

Volume 5

Special Reports

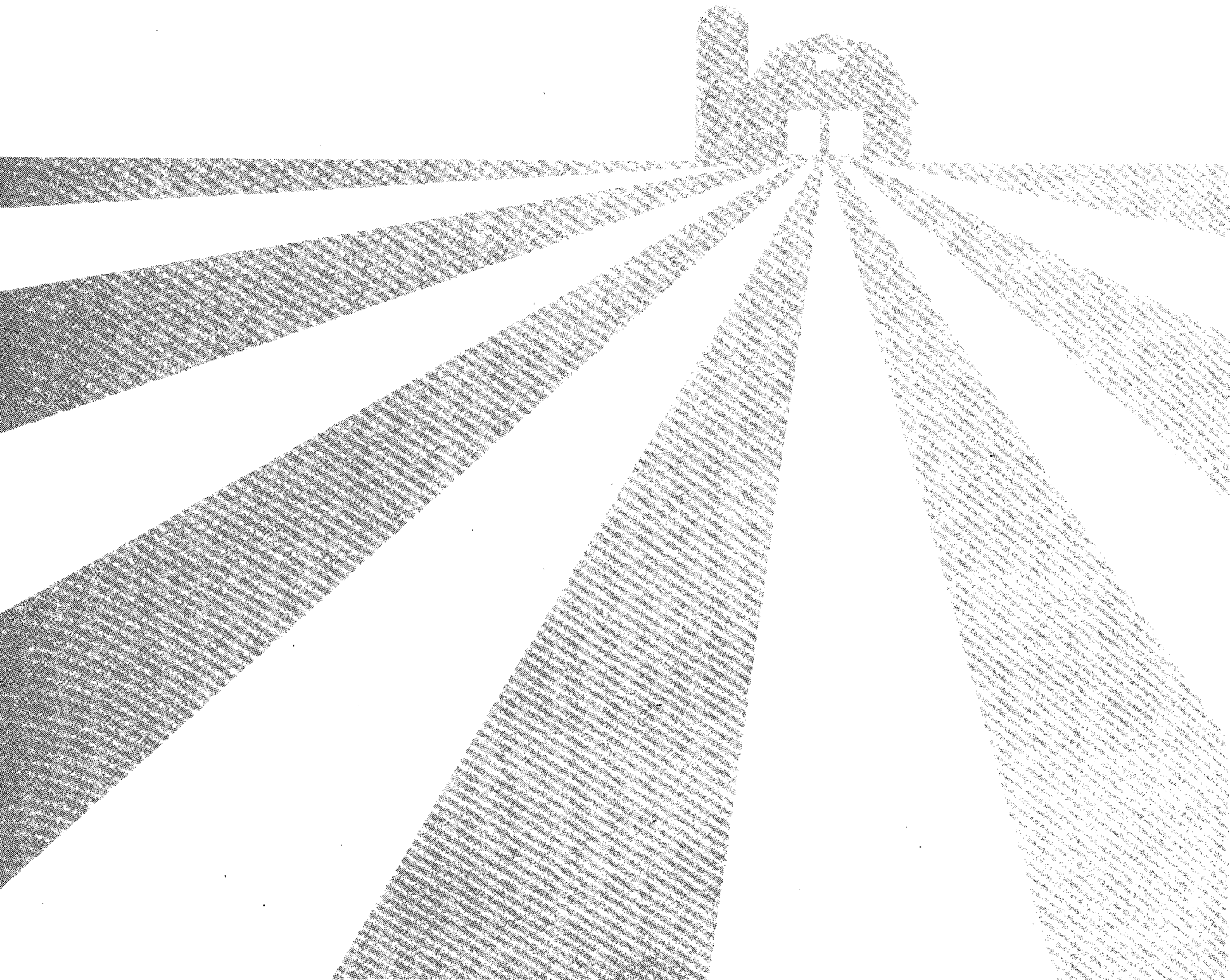
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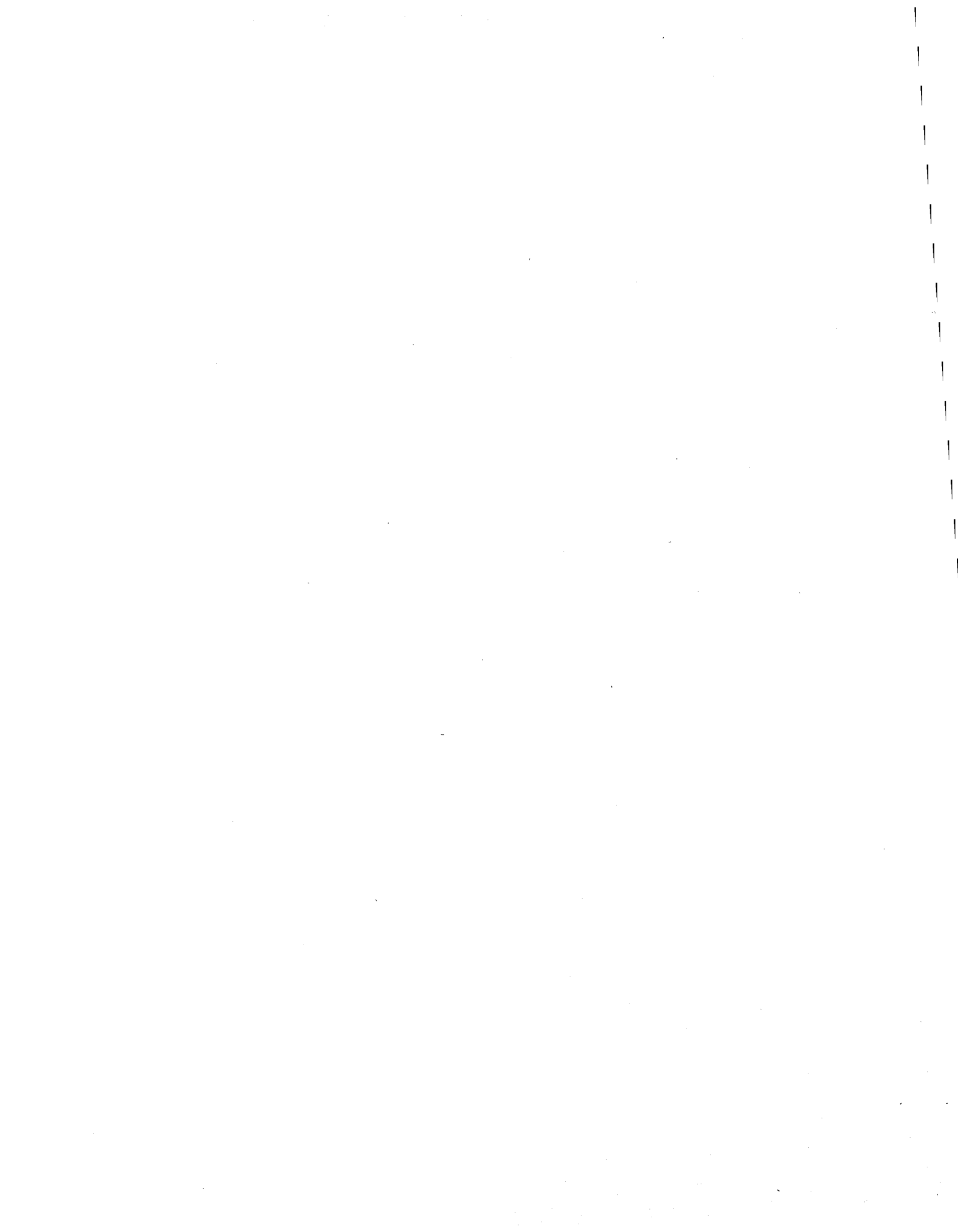
**1979 Farm and
Ranch Irrigation
Survey**

