works as they existed on December 31, 1939.

Investment in irrigation enterprises. — The amounts reported for the individual and partnership enterprises are largely estimates. The greater part of the works of such enterprises was built by the owners or their predecessors who kept no records of money or time expended. This is true also of many of the cooperative enterprises. A substantial proportion of those systems was built decades ago. Many have changed ownership within recent years, some repeatedly, with greatly changed capitalization and indebtedness resulting. Thus, investment of present owners may correctly be reported as more or less than the investment of the original or previously reported owners.

In the 1940 census of interstate, interdrainage basin, or intercounty irrigation enterprises, the investment, indebtedness, assessments, and other charges were allocated to the various subdivisions, in proportion to the lands in each for which the works were capable of supplying water in 1940. However, the items of physical works were tabulated in the county or other subdivision in which they existed. In some instances this procedure distorted the comparisons of 1940 statistics with those of previous censuses.

Amount expended for water rights. — The question on the schedule sought any actual purchase price of water rights and also filing fees, legal fees, and court costs, but the statistics obtained, although carefully edited and checked by correspondence, can only be considered approximations of actual water-right expenditures.

Cost of maintenance and operation. — For many enterprises this cost was not reported, and no attempts were made to estimate it. It is probable, therefore, that the cost reported based on recopy or good memory and is substantially correct. In tables showing this item the irrigated areas reporting are also shown, in order to provide a gauge of the value of the averages.

Quantity of water used. — Reports on this item were obtained from the more extensive projects and from all but a few of the pumping enterprises. No figures were supplied for enterprises if the question was not answered. The data for enterprises reporting estimates and those reporting measurements are shown separately. In every case the irrigated area reporting is given in order to give the value of the averages.

Area for which drains have been installed. — The figures shown for this item are probably more accurate than those for the additional areas in need of drainage, the latter necessarily being largely estimated based on the opinion of the persons supplying the information.

Irrigation works and equipment. — The reported inventory of physical works sometimes indicated a lack of exact knowledge regarding the lengths and capacities of canals, the sizes and lengths of pipe lines, and the capacities of small reservoirs, pumping stations, and wells. Certain places have not been included in the data and in other cases community lateral included, contrary to instructions. A complete inventory of quantities was not obtained for all farm pipe lines located in the large enterprises; however, the pipes reported were well grouped according to materials and types. Some confusion appeared in some instances because of the designations of certain kinds of pumps, especially, in the 1940 irrigation census, between centrifugal and turbine types, and in the 1930 census, between centrifugal and rotary. Owners of pumps and engines are presumed to know the capacities at which the pumps and engines were rated.
CENSUS OF IRRIGATION: 1940

by their manufacturers, but these ratings often vary widely and usually exceed the discharges produced in actual use. Most wells have never been tested beyond the capacities of the pumps used in them, and it is probable that in only a minority of cases have the most economic yields been determined. Therefore, most instances of the reported yields of pumped wells represent the owners' estimates of what has been pumped, based on the rated capacities of the pumps used, and not on the amounts of water which the wells could produce economically as determined by tests or measurements. Similarly, the exact lifts, including drawdown, for many pumping plants have not been ascertained accurately by farmers, although in most sections where pumping from wells is widespread, close approximations to correct figures are increasingly obtainable. Many farm tractors, pumping irrigation water, reported power much in excess of that necessary for the work performed. When such cases were revealed the horsepower was adjusted to correspond to a reasonable efficiency representative of that obtained from stationary types of internal-combustion engines, and the investment in such farm tractors by farmers in that section from irrigation investment. The 1940 census made inquiry as to the number of hours pumping plants were operated in 1939. This time factor was used with the reported capacity of the pump to obtain more accurately the amounts of water pumped and applied to the land.

Finances, pay roll, and employees.—The 1940 Census of Irrigation inquired as to the "amount expended for construction, etc. (capital expenditures), in 1939," the "total amount of wages and salaries paid and payable for 1939," and the "total number employed during the week ending April 29, 1939," of irrigation enterprises serving 5 or more farms. Statistics obtained from these inquiries are shown by type of enterprise and size of enterprise, and in various detailed tabulations.