AC78-SR-8

1978
CENSUS OF
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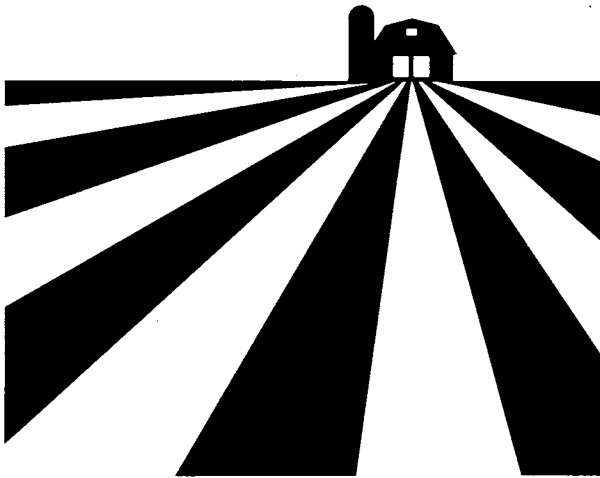
U.S. Department of Commerce
BUREAU OF THE CENSUS





1978
CENSUS OF
AGRICULTURE

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Part 8
**1979 Farm and
Ranch Irrigation
Survey**

AC78-SR-8

Issued November 1982



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This report was prepared by the staff of the Agriculture Division under the general supervision of **Orvin L. Wilhite**, Chief (to January 1980), and **Arnold L. Bollenbacher**, his successor (to April 1982).

The computer processing facilities were provided by the Computer Operations Division.

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Economic Research Service
Agriculture Research Service
Statistical Reporting Service
Soil Conservation Service
Environmental Protection Agency

Army Corps of Engineers
Bureau of Reclamation
Bureau of Indian Affairs
Bureau of Economic Analysis
U.S. Water Resources Council

Members of the Census Advisory Committee on Agriculture Statistics and representatives of both public and private organizations made significant recommendations which helped establish data content.

Special tribute is paid to the farm and ranch operators who furnished the information requested in the survey. Only through their cooperation was it possible to collect and publish the data in this report.

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PURPOSE AND SCOPE OF THE SURVEY

The 1979 Farm and Ranch Irrigation Survey was conducted to supplement the basic irrigation data collected in the 1978 Census of Agriculture. This survey was conducted on a sample basis to provide needed data for on-farm irrigation, without burdening all farm operators. This method allowed for the use of a shorter report form in the 1978 Census of Agriculture. The survey provides detailed information for on-farm irrigation such as: Acres irrigated, yields of irrigated and nonirrigated crops, quantity of water used, method of water distribution, type of pumps, inventory and characteristics of irrigation wells, expenditures for pumping irrigation water, and expenditures for water obtained from off-farm suppliers. These data combined with data from the 1978 Census of Irrigation Organizations and the 1978 Census of Agriculture provide a relatively complete and detailed picture of irrigation in the conterminous United States.

Selected irrigation data for on-farm irrigation have been collected in the census of agriculture since 1890. In 1902, a census of farms reporting irrigation in the 1900 Census of Agriculture was authorized by Congress. Surveys of irrigation in humid areas were taken in connection with the 1954 and 1959 censuses. The 1979 Farm and Ranch Irrigation Survey is the first survey devoted entirely to the collection of on-farm irrigation for the conterminous United States.

AUTHORITY AND AREA COVERED

The census of agriculture is authorized under the provisions of title 13, United States Code. Section 182 of this Act authorizes the Secretary of Commerce to make surveys deemed necessary to furnish annual or other data on the subjects covered by the census. The 1979 Farm and Ranch Irrigation Survey was conducted under the provisions of this section.

FARM DEFINITION

Since 1850, when minimum criteria defining a farm for census purposes were first established, the farm definition has been changed nine times, as the Nation has grown and changed. The current definition was announced on August 12, 1975, in accordance with a joint agreement between the U.S. Depart-

ment of Agriculture, the Office of Management and Budget, and the Bureau of the Census. It defines a farm, for statistical purposes, as any place from which \$1,000 or more of agricultural products were sold or normally would have been sold during the census year. Any farm meeting this definition with agricultural land irrigated in 1978 had a chance of being included in this survey. The previous definition (used for the 1959, 1964, and 1969 censuses and the 1974 preliminary county reports) counted as a farm any place with less than 10 acres from which \$250 or more of agricultural products were sold or normally would have been sold during the census year, or any place of 10 acres or more from which \$50 or more of agricultural products were sold or normally would have been sold during the census year.

GRAPHICS

Charts and maps are presented to show total precipitation for the United States, and drainage boundaries within the United States. The map showing Water Resources Areas and Aggregated Subareas differ from the map showing Water Resources Regions and Subregions in the method of boundary delineation. Water Resources Regions and Subregions are delineated on the basis of topographic drainage characteristics; whereas, Water Resources Areas and Aggregated Subareas are delineated on the basis of county boundaries, which approximate actual water resources boundaries.

TABULAR PRESENTATION

Table 1 shows farms and acres irrigated for the censuses of 1959 through 1978 and the 1979 Farm and Ranch Irrigation Survey. Tables 2 and 19 through 24 present detailed data for the 20 principal irrigating States, 28 Eastern States, and 18 Water Resources Areas. These tables include data on farm counts, acres irrigated, size of farms irrigated, standard industrial classifications, value of agricultural products sold by amount of sales, and selected characteristics of farms by acreage of crops irrigated and reasons for discontinuance of irrigation. Also, some historical data are included from previous censuses. Table 22 shows selected characteristics of irrigated farms by the largest irrigated crop. This table presents such data as: Value of agricultural products sold, method of water distribution, quantity of water applied by source, and expenditures for energy on those specific crops accounting for the largest acreage irrigated on the farm. Tables 3 through 18 present data for the 20 principal irrigating States, 28 Eastern States, and 60 Water Resources Areas and Aggregated Subareas. These tables show data on farm counts, land use, quantity of water applied by method of distribution, energy use, and expenditures for maintenance and investments.

CENSUS DISCLOSURE RULES

In keeping with the provisions of title 13, United States Code, data are not published that would disclose the operations of an individual farm. However, the number of farms in a given size category or other classification is not considered a disclosure.

In many tables, data are suppressed and a (D) is used instead of a number to ensure the confidentiality of information on a characteristic of an individual farm. It is necessary to suppress data when the value of an item for one or two farms can be definitely or approximately determined by mathematical manipulation.

Suppressions of data within frequency distributions are accomplished in a way that will maintain maximum integrity of the frequency group as suppressions are made whenever possible in adjacent frequency classes. This allows the user, by subtraction from the total, to have a farm count and total quantity reported for the combined suppressed frequencies.

Although the published frequency data are not complete, the truncated frequency distribution is available for analysis purposes.

ABBREVIATIONS AND SYMBOLS

The following abbreviations and symbols are used throughout the tables:

- Zero.
- (D) Data withheld to avoid disclosing information for individual farms.
- (S) Data does not meet publication standards due to sampling error.
- (X) Not applicable.
- (Z) Less than half of the unit reported.
- (NA) Not available.
- WRA Water Resources Areas.
- ASA Aggregated Subareas.

GENERAL EXPLANATION

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PLANNING AND DEVELOPMENT

Follow-on surveys have become an integral part of each census of agriculture and initial planning begins with each census. To assist with the planning and coordination of data collection for this survey, an interagency committee was established in February 1977 as a task force on water-use data. This committee consisted of representatives from:

- U.S. Water Resources Council
- U.S. Department of Agriculture—Economic Research Service (ERS); Soil Conservation Service (SCS); Science and Education Administration (SEA); and Statistical Reporting Service (SRS)
- U.S. Department of Commerce—Bureau of the Census and Bureau of Economic Analysis
- U.S. Department of Interior—Bureau of Indian Affairs, Bureau of Reclamation, and Geological Survey
- U.S. Army Corps of Engineers
- U.S. Environmental Protection Agency

This committee, in conjunction with representatives from various private agencies, were solicited for their data needs and comments. These results helped document the questions and the development of a pretest report form.

Prior to the actual survey, the content and format of the report form was tested on a sample of irrigated farms. Results from the pretest were used to finalize the content of the report form. Overall content of the form was changed very little; however, there were a number of changes in the format of certain sections to improve clarity.

SAMPLE SELECTION

The survey sample was selected from agricultural operations reporting irrigation activities in the 1978 Census of Agriculture.

This sample represented approximately 10 percent of the 303,000 operations that reported, excluding abnormal (Indian reservations, institutional, experimental, and research farms) and horticultural specialty farms, and all irrigated farms in Alaska and Hawaii. The sample was designed to provide data for Water Resources Areas and Aggregated Subareas as delineated by the U.S. Water Resources Council. All irrigation operations in the 20 principal irrigating States with 3,000 or more acres irrigated, and the 28 Eastern States with 200 or more acres irrigated were included in the sample. Farms with smaller acreage irrigated were sampled by strata within the 60 Water Resources Areas and Aggregated Subareas Water Resources Areas were sampled in all States; however, Water Resources Aggregated Subareas were also sampled in the selected Water Resources Areas.

METHOD OF ENUMERATION AND DATA COLLECTION

The 1979 Farm and Ranch Irrigation Survey was conducted by mail for maximum economy, supplemented by telephone calls to selected nonrespondents. Approximately 32,000 report forms were mailed beginning in March 1980. The initial mail package included a report form for the respondent's records, a pamphlet explaining why the survey was being taken, and a transmittal letter requesting prompt response. The operators were asked to complete and mail the report form to the Bureau of the Census. The initial mailing was followed by four mail followups between the last week of May and the second week of August. The first and third mail followups included report forms, while the second and fourth followups consisted of only a reminder letter. Telephone calls were made at the conclusion of the enumeration period to all nonrespondents with large irrigated acreage and selected smaller irrigation operations as reported in the 1978 Census of Agriculture.

Data collection was completed in November 1980, with a 75-percent response. Data for large operations not contacted or refusing to provide information were imputed from information reported in the 1978 Census of Agriculture. For a description of the adjustment for nonresponse, see **Statistical Adjustment**.

DATA PROCESSING

All report forms were subjected to a clerical edit to identify those with inconsistencies and to ensure ability to key the data. Major inconsistencies, incorrect entries, blank forms, and large irrigation cases were referred to statisticians for review and corrections. After the report forms were edited and corrected, they were data keyed to magnetic tapes. Data from each report form were subjected to a detailed item-by-item computer edit. The edit included comprehensive checks for consistency and reasonability of reported and corrected data and, when needed,

made adjustments based on similar size farms within the same geographic area. Entries of large magnitude and significant computer-generated changes, to the data, were verified.

Many of the acceptability limits on data were necessarily wide, making it impossible to identify and correct all errors or to always supply precise estimates for all the incompleteness in the reports. These factors and others may affect the reliability of data for some minor data items, but they should not have a significant effect on major data items.

Also, prior to tabulation, the entire data file was subjected to a series of consistency checks. Inconsistencies in the data were identified and corrected.

Prior to publication, tabulated totals were reviewed to identify remaining inconsistencies and potential coverage problems. Comparisons were made to 1978 census data and other check data. Selected report forms were reviewed and problem entries were either verified as being correct or the data were corrected.

COMPARABILITY OF DATA

The 1978 Census of Agriculture includes data for all farms in the United States with irrigated land in 1978 including horticultural specialty farms and abnormal farms. The 1979 Farm and Ranch Irrigation Survey excludes operations irrigating in 1979 that did not irrigate in 1978, horticultural specialty farms, abnormal farms, and farms in Alaska and Hawaii. Volume 5, Part 7, **1979 Census of Horticultural Specialties**, includes some data on irrigated acres used for outdoor production of nursery products, sod, and other horticultural products.

Farmers in some areas irrigate intermittently and farmers in other areas are commencing irrigation operations each year. Data for operations that discontinued irrigation in 1979 were tabulated separately and appear in table 24.

Reporting error in the 1978 Census of Agriculture account for a difference between the number of farms reporting irrigation in 1978 and 1979. Approximately 16,000 farms that reported irrigation in the 1978 census responded that they did not irrigate in 1979 nor in 1978. There are several reasons for this discrepancy. Report forms may have had acres irrigated imputed by the computer edit, or farmers may have misreported or misinterpreted the questions. Most of the farms misreporting irrigation in the 1978 census reported irrigation of small acreage of vegetables, fruits and nuts, tobacco, potatoes, or berries. Small amounts of water were applied at the time of transplanting these crops.

When comparing farms and acres irrigated between the 1979 survey and the 1978 census, coverage is adequate for farms reporting 50 or more acres irrigated. Data for farms reporting less than 50 acres irrigated provides less coverage. Table A shows acres irrigated in the 1979 survey and the 1978 census. The data for the 1979 survey do not include horticultural specialty and abnormal farms nor farms not irrigating in 1978, but irrigating in 1979. The data for the 1978 census include horticultural specialty and abnormal farms.

A great deal of caution should be used with minor characteristics of irrigated farms within a geographic area. These

minor characteristics have a high sampling error rate and tend to have a higher reporting error rate.

DEFINITIONS AND EXPLANATIONS

Definitions and explanations of terms in this section provide more detailed descriptions for selected items and terms than are available on the report forms or in the tables. For an exact wording of the 1979 Farm and Ranch Irrigation Survey report form and the information sheet, see the appendix.

Water Resources Areas (WRA) and Aggregated Subareas (ASA)

Data from the 1979 Farm and Ranch Irrigation Survey were tabulated by WRA's and ASA's. Boundaries of these areas are shown in the map on page XVII, and on a large-scale map in the back of this volume. A written description of the WRA boundaries is not available, but the boundaries are essentially the same as the Water Resources Regions (WRR's) as delineated and defined by the U.S. Water Resources Council. The areas and subareas differ somewhat from the regions and subregions because of the method used for boundary delineation. The region and subregion boundaries which are shown in the map on page XVIII, are delineated on the basis of topographic drainage characteristics, whereas, areas and subareas, are delineated on the basis of county boundaries which approximate actual drainage-basin boundaries. The areas and subareas bear the same names and codes as regions. For example, the Texas Gulf Region (WRR 12) refers to the area draining into the Gulf of Mexico along the Texas shore. The Texas Gulf Area (WRA 12) refers to the counties that approximate the area of the Texas Gulf Region (WRR 12) as shown in the tables of this publication.

Geographic descriptions of each Water Resources Region that can be used to approximate the area included in each Water Resources Area are:

01 New England Region—The drainage within the United States that ultimately discharges into the Bay of Fundy and the

Table A. Irrigated Farms by Acres Irrigated

	1979 Survey		1978 Census
	Total	Percent of 1978 Census	
Acres irrigated.....farms..	259,279	85.7	302,674
acres..	49,637,093	97.6	50,837,940
1 to 9 acres.....farms..	48,282	63.9	75,530
acres..	222,019	77.0	288,497
10 to 49 acres.....farms..	69,212	84.7	81,757
acres..	1,692,093	86.2	1,963,021
50 to 99 acres.....farms..	34,204	90.7	37,706
acres..	2,393,527	90.4	2,646,387
100 to 199 acres.....farms..	41,934	100.1	41,888
acres..	5,809,093	99.7	5,827,272
200 to 499 acres.....farms..	42,444	99.6	42,603
acres..	12,981,263	99.3	13,067,133
500 to 999 acres.....farms..	15,492	100.9	15,354
acres..	10,462,080	100.9	10,371,097
1,000 acres or more.....farms..	7,711	98.4	7,836
acres..	16,077,018	96.4	16,674,533

Atlantic Ocean. These points of discharge are located within and between Maine and Connecticut; Long Island Sound and the St. Francis River, a tributary of the St. Lawrence River.