Employment during the period of one week was requested in order to eliminate the effect of turn-over—so that the number of employees can be taken to correspond to the number of jobs in that period. The last week in April 1939 was selected to harmonize with the period covered by inquiries of the Bureau of the Census, on State and local governmental employment. This was desirable because many irrigation enterprises are themselves governmental units.

Wages and salaries paid and payable were requested for the year 1939 because pay-roll figures are not distorted by turn-over of personnel. The annual total thus provides a reliable indication of the volume of employment throughout the year, including both year-round and seasonal work.

The amount of wages shown should not be divided by the total number employed to arrive at average earnings per employee during the year, because turn-over and seasonal variations in employment would result in a much larger number being employed during the year than during any one week in the year.

DEFINITION OF TERMS AND EXPLANATION OF TABLES

Irrigation census statistics are presented for 20 States, according to source of water supply, type of irrigation, type of equipment, and size of enterprise. Similar statistics are given in more detail for drainage basins and counties in each State, and in a summary, for drainage basins and individual States. The summary includes the 17 western States and Arkansas and Louisiana. In the summary data are shown for Florida only in tables 20 and 21 (section C).

Farms.—A "farm" irrigated or unirrigated, is considered as indicated in tabulations referring to "all farms," was defined on the 1940 Farm and Ranch Schedule as:

"all the land on which some agricultural operations are performed by one person, either by his own labor alone or with the labor of members of his household, or hired employees. The land operated by a partnership is likewise considered a farm. A farm may consist of a single tract of land, or a number of separate tracts, and the several tracts may be held under different tenures, as when one tract is owned by the farmer and another tract is rented by him. When a landowner has one or more tenants, renters, croppers, or managers, the land operated by each is considered a farm. Thus, on a plantation the land operated by each cropper, renter, or tenant

should be reported as a separate farm, and the land operated by the owner or manager by means of wage hands should likewise be reported as a separate farm.

The enumerators were instructed not to report as a farm any tract of land of less than 3 acres, unless its agricultural products in the year preceding the enumeration were valued at $500 or more. (See also discussion under "Relative Completeness and Accuracy.")

"Irrigated farms" are those reporting irrigation in the year preceding the date of enumeration. "Wholly irrigated" farms are those reporting the irrigation of all cropland harvested. "Partly irrigated" farms are all other farms reporting irrigation, including those farms on which the irrigation was confined to pasture.

Land in all farms.—The acreage designated as "land in all farms" includes considerable areas of land not actually under cultivation and some not even used for pasture, since each farmer was asked to report as a unit all the land under his control, or rather all the land which he thought of as a part of his farm. Included are tracts of timberland and other areas not connected with the farm were not included.

Land in irrigated farms.—This is the area of those farms which were wholly or partly irrigated in the year preceding the enumeration.

Farms values.—The operator of the farm was asked to report first, the total value of his farm (land and buildings), and then the value of all the land he operated, whether he owned it, whether he operated for himself or managed for others. He was asked to give the current market value—that is, the amount for which the farm would sell under normal conditions, not at forced sale. The tabulated results of this inquiry are shown as "Value of land and buildings" and represents the total value of farm real estate. The values of irrigated farms are thus the value of farms which were wholly or partly irrigated.

The value of farm implements and machinery shown is that reported on the Farm and Ranch Schedule. Enumerators were instructed to exclude the value of commercial mills and factories and "permanently installed irrigation and drainage equipment."

Tenure of farm operator.—A "farm operator," according to the Census definition, is a person who operates a farm, either performing the labor himself or directly supervising it.

Owners, as used in the term "owners and managers," include part owners as well as full owners, as classified in the Census of Agriculture.