02 Middle Atlantic Region—The drainage within the United States that ultimately discharges into the Atlantic Ocean, whose point of discharge is located within and between New York and Virginia, and the Richelieu River, a tributary of the St. Lawrence River.

03 South Atlantic-Gulf Region—The drainage that ultimately discharges into the Atlantic Ocean, whose point of discharge is located within and between North Carolina and Florida; and the Gulf of Mexico, whose point of discharge is located within and between Florida and Mississippi, including the Pearl River.

04 Great Lakes Region—The drainage within the United States that discharges into the Great Lakes system, including the Lakes' surfaces; and the St. Lawrence River as far east as, but excluding the Richelieu River.

05 Ohio Region—The drainage of the Ohio River, excluding that of the Tennessee River.

06 Tennessee Region—The drainage of the Tennessee River.

07 Upper Mississippi Region—The drainage of the Mississippi River above the mouth of the Ohio River, but excluding the drainage of the Missouri River above a point immediately below the mouth of the Gasconade River.

08 Lower Mississippi Region—The drainage of the Mississippi River below the mouth of the Ohio River, but excluding the drainages of the Arkansas, White, and Red Rivers and above the points of highest backwater affects of the Mississippi River in those parts; and the coastal streams, other than the Mississippi River, that discharge into the Gulf of Mexico from the boundaries of but excluding the Pearl and Sabine Rivers.

09 Souris-Red-Rainy Region—The drainage within the United States of the Souris, Red, and Rainy Rivers.

10 Missouri Region—The drainage within the United States of the Missouri River above a point immediately below the mouth of the Gasconade River; and the Saskatchewan River.

11 Arkansas-White-Red Region—The drainage of the Arkansas River above the point of highest backwater affect of the Mississippi River; the Red River above the point of highest backwater affect of the Mississippi River; and the White River above the point of highest backwater affect of the Mississippi River, near Peach Orchard Bluff, Ark.

12 Texas-Gulf Region—The drainage that discharges into the Gulf of Mexico from and including Sabine Pass to, but excluding the Rio Grande and the Lower Rio Grande Valley.

13 Rio Grande Region—The drainage within the United States of the Rio Grande; the San Luis Valley, North Plains, San Augustine Plains, Mimbres, Estancia, Jornada del Muerto, Tularosa, Salt, and various smaller closed basins; and the Lower Rio Grande Valley.

14 Upper Colorado Region—The drainage of the Colorado River above the Lee Ferry Compact Point which is about 1 mile below the mouth of the Paria River; and the Great Divide closed basin.

15 Lower Colorado Region—The drainage within the United States of the Colorado River below the Lee Ferry Compact Point which is about 1 mile below the mouth of the Paria River; the Rios Yaqui, Magdalena, and Sonoita and other lesser streams that ultimately discharge into the Gulf of California; and the Animas Valley, Wilcox Playa, El Dorado Valley, and other smaller closed basins.

16 Great Basin Region—The drainage of the Great Basin that ultimately discharges into Utah and Nevada.

17 Pacific-Northwest Region—The drainage within the United States that ultimately discharges into the Straits of Georgia and of Juan de Fuca; the Pacific Ocean, whose point of discharge is within Washington and Oregon, including the Columbia River; and the Great Basin in Oregon.

18 California Region—The drainage within the United States that ultimately discharges into the Pacific Ocean, whose point of discharge is within California, which includes the Central Valley; and that portion of the Great Basin, and other closed basins in California.

Irrigated Farms

This category includes farms with any agricultural land irrigated in the specified calendar year. The acreage irrigated may vary from a very small portion of the total acreage in the farm to irrigation of all agricultural land in the farm.

Acres Irrigated

This category includes acreage of agricultural land to which water was artificially applied by controlled means to include pre-plant, partial, supplemental, and semi-irrigation. Land flooded during high-water periods was to be included as irrigation only if the water was diverted to agricultural land by dams, canals, or other works.

On-Farm Surface Supply

This category includes water from a surface source not controlled by a water supply organization. It includes sources such as streams, drainage ditches, lakes, ponds, and reservoirs on or adjacent to the operated land.

Off-Farm Water Supply

This category includes water from off-farm water suppliers, such as U.S. Bureau of Reclamation; irrigation districts; mutual,

private, cooperative, or neighborhood ditches; commercial companies; or community water systems.

Acre-Feet

The quantity of water required to cover 1 acre to a depth of 1 foot is an acre-foot. This is equivalent to 43,560 cubic feet or 325,850 gallons.

Flowing or Artesian Wells

An artesian well is a deep irrigation well under hydrostatic pressure which, under normal conditions, requires a pump to lift the water to the surface; and a flowing well does not require a pump.

There were no provisions made on the report form for the respondents to report artesian or flowing wells. Therefore, all of these wells had to be identified during the processing of the survey from remarks or other indications made by the respondent. In almost all cases, it was impossible to determine if pumps were used on these types of wells.

Hence, all flowing or artesian wells were excluded from tables 9 and 10. This should be taken under consideration when using the data from these two tables.

Land in Farms

The acreage designated in the tables as "land in farms" consists primarily of agricultural land used for crops, pasture, or grazing. It also includes woodland and wasteland not actually under cultivation or used for pasture or grazing, provided it was part of the farm operator's total operation. Large acreages of woodland or wasteland held for nonagricultural purposes should not have been reported by the respondent. If this land was reported, it was deleted from individual reports during the processing operations.

Land in farms is an operating unit concept that includes land owned and operated as well as land rented from others. Land used rent free was to be reported as land rented from others. Except for open range and grazing land used under government permits, all grazing land was included as "land in farms" provided it was part of a farm or ranch.

Total Cropland

This category includes all harvested cropland, cropland used only for pasture, and other cropland.

Harvested Cropland

This category includes land from which crops were harvested or hay was cut; and land in orchards, citrus groves, vineyards, nurseries, and greenhouses. Land from which two or more crops were harvested was counted only once, even though there was more than one use of the land.

Cropland Used Only for Pasture

This category includes land used only for pasture or grazing that could have been used for crops without additional

improvement, and all land planted in crops that were grazed before the crops reached maturity. Also included was all cropland used for rotation pasture and land in government diversion programs that was pastured. However, cropland that was pastured before or after crops were harvested was not included.

Other Cropland

This category includes cropland used only for soil improvement crops, land on which all crops failed, cultivated summer fallow, idle cropland, and land planted in crops that were to be harvested after the census year.

Woodland

This category includes both woodland pastured and not pastured. For census purposes, woodland includes natural or planted woodlots or timber tracts and cutover and deforested land with young growth that has or will have value for wood products. Land covered by sagebrush or mesquite was reported as other pasture or other land.

Woodland Pastured

This category includes woodland used for pasture or grazing during the census year. Woodland or forest land pastured under a per-head grazing permit was not counted as land in farms and, therefore, it is not included in these data.

Other Land

This category includes land in house lots, barn lots, ponds, roads, and wasteland.

Value of Agricultural Products Sold

This item represents the gross market value before taxes and production expenses of all agricultural products sold or removed from the place in 1978 regardless of who received the payment. It includes sales by the operator as well as the value of any shares received by partners, landlords, contractors, and others associated with the operation. These data were taken from the 1978 Census of Agriculture report form for survey respondents.

The value of agricultural products sold represents the sum of all crops including nursery products sold, and livestock and poultry and their products sold. It does not include income from farm-related sources, such as customwork or agricultural services, or income from nonfarm sources.

The value of agricultural products sold in 1978 does not necessarily represent the sales from crops harvested in 1978. Data include sales from crops produced in earlier years and exclude some crops produced in 1978, but held in storage and not sold in 1978. For crops sold through a co-op which made payments in several installments, only the total payments received in 1978 were to be reported.

The value of agricultural products sold was collected from all operators. Where the operator failed to report a value of sales, estimates were made based on the amount of crops harvested, or the number of livestock or poultry sold. Extensive estimation

was required for operators growing crops or livestock under contract.

Acres and Quantity Harvested

Crops were reported in whole acres. If two or more crops were harvested from the same land during the year, the acres would be counted for each crop. Therefore, the total acres of all crops harvested generally exceeds the acres of harvested cropland. The exception to this procedure is hay crops. When more than one cutting of hay was taken from the same acres, the acres are counted only once but the quantity harvested includes hay from all cuttings. For interplanted crops or "skip-row" crops, acres were to be reported according to the portion of the field occupied by each crop.

If a crop was planted but not harvested, the acreage was not to be reported as harvested. These acres were to be reported in the "land use" section under the appropriate cropland items—cropland used only for pasture or grazing, or other cropland.

Acres of land in bearing and nonbearing orchards—citrus or other groves, vineyards, and nut trees—were to be reported as harvested cropland regardless of whether the crop was harvested or failed. However, abandoned orchards were to be reported as cropland idle, not as harvested cropland or for the individual crop acreages.

Crop Unit of Measure

Respondents were instructed to report each crop in the same unit of measure in all areas. For example, corn for grain or seed was reported in bushels shelled, and rice was reported in 100-pound bags.

Farms by Standard Industrial Classification

Irrigated farms and ranches are classified by standard industrial classification (SIC), as described in the 1972 SIC Manual. This classification was designed to promote uniformity and comparability for statistical data collected by various agencies. An establishment (farm, ranch, nursery, greenhouse, etc.) primarily engaged in crop production (major group 01) or livestock production (major group 02) is classified in the 3- or 4-digit industry group, which accounts for 50 percent or more of the total value of sales from agricultural products. If the total value of agricultural products sold by an establishment was less than 50 percent from a single 4-digit industry, but 50 percent or more from the products of two or more 4-digit industries within the same 3-digit industry group, the establishment is classified in the miscellaneous industry of that industry group; otherwise, it is classified as a general crop farm in industry 0191 or a general livestock farm in industry 0291.

All farms in the 1978 census were classified by SIC. Classifications of irrigated farms by selected SIC groupings are shown in table 19. The SIC code was obtained from the 1978 Census of Agriculture report form for survey respondents.

Principal Irrigating States

The 20 principal irrigating States are: Arizona, Arkansas,

California, Colorado, Florida, Idaho, Kansas, Louisiana, Montana, Nebraska, Nevada, New Mexico, North Dakota, Oklahoma, Oregon, South Dakota, Texas, Utah, Washington, and Wyoming.

NONSAMPLING ERRORS

Every census or survey is subject to errors. In addition to sampling variability, errors may arise from incorrect or incomplete reporting, processing, and the inability to obtain a report from each eligible reporting unit. Sampling variability is discussed below under **Statistical Adjustments**.

Some data reported in this survey may be incorrect as a result of the misinterpretation of questions or because of the use of estimates in reporting. Data processing adjustments were made to data items which appeared to be inconsistent with other items reported for the same farm.

Respondents may have failed to provide all of the information requested. In some cases, the respondent may have indicated the presence of an item but not the amount. Imputations were made for missing data on acres irrigated, quantity of water used, method of water distribution, quantities of crops harvested; but no imputations were made for affects of discontinuance of irrigation on crop yields, expenditures on irrigation facilities, and other irrigation uses on the place such as: application of fertilizer, chemicals, or water to prevent freeze damage.

Careful efforts were made to keep errors introduced during clerical and electronic processing to a minimum through the use of quality control, verification, and check measures on specific operations.

STATISTICAL ADJUSTMENT

The estimates for this survey are based on a probability sample of farms identified in the 1978 Census of Agriculture. To achieve these estimates certain adjustments were made to the data collected.

Sample Selection

Farms enumerated in the 1979 Farm and Ranch Irrigation Survey were a sample of irrigated farms identified in the 1978 Census of Agriculture. All farms in the 1978 Census of Agriculture were divided into strata based on (1) water resources areas and subareas, (2) the number of acres irrigated, and (3) whether they were enumerated from the mail list or from the direct enumeration area sample. The number of acres irrigated to define strata changed from water resources subarea to subarea. All large farms and all farms from the direct enumeration area sample with a large expansion factor were included into the sample as certainty farms.

Within each noncertainty strata a systematic sample of farms was selected. Samples were selected independently by water resources area and within each stratum of a water resources subarea. A different integer sampling interval was used for each stratum.

Whole Farm Nonresponse

Each farm included in the sample was mailed a series of report forms and letters to encourage response. All nonrespondents in the certainty strata were telephoned. When responses could not be obtained from certainty farms, data were imputed using the 1978 census report form and information from similar farms which responded to the 1979 Farm and Ranch Irrigation Survey.

Nonrespondents in the noncertainty strata were enumerated on a sample basis. A sample of one-in-six nonresponding farms was selected to be enumerated. To correct the nonresponse among farms in the survey, an adjustment was made to the expansion factor of enumerated and imputed farms. The expansion factor was adjusted by stratum within a water resources subarea.

Method of Estimation

Estimates were made by weighing the data for each farm by the initial sampling interval adjusted for nonresponse. A final expansion factor was calculated by multiplying the adjustment factor by the original expansion factor. Weights assigned to individual farms range from 1 to 1,825.

RELIABILITY

The statistics in this report are estimates derived from a sample survey. Two types of errors are possible in an estimate based on a sample survey—sampling and nonsampling. Sampling error occurs because observations are made only on a sample, not on the entire population. Nonsampling errors can be attributed to many sources, e.g., inability to obtain information about all cases in the sample, definitional difficulties, difference in the interpretation of questions, inability or unwillingness to provide correct information on the part of respondents, mistakes in recording or coding the data obtained and other errors of collections, responses, processing, coverage, and estimation for missing data. Also, nonsampling errors occur in complete censuses. The “accuracy” of a survey result is determined by the joint affects of sampling and nonsampling errors.

Coverage

The target population for this survey is all farms reporting irrigation in the 1978 Census of Agriculture or their successors. The population of farms from which the sample was selected was different from the target population. This difference introduces a coverage error. This coverage error is caused by several factors: (1) the list of farms from which the sample was selected was a preliminary list which did not include all farms in the census, (2) horticultural specialty and abnormal farms were excluded from the sample, (3) respondents reporting errors in the census, and (4) farms which went out of business after the census were dropped from the sample.

In 1978, there were 2,302 abnormal farms which accounted for 56 million acres of land and \$245 million in the value of

agricultural products sold. Of these abnormal farms, 769 farms reported irrigating 297,278 acres. Also, in 1978 there were 16,105 horticultural specialty farms that reported 253,698 irrigated acres. In Alaska and Hawaii, there were 1,528 irrigated farms and 160,243 acres irrigated, that were excluded to reduce respondent burden.

If the operator of a 1979 sample farm continued to operate any part of the farm he/she operated in 1978, the operator was eligible for inclusion in the survey regardless of the size of the 1978 operation. However, if the operator did not operate any part of the farm in 1979 he/she operated in 1978, the operator was requested to identify who the operator was in 1979. To avoid duplication in the sample, the “new” operator was eligible for inclusion in the survey only if he/she did not farm at all in 1978. By use of this successor procedure, survey estimates account for consolidations and breaking up of farms. This permits some “new” operators to fall into the sample, and prevents an operator from having more than one chance of being selected in the sample. Unless it was directly obtainable from sample farms, farms starting into business after the census were not included in the survey.

Some respondents were incorrectly classified as irrigation farms in the 1978 Census of Agriculture. The survey identified farms with no irrigation in either 1978 or 1979. An estimated 16,000 farms reporting irrigation in the 1978 census did not irrigate in that year.

Table B measures in part the coverage error associated with the survey.