Irrigated land.—The following instruction was given to enumerators in 1940, 1950, and 1960:

Land should be classed as irrigated which has water supplied to it for agricultural purposes by artificial means or by seepage from canals, reservoirs, or irrigated lands, but land which has natural ground water sufficiently near the surface to support plant life should not be classed as irrigated. Land which is flooded during high-water periods should be classed as irrigated if water is caused to flow over it by dams, canals, or other works, but should not be classed as irrigated if the overflow is due to natural causes alone.

"Area irrigated" is, therefore, the acreage to which water was actually supplied in the seasons (1939, 1939, and 1919) preceding the enumeration years of the sixteenth, fifteenth, and the fourteenth censuses, respectively. It is not necessarily the area for which water was available or the area entitled to water; hence it does not include land under canals and sometimes irrigated but which was not watered in 1939, 1939, or 1919. Moreover, it takes no account of the degree of sufficiency of the irrigation.

Area works were capable of supplying water.—This figure relates to the year of the census (1940, 1950, or 1960). It is based on reports made by those controlling the enterprises, and represents the area the constructed works, as they existed on January 1 of the census year, could serve, regardless of whether or not the land was farmed.

Irrigable area in enterprises (1940 and 1930) and total area in enterprises (1920)—These items represent the extent of the plans of those controlling the enterprises. Possible extensions of projects not definitely planned in 1940 or 1930 were not included in the area reported as irrigable.
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Irrigated areas (1899, 1898, and 1928). Irrigated areas (1940 and 1950), and areas works were capable of supplying (1940, 1950, and 1960) are net; i.e., they do not include known duplications representing areas served or susceptible of being served by more than one primary enterprise. Acres shown for supplemental enterprises (1940 Census) constitute the portions of the areas shown for primary enterprises that received or were capable of receiving additional water.

Irrigation enterprise.—An "enterprise" is an independent irrigation establishment owning or operating works for supplying water to agricultural land. An enterprise may represent a short canal or a pumping plant watering a single small farm, or a large system of canals and reservoirs operated under terms of annual contracts supplying thousands of farms. Only such enterprises as supplied water for irrigation in 1939 and 1969, or were capable of supplying water for irrigation in 1940 and 1950, or were in advanced stages of construction January 1, 1940 or 1950, were included in the sixteenth and fifteenth censuses. The 1960 totals take into account various consolidations made since 1950.

Presentation of the statistics by States, drainage basins, and counties, requires that for an enterprise comprising land in more than one State, basin, or county, the part in each be considered a separate enterprise. However, the actual number of enterprises, eliminating such duplications, is shown in summary tables showing areas and investment by character of enterprise.

Type of enterprise.—The types of enterprises under which all data are classified are as follows:

**Individual and partnership enterprises** belong to individual farmers or to partnerships who together own and operate an irrigation establishment. These are largely enterprises using small gravity diversions from streams, springs, or water from pumped wells.

**Corporate or mutual enterprises** are controlled by the water users, under some form of cooperation, either incorporated or unincorporated. The most common form of organization is the stock cooperative, in which mutual enterprises, the charges of stock are owned by the water users and represent proportions of the available water. The stock may or may not be appurtenant to the land irrigated, and in some cases the interest in the stock is transferred by the users to the enterprise.

In the Southwest, where irrigation was practiced before the region became a part of the United States, part of the land is still watered by "community ditches," or public "aqueducts," organized and operated in accordance with old Mexican customs providing for the election of officials by the landowners and for fixed labor on repairs and cleaning of the ditches. These enterprises are classified as cooperative enterprises. However, many incorporated irrigation enterprises are known as "mutual" enterprises, under which water is supplied to members, which is so classified.

In the tabulations were various water-user organizations essentially cooperative, which have administrative, managerial, protective, or sometimes even protective, the sole object, physical works although perhaps assessing their members for various and costs and expenses. (See, also, United States Bureau of Reclamation enterprises.) Usually such entities operated outside the year to safeguard the existing or prospective rights of their members, but did not own or distribute water.