Nonresponse Adjustment

Budget restrictions prevented the enumeration of all farms in the nonresponse adjustment sample which introduced a potential bias of unknown size to the survey. If the estimates are to be unbiased, the adjustment procedure used requires that on the average, nonrespondent farms be the same as respondent farms and that all nonrespondents operate farms.

Item Nonresponse and Processing Error

Misinterpretation of questions by respondents resulted in some incorrect or missing answers. During processing, respondent data were examined for consistency and reasonability. Data considered unreasonable or missing were estimated based on responses to related questions, subject matter specialists' knowledge of the subject, and by statistical estimation procedures. Processing errors, item nonresponse, and respondent problems introduced a nonsampling error for which there is no measure.

Sampling Error

The sample used for this survey is the same size as many other possible samples using the same design. However, estimates derived from the different samples would differ from each other.

The standard or sampling error of a survey estimate is a measure of the variation of the estimates from all possible

Table B. Counts of Irrigated Farms in the 1979 Survey and in the 1978 Census

(Data do not include Alaska, Hawaii, and abnormal or horticultural specialty farms)

	1978 Census published counts		1979 Survey final counts processed and tabulated			
			Unexpanded		Expanded	
	Farms	Acres	Farms	Acres	Farms	Acres
Conterminous United States.....	284,813	50,109,501	21,275	12,433,011	259,279	49,637,093
17 Western States, Arkansas, Florida, and Louisiana.....	248,522	47,516,366	17,949	11,510,204	235,425	47,090,222
Arizona.....	4,697	1,165,034	494	431,659	4,093	1,243,234
Arkansas.....	6,344	1,681,699	523	260,924	5,630	1,626,586
California.....	58,012	8,519,833	3,105	2,792,165	56,095	8,484,955
Colorado.....	16,687	3,422,564	1,212	686,869	16,976	3,442,629
Florida.....	9,107	1,934,141	985	1,182,406	8,002	1,854,902
Idaho.....	19,508	3,489,544	726	507,694	18,576	3,558,353
Kansas.....	7,844	2,681,632	392	396,951	7,729	2,634,129
Louisiana.....	3,952	679,728	386	153,387	3,431	636,289
Montana.....	9,608	2,069,967	1,008	472,466	9,265	2,044,713
Nebraska.....	23,969	5,685,406	794	481,111	23,788	5,842,158
Nevada.....	2,310	881,672	359	369,179	2,283	884,644
New Mexico.....	7,517	861,660	948	256,450	7,189	862,758
North Dakota.....	763	140,272	59	22,457	580	115,567
Oklahoma.....	3,726	595,833	446	124,252	3,316	561,710
Oregon.....	14,904	1,879,771	1,200	498,082	14,423	1,866,104
South Dakota.....	1,780	336,335	140	63,635	1,863	371,269
Texas.....	24,979	6,989,867	2,709	1,855,260	21,412	6,729,850
Utah.....	11,469	1,156,773	1,005	194,435	10,481	1,068,939
Washington.....	16,188	1,670,592	924	333,590	15,325	1,671,286
Wyoming.....	5,158	1,674,043	534	427,232	4,968	1,590,147
All other States.....	36,291	2,593,135	3,326	922,807	23,854	2,546,871

samples, and thus is a measure of the precision with which an estimate from a particular sample approximates the average result of all possible samples. The relative standard error is defined as the standard error of the estimate divided by the value being estimated times 100.

As calculated for this report, the standard error also partially measures the effect of certain nonsample errors, but does not measure any systematic biases on the data. Bias is the difference, average of all possible samples, between the estimates and the desired values. Obviously, the accuracy of the survey depends on both the sampling and nonsampling errors measured by the standard error and the bias and other types of nonsampling error not measured by the standard error.

The sample estimate and an estimate of the standard error permit us to construct interval estimates with prescribed confidence that includes the average result of all possible samples (for a given sampling rate) for that interval.

To illustrate, if all possible samples were selected and each of these were surveyed under the same conditions, and its estimated standard error were calculated from each sample, then:

1. Approximately two-thirds of the intervals from one standard error below the estimate to one standard error above the estimate would include the average value of all possible samples. We call an interval from one standard error below the estimate to one standard error above the estimate a 67-percent confidence interval.
2. Approximately 9/10 of the intervals from 1.6 standard errors below the estimate to 1.6 standard errors above the estimate would include the average value of all possible

samples. We call an interval from 1.6 standard errors below the estimate to 1.6 standard errors above the estimate a 90-percent confidence interval.

3. Approximately 19/20 of the intervals from two standard errors below the estimate to two standard errors above the estimate would include the average value of all possible samples. We call an interval from two standard errors below the estimate to two standard errors above the estimate a 95-percent confidence interval.
4. Almost all intervals from three standard errors below the sample estimate to three standard errors above the sample estimate would include the average value of all possible samples.

The average value of all possible samples may or may not be contained in any particular computed interval. But for a particular sample, one can say with specific confidence that the average of all possible samples is included in the constructed interval.

For example, an approximate 95-percent confidence interval on the number of farms irrigating in Oregon in 1979 can be constructed as follows:

1. The estimate of the number of farms irrigating is 14,423 from table 1.
2. The estimate of the relative standard error of the estimated total is 6.1 from table C.
3. An estimate of the absolute standard error of the estimate can be calculated by multiplying the estimate times the relative error of the estimate divided by 100.

$$\text{Absolute standard error} = (14,423) \times (6.1/100) = 879.8$$

Table C. Percent of Relative Standard Error for Selected Irrigation Data: 1979

	Acres in		Acres irrigated				Acre-feet of water applied, all sources	Wells used in 1979	Pumps, all types	Expenditures for irrigation		
	Farms	farms	Total	Cropland harvested	By sprinkler systems	By gravity flow				Energy used for pumping	For wells, pumps, equipment, and facilities	Maintenance and repairs
Conterminous United States..	1.5	4.9	1.4	1.5	1.9	2.0	1.3	2.4	4.2	2.0	1.9	2.5
17 Western States, Arkansas, Florida, and Louisiana.....	1.6	5.2	1.4	1.4	1.9	2.0	1.3	2.5	4.7	2.0	1.9	2.6
Arizona.....	3.8	12.2	8.0	8.6	3.9	3.9	5.6	12.9	12.1	4.0	3.9	12.4
Arkansas.....	9.5	12.0	7.5	7.5	9.5	9.4	8.6	10.2	8.8	9.4	9.4	10.3
California.....	4.6	5.8	3.1	2.7	4.4	4.1	3.1	3.5	18.6	4.2	4.3	4.6
Colorado.....	5.5	9.1	5.1	5.2	5.4	5.4	6.3	8.5	7.4	5.4	5.4	10.7
Florida.....	7.2	10.4	3.2	3.4	7.6	7.9	3.2	17.2	16.1	7.7	7.7	6.6
Idaho.....	6.2	10.5	3.5	4.7	6.3	6.2	3.3	12.5	6.7	6.3	6.3	16.0
Kansas.....	8.8	17.1	7.3	7.4	10.1	23.3	6.9	8.6	7.4	13.5	11.2	17.8
Louisiana.....	8.0	4.8	6.6	7.0	8.0	8.0	9.0	10.9	11.2	8.0	8.0	11.2
Montana.....	6.0	7.3	4.9	5.5	5.9	5.9	5.5	20.9	7.7	6.0	5.9	18.4
Nebraska.....	4.4	19.5	6.0	6.3	4.3	4.4	5.5	4.9	4.1	4.3	4.3	14.5
Nevada.....	4.5	22.7	9.4	8.7	4.2	4.2	7.4	15.0	12.3	4.2	4.2	22.0
New Mexico.....	6.0	21.2	6.4	7.0	6.2	6.2	6.8	6.5	6.4	6.2	6.2	9.0
North Dakota.....	10.2	15.1	10.5	13.0	13.7	23.2	16.8	16.1	12.0	13.7	13.5	28.2
Oklahoma.....	9.5	8.0	5.9	5.8	9.5	9.5	8.4	14.6	12.2	9.4	9.5	13.5
Oregon.....	6.1	12.2	5.4	5.8	6.3	6.4	5.8	8.9	5.9	6.3	6.3	15.0
South Dakota.....	10.2	22.8	7.2	7.2	10.1	12.1	7.9	16.4	10.8	10.1	10.1	10.7
Texas.....	4.3	10.7	4.0	3.7	4.5	4.8	4.0	4.0	3.5	5.0	4.6	6.0
Utah.....	6.5	10.8	7.2	7.7	6.5	6.5	7.2	15.6	9.8	6.5	6.5	11.3
Washington.....	5.5	14.1	5.6	4.8	5.5	5.5	4.1	11.8	5.7	5.5	5.5	8.0
Wyoming.....	5.7	8.8	5.7	7.3	5.7	5.7	7.6	24.7	20.2	5.7	5.7	10.8
All other States.....	2.6	6.0	3.3	3.3	3.3	3.9	4.1	5.7	3.2	3.5	3.3	7.1
WATER RESOURCES AREAS AND SELECTED AGGREGATED SUBAREAS												
WRA 01 New England.....	15.5	26.0	14.9	15.1	16.9	19.2	12.7	20.6	11.4	17.4	19.9	11.4
WRA 02 Mid-Atlantic.....	7.8	5.9	5.6	5.5	25.3	25.1	5.3	22.9	9.2	25.4	25.0	30.4
WRA 03 South Atlantic-Gulf:												
ASA 0301 Roanoke-Cape Fear.....	7.5	7.7	9.9	9.7	7.5	7.5	22.0	49.7	8.3	7.5	7.5	28.9
ASA 0302 Pee Dee-Edisto.....	3.6	18.7	22.9	23.0	3.7	3.7	53.0	39.6	10.1	3.7	3.7	69.5
ASA 0303 Savannah-St. Marys.....	13.3	24.3	12.2	12.7	13.5	13.3	15.8	17.6	15.1	13.5	13.6	62.3
ASA 0304 St. Johns-Suwannee.....	12.8	22.7	9.5	9.1	13.2	13.4	8.0	8.2	10.0	13.3	13.4	13.1
ASA 0305 Southern Florida.....	4.6	6.4	2.7	3.6	4.8	5.7	3.7	22.0	20.8	4.9	4.9	6.9
ASA's 0306 Apalachicola, 0307 Alabama-Choctawhatchee, 0308 Mobile-Tombigbee, and 0309 Pascagoula-Pearl.....	6.8	12.0	14.1	14.3	6.0	4.2	16.2	10.6	9.0	5.5	5.6	13.3
WRA 04 Great Lakes.....	5.1	7.3	5.9	5.9	4.8	5.0	5.9	9.0	3.0	4.6	5.1	10.8
WRA 05 Ohio.....	19.1	14.9	14.4	13.5	19.4	19.7	16.5	18.0	14.8	19.4	19.5	29.6
WRA 06 Tennessee.....	16.9	16.9	26.0	27.8	17.1	17.6	32.2	28.2	25.4	17.2	17.3	30.9
WRA 07 Upper Mississippi.....	6.7	5.3	5.0	5.1	7.1	6.8	6.5	14.1	10.7	7.1	7.0	8.1
WRA 08 Lower Mississippi:												
ASA 0801 Hatchie-Mississippi-St. Francis.....	11.4	13.4	6.5	6.6	12.1	12.5	9.0	4.8	8.0	12.2	12.1	11.7
ASA 0802 Yazoo-Mississippi-Quachita.....	10.7	11.0	10.0	10.1	10.7	10.3	11.2	9.1	9.4	10.4	10.5	13.3
ASA 0803 Mississippi Delta.....	9.3	5.5	7.7	8.2	9.3	9.2	10.8	13.2	13.4	9.2	9.3	13.2
WRA 09 Souris-Red-Rainy.....	19.8	15.7	16.4	16.8	18.7	16.2	28.0	19.5	17.5	18.3	18.6	17.1
WRA 10 Missouri:												
ASA's 1001 Missouri-Milk-Saskatchewan, and 1003 Missouri-Musselshell.....	9.8	16.5	6.6	6.7	9.9	9.9	8.8	48.9	7.3	6.5	6.5	9.2
ASA 1002-Missouri-Marias.....	6.4	9.9	4.1	4.2	6.5	6.5	5.0	-	-	-	-	-
ASA 1004 Yellowstone.....	12.3	19.1	13.5	16.0	11.8	11.8	16.3	55.5	24.8	12.1	12.0	29.9
ASA's 1005 Western Dakotas, and 1006 Eastern Dakotas.....	18.5	20.1	12.2	12.0	23.2	41.0	13.8	19.4	14.3	29.9	23.9	26.9
ASA 1007 North and South Platte.....	7.4	5.5	6.1	6.8	8.7	9.2	8.0	14.5	13.0	9.0	8.8	14.7
ASA 1008 Niobrara-Platte-Loup.....	5.5	44.3	9.0	9.8	5.1	4.8	7.2	6.2	5.2	4.8	5.2	24.3
ASA's 1009 Middle Missouri, and 1011 Lower Missouri.....	19.7	12.8	10.4	10.4	17.2	18.3	9.7	17.3	16.8	16.1	17.8	11.2
ASA 1010 Kansas.....	7.9	13.4	9.1	9.7	6.0	9.0	8.3	6.7	5.1	5.7	5.5	14.2
WRA 11 Arkansas-White-Red:												
ASA's 1101 Upper White, and 1104 Lower Arkansas.....	14.0	11.6	23.2	23.6	15.2	16.2	20.7	22.1	15.8	15.6	15.2	20.1
ASA 1102 Upper Arkansas.....	5.5	17.9	10.4	10.5	5.6	5.6	13.6	14.5	11.5	5.6	5.6	12.5
ASA 1103 Arkansas-Cimarron.....	14.0	18.5	9.8	10.0	21.5	36.9	8.0	12.7	11.8	28.8	24.8	23.9
ASA 1105 Canadian.....	14.2	19.6	10.9	11.9	14.5	15.1	10.1	10.1	7.5	16.2	14.8	14.3
ASA 1106 Red-Washita.....	5.6	13.3	7.7	8.2	5.6	5.6	11.1	14.9	13.5	5.5	5.6	7.8
ASA 1107 Red-Sulphur.....	29.5	22.6	11.5	11.3	40.2	40.6	9.8	25.6	40.4	41.0	39.9	13.2

Table C. Percent of Relative Standard Error for Selected Irrigation Data: 1979—Con.

(Data are in percent)