Irrigation districts are public corporations established under State laws empowering them to issue bonds to obtain funds for the purchase or construction of irrigation works and to levy and collect taxes for the acquisition of land and water rights and the cost of maintenance and operation of the works. The term "irrigation districts" also covers water-improvement districts, water-utilization districts, and water-storage districts, which are in addition to irrigation districts and in other States are in lieu of them. Irrigation districts are controlled by the owners of the lands comprising them through boards or directors elected by the landowners. A few districts which have the sole function of storing water for irrigation purposes are included in the classification. (See, also, United States Bureau of Reclamation enterprises.)

Commercial enterprises, incorporated or unincorporated, supply water for irrigation to farmers who own an interest in the water. In many States enterprises may be organized in any form, but their operations are subject to some degree of public control in most States. This was the case in the past with the construction of large irrigation systems. Such enterprises built irrigation works and were given the right by the users to supply water to the purchasers on payment of a fixed charge for the water. However, in recent years, more and more water users have organized irrigation districts to supply water to their members on a cooperative basis.

Multiple-purpose enterprises.—The number of multiple-purpose enterprises which render irrigation service in connection with other services has increased during recent years. In the 1960 census, cities and public utility enterprises which supply irrigation water from domestic water systems or extensions thereof and/or from the effluent of sewage disposal plants, were recorded as irrigation enterprises, provided the receipts received from irrigation customers exceeded 50% of the total receipts from other services and represented substantial amounts. Cities supplying water to only a few irrigators at domestic water rates were not considered irrigation enterprises; however, each farmer receiving such water was counted as an individual enterprise with a "City water" supply. Large multiple-purpose enterprises involving water storage, power development, flood protection, channel development, ground water recharge, and other...
functions in addition to irrigation, were enumerated as irrigation enterprises. In each case, however, unless otherwise indicated, only such construction statistics as were included in the 1940 Irrigation Census tabulations as could reasonably be allocated to the irrigation phase or purpose. Thus, the allotment was determined from varying factors such as capital chargeable to the irrigated land, works used wholly for irrigation, actual or anticipated irrigation revenues, etc. Drainage, reclamation, irrigation, and other types of districts which, in lieu of service on an irrigation service with one or more supplemental services were classed as irrigation enterprises. Works and costs in each case were allocated as closely as possible to each purpose. For instance, in the case of enterprises operating pumping plants primarily installed for drainage purposes held by water for irrigation, the capital costs were allocated to drainage and the cost of maintenance and operation to irrigation.

Primary and supplemental enterprises.—Each irrigation enterprise, regardless of type, was classified in the 1940 Census as "primary," "supplemental," or a combination of both, according to the service it rendered to irrigators. A primary enterprise is one which furnishes water to the irrigators, or, the major portion, of the irrigation water used. A stream diversion or pumping plant which one or more farmers consider a principal source of their water which is in any way to provide irrigation and shall waters, or to retard surface waters until they percolate into underground storage from which irrigation water is pumped. In the 1940 Census, classification of sources of water supplies was expanded somewhat to group those enterprises which have like combinations of primary sources and those which receive supplemental water from streams by gravity, from storage or by pumping. Where these supplemental sources appear, no attempt was made to separate the supplemental Census. All areas shown as receiving water from supplemental sources are also included in the areas shown as receiving water from primary sources, however, duplication of area statistics is avoided in the tables showing sources of supply by omitting from the totals the areas served from supplemental sources. The amounts of water derived from irrigation and investment costs and cost statistics are shown separately for each source classification.

Water rights.—The 1940 irrigation census made inquiry regarding the type of water rights held by the reporting enterprise with three questions calling for indication of riparian, appropriation, and "all other" rights, with instruction accompanying the questions directing that rights other than riparian or appropriative be reported under "all other," and that the physical designation of types of rights be made. More specific questions or instructions might have been made reporting of a greater number of "other" types, as in many instances the enterprises failed to identify such other rights. The water-right tabulations present acreage figures according to the predominant types of rights reported, but owing to the lack of knowledge of the distinctions between the various types on the part of many irrigators and enumerators, the tabulations can only be considered to disclose approximately the actual situation.