	Acres in Farms farms		Acres irrigated				Acres-foot of water applied, all sources	Wells used in 1979	Pumps, all types	Expenditures for irrigation		
			Total	Cropland harvested	By sprinkler systems	By gravity flow				Energy used for pumping	For wells, pumps, equipment, and facilities	Maintenance and repairs
WATER RESOURCES AREAS AND SELECTED AGGREGATED SUBAREAS--Con.												
WRA 12 Texas-Gulf:												
ASA's 1201 Sabine-Neches, and 1202 Trinity-Galveston Bay.....	28.8	11.6	9.8	9.4	29.0	30.0	12.6	56.2	39.5	29.4	29.7	27.0
ASA 1203 Brazos.....	4.8	9.1	4.5	4.6	5.5	6.2	5.5	2.8	2.5	6.0	5.4	8.2
ASA 1204 Colorado (Texas).....	6.6	9.4	14.5	6.9	7.2	7.8	10.4	9.6	5.0	7.7	7.1	16.8
ASA 1205 Nueces-Texas Coastal.....	9.3	19.5	12.6	11.9	9.0	8.9	10.5	14.2	12.6	8.9	9.0	17.1
WRA 13 Rio Grande:												
ASA 1301 Rio Grande Headwaters....	18.7	13.5	14.5	13.7	18.9	18.9	12.5	15.0	13.5	18.8	18.8	16.8
ASA 1302 Middle Rio Grande.....	9.6	15.3	15.9	17.2	9.8	9.9	14.5	11.8	12.0	10.0	9.8	20.2
ASA's 1303 Rio Grande-Pecos, and 1304 Upper Pecos.....	7.3	25.3	17.4	11.0	6.9	6.7	11.3	17.1	17.4	6.7	6.9	24.0
ASA 1305 Lower Rio Grande.....	12.0	16.9	7.1	6.8	12.7	12.9	6.9	31.6	18.4	12.8	12.8	19.8
WRA 14 Upper Colorado:												
ASA 1401 Green-White-Yampa.....	10.0	24.0	8.5	8.6	10.0	10.2	9.7	29.7	46.9	10.1	10.0	12.7
ASA 1402 Colorado-Gunnison.....	4.9	10.1	3.3	3.8	5.8	6.1	4.6	8.4	5.4	6.1	5.9	8.6
ASA 1403 Colorado-San Juan.....	18.6	22.8	11.7	11.9	18.7	18.6	16.1	32.7	21.9	18.7	18.6	25.1
WRA 15 Lower Colorado:												
ASA's 1501 Little Colorado, and 1502 Lower Colorado Main Stem....	3.8	29.6	12.7	13.5	4.0	4.1	9.2	15.8	22.2	4.2	4.1	21.0
ASA 1503 Gila.....	5.5	21.8	9.6	10.8	5.4	5.5	7.0	14.6	13.8	5.5	5.5	14.5
WRA 16 Great Basin:												
ASA 1601 Bear-Great Salt Lake.....	11.4	15.1	11.5	11.6	11.2	11.2	10.3	15.4	9.2	11.2	11.2	18.1
ASA 1602 Sevier Lake.....	8.6	11.7	12.0	13.4	8.7	8.7	12.7	23.0	17.1	8.7	8.7	18.3
ASA's 1603 Humboldt-Tonopah Desert and 1604 Central Lahontan.	4.8	23.9	9.9	9.1	4.5	4.5	7.8	16.2	13.3	4.5	4.5	23.8
WRA 17 Pacific Northwest:												
ASA 1701 Clark Fork-Kootenai.....	5.8	14.2	10.5	14.1	5.7	5.6	9.2	19.8	7.8	5.6	5.6	16.7
ASA 1702 Upper Middle Columbia....	6.8	17.5	5.3	5.6	7.2	7.0	3.9	7.5	3.9	7.0	7.0	6.7
ASA 1703 Upper Central Snake.....	6.5	11.3	4.1	5.0	6.6	6.6	3.6	14.6	9.1	6.6	6.6	16.5
ASA 1704 Lower Snake.....	9.2	27.4	10.5	13.2	8.9	8.9	9.9	26.3	15.8	8.9	8.9	10.3
ASA 1705 Coast-Lower Columbia....	5.2	13.0	14.5	14.6	5.2	5.2	21.4	12.0	8.1	5.2	5.2	12.4
ASA 1706 Puget Sound.....	24.7	27.0	31.7	8.1	24.5	24.7	32.3	39.9	22.7	24.6	24.5	19.5
ASA 1707 Oregon Closed Basin.....	9.8	8.5	10.2	12.8	9.7	9.7	11.0	25.8	21.6	9.7	9.7	13.9
WRA 18 California:												
ASA 1801 Klamath-North Coastal....	8.6	19.6	7.2	7.1	8.7	8.7	15.2	11.8	6.3	8.6	8.6	20.1
ASA 1802 Sacramento-Lahontan.....	7.0	12.8	10.3	6.9	7.2	7.2	12.0	6.8	10.3	7.2	7.2	14.7
ASA 1803 San Joaquin-Tulare.....	8.2	8.0	2.5	2.3	7.9	7.5	2.3	3.8	4.3	7.6	7.7	5.3
ASA 1804 San Francisco Bay.....	8.2	22.5	28.3	30.6	8.3	8.4	31.3	12.1	13.6	8.3	8.4	24.7
ASA 1805 Central California Coast.	10.8	20.2	20.2	20.7	10.9	11.0	9.3	21.1	19.0	11.0	11.0	27.0
ASA 1806 Southern California.....	9.2	8.3	7.7	7.2	9.2	9.2	5.0	9.3	25.1	9.2	9.2	10.5
ASA 1807 Lahontan-South.....	18.7	35.0	34.6	29.7	18.9	19.1	47.2	32.9	46.2	19.0	19.0	39.1

4. A 95-percent confidence interval is constructed by adding and subtracting twice the absolute standard error from the estimate.

Confident limit

Upper = 16,182.6 = 14,423 + 2 x (879.8)

Lower = 12,663.4 = 14,423 - 2 x (879.8)

The estimate and confidence interval can be interpreted in the following way. The best estimate of the number of farms irrigated in Oregon is 14,423. You can be 95-percent confident that the average result of all possible samples lies in the interval of 12,663.4 to 16,182.6.

Estimation of Sampling Error

Sampling error was estimated using a random group method of estimation within each stratum. When the sample was selected, each sample farm in a stratum was assigned to one of eight random groups. An estimate of the stratum total was made

for each of the random groups within each stratum. The sampling error of the estimate was calculated using these estimates from the random groups.

UNPUBLISHED DATA

Similar tables to those published have been assembled for the 28 Eastern States. These data can be tabulated at a minimal cost depending on the detail of data requested.

Additional information on the availability and cost of unpublished tabulations may be obtained by writing to the Chief, Agriculture Division, Bureau of the Census, Washington, D.C. 20233.

SUMMARY AND CONCLUSIONS

Method of Irrigation

There were 50.2 million acres irrigated by different water distribution systems in the conterminous United States in 1979.

Of these acres, about 0.5 million acres were irrigated by more than one system, 31.2 million acres (62.2 percent) by gravity flow systems, and 18.4 million acres (36.7 percent) by sprinkler systems.

Flooding was the major method of gravity flow irrigation used, followed by ditches with siphon tubes and gated pipe. Of the land irrigated by this method, flooding accounted for 14.2 million acres (28.2 percent), ditches with siphon tubes for 8.7 million acres (17.3 percent), and gated pipe for 8.4 million acres (16.8 percent).

Sprinkler systems were used to irrigate 18.4 million acres (36.7 percent). Of these, 8.6 million acres (17.2 percent) were irrigated by center pivot systems, 5.1 million acres (10.1 percent) by mechanical move systems, 3.7 million acres (7.4 percent) by hand move systems, and almost 1 million acres (2.0 percent) by solid set and permanent systems. The use of the sprinkler system has almost doubled since 1974, when comparable data were first collected in the census of agriculture, showing 9.9 million acres irrigated by this method.

Quantity of Water Applied

A total of 93.1 million acre-feet of water was applied to the 50.1 million acres irrigated in 1979, an average of 1.86 acre-feet

per acre irrigated in the conterminous United States. The average amount of water applied per acre in the principal irrigating States ranged from a high of 3.45 acre-feet in Arizona to a low of 1.01 acre-feet in South Dakota. The average for the remaining States was 0.94 acre-feet.

The amount of water applied per acre varied by method of water distribution. When only the sprinkler system was used, the average amount of water applied per acre was 1.40 acre-feet as compared to 2.09 acre-feet with the gravity flow system. Tables 4 and 5 present more detailed information on the different methods of distribution and the quantity of water applied per acre by each method.

Source of Water

Of the 93.1 million acre-feet of water used for irrigation in 1979, 43.2 million acre-feet (46.5 percent) was pumped from wells, off-farm water suppliers provided 41.0 million acre-feet (44.0 percent), and the other 8.8 million acre-feet (9.5 percent) came from on-farm surface sources.

The amount of water applied per acre was lower for farms reporting wells as the only source than by farms reporting off-farm water suppliers as the only source.