For the sake of such comparisons as may be significant, the water-right tabulations of the 1930 Irrigation Census are shown. However, present interest in water-right statistics appears to lie principally in the relative status of appropriative to riparian rights in States which recognize both, and in rights to ground water, rather than to the various stages in which appropriative rights exist.

Cost of irrigation works and equipment.—The census instruction was as follows:

Include the original cost of the irrigation works plus the cost of extensions and improvements; also the cost of equipment, buildings, and labor for maintenance and operation, but not water rights. If works are not complete give investment to December 31, 1939. If there are no records of cost, or if the owner has done all or part of the construction, make the best estimate of cost obtained, including the estimated value of the work done by the owner. Only such costs for drainage works as are chargeable to irrigation should be included.

Cost of water rights.—Instructions specified that this item should "include filing and legal fees paid by the enterprise in acquiring them; and, if they were purchased by the enterprise, give the purchase price."
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The 1940 Census tabulations show the reported cost of water rights separately, while in previous censuses this item was added to the cost of irrigation works and presented as "capital investment." However, the cost of irrigation works and equipment and the cost of water rights were added together in 1940, as in previous censuses, to produce figures representing total investments and these totals were related to acreages the works were capable of supplying with water in 1940, as previously, to produce comparable average investments per acre.

Financing. The 1940 Census made no data for the first time regarding the financial status of those enterprises designed for 5 or more farms. The total indebtedness and the amount in principal or interest on bonds or other funded obligations, were reported as of December 31, 1939. Inquiry was made as to the amount of mortgage. December 31, 1939, the amount of water taxes, including special assessments, and the amount expended for construction in 1939, as capital expenditure. In the tabulations, the financing items have been related to the areas, capital investment, and charges and assessments of enterprises reporting indebtedness, as far as the replies permitted.

Cost of maintenance and operation.—Instructions were to "report only the costs of maintenance, including ordinary cleaning and operating expenses, including the cost of fuel, and energy, and attendance." Also to be included were the amounts of operating and maintenance costs of the drainage pumps or systems which are chargeable to irrigation. In tables showing these costs, they are related to the acreages irrigated in 1939 by the enterprises reporting.

Main canals and laterals.—A main canal is any open conduit conveying water from the source of supply to the tract of land to be irrigated or to a storage reservoir. A lateral canal is a branch of a main canal conveying water from a main canal to one or more farms. Main canals and laterals are tabulated as "canals." Farm ditches which distribute water to fields with supplies of the individual farm are not reported. Lengths of earth canals and lined canals, including sloughs, appear separately in the tabulations. The material used, for most lined canals, was reported as concrete.

Diversion dams.—A diversion dam is a structure placed across the channel of a natural stream for the purpose of diverting all or a portion of the stream flow into a canal or other water conduit. Many of the diversion dams reported are temporary structures built of sand, rock, brush, or other accessible materials. Tables classifying diversion dams by material include these temporary structures as "other and mixed" because of the variety of materials used. Most such dams are destroyed during periods of high water and have to be replaced annually or even more frequently.

Storage dams and reservoirs.—A storage dam is a structure built for the purpose of storing water in a stream channel, ravine, or other natural depression. These dams are tabulated according to the materials of construction. Dams were not reported for all reservoirs as many small reservoirs are built by excavation and embankments on level ground in connection with pumping plants for overnight storage. Tanks and other small structures capable of storing less than 1/8 acre-foot of water were not included in the tabulations.

Pumping plants.—The census of pumping plants was confined to those used for lifting irrigation water and were associated and tabulated according to the kind or motive power, i.e., "electric motors," "internal-combustion engines," and "other power"; and by type of pump, i.e., "centrifugal," "turbine," "plunger," and "other pumps." Steam, water, and wind were classified as "other power." Rotary, hydraulic, ram, and air, and home-made pumps were classified as "other pumps." The inquiry regarding the average lift of pumping plants related for the vertical distance, in feet, between the average elevation of the water in the source of supply when the pump is running and the average elevation to which the water is lifted. It does not take into account friction and velocity heads. The lift statistics show separately the lifts from wells and from surface sources to indicate the lifts of ground water in areas irrigated from wells.

Units of measure.—The following units of measure are used in this report:

Capacity of a canal at main heading is given in second feet ("acc.-ft." or "c.f.s.") abbreviations for cubic feet per second. A second-foot is the rate of discharge of water flowing in a channel when the cross-sectional area is 1 square foot, and the average velocity is 1 foot per second.

Capacity of a reservoir is given in acre-feet ("ac.-ft."). An acre-foot of water is the quantity that will cover 1 acre to a depth of 1 foot, and equals approximately 43,560 cubic feet or 325,851 gallons.

Capacity of a motor and an engine is given in horsepower ("hp."). One horsepower is the energy required to lift 33,000 pounds through a vertical distance of 1 foot in 1 minute.

Irrigated crops.—Table 28 (section C) carries data for specified crops grown on irrigated and nonirrigated lands in the 17 western States and Arkansas and Louisiana in 1939, with comparable acreages for 1929, where available. The average yields shown in this table for irrigated crops are based on the farms reporting the entire crop irrigated, while the yields for nonirrigated crops are based on farms reporting no irrigation for such crops. The 1939 basic data for these crops appear in volumes I and III of the Reports for the 1940 Census of Agriculture. The 1929 basic data for the irrigated crops appear in the 1930 report "Irrigation of Agricultural Land" and data for crops in volumes II and IV of the Reports for the 1930 Census of Agriculture. In the 1940 Census, a farm reporting both irrigated and nonirrigated acreages of a given crop was recorded as a farm in each group. Therefore, the total of the farms reporting irrigated and nonirrigated acreages for a crop exceeded the actual number of farms having that crop to the extent of the number of farms which used both irrigated and nonirrigated culture in the census year.

Farms mortgage debt and taxes on irrigated farms.—In the 1940 Census of Agriculture, mortgage and tax information was obtained only for farms of full owners and for the owned portions of farms of part owners. The mortgage inquiries were made for the mortgage status (the amount of mortgage debt and the rate of interest on the first mortgage). The tax inquiries were made for taxes levied on the real estate in the farm as well as those levied on personal property on the farm. The statistics are shown separately for full owners and for part owners. In presenting the mortgage statistics, farms are classified by mortgage status and the amount of the mortgage is related to the acreage and value of the farms reporting these items. The number of farms, acreage, and value are also shown by mortgage status.

In presenting the statistics for farm taxes, the real-estate taxes are related to the acreage and value of the farms reporting these items. A more detailed discussion of mortgage and tax statistics for all owner-operated farms is presented by States in chapter IV, of volume III, of the Reports of the 1940 Census of Agriculture. The statistics relating to mortgage debt and real estate taxes, especially those values and percentages for farms reported to farm of owner operators where all of the cropland harvested in 1939 was irrigated.

In comparing the mortgage and tax statistics for irrigated farms with those for farms it cannot be assumed that the differences in the totals represent nonirrigated farms only. Such differences include not only nonirrigated farms, but also farms where irrigation was restricted to pasture lands, fallow land, and partly irrigated farms where only a portion of the crops harvested were irrigated.

Separate figures for mortgage debt and real-estate taxes are presented for owner operators owning no additional land. The mortgage and tax data for these farms are not distorted by any debt or taxes which might relate to other land.

The interest rate reported was the annual rate as specified in the first mortgage. Figures given for this item are presented under "average of the rates." They do not represent weighted average as they are simply the sum of the rates reported divided by the number of reports.

The real-estate taxes were related to the taxes levied in 1939 on the real estate of the farm owned by the operator on April 1, 1940, including buildings and other improvements. The taxes levied by drainage or irrigation districts were not to be included.

The personal-property taxes were related to taxes on personal property such as livestock, machinery, etc., owned by the operator and on the farm operated. Automobile taxes, fees, and licenses were to be excluded.