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Agricultural Irrigated Land-Use Inventory for Jackson, Calhoun, and Gadsden Counties in Florida, and Houston County in Alabama, 2014

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Abstract

A detailed inventory of irrigated crop acreage is not available at the level of resolution needed to accurately estimate water use or to project future water demands in many Florida counties. This report provides a detailed digital map and summary of irrigated areas for 2014 within Jackson, Calhoun, and Gadsden Counties in Florida, and Houston County in Alabama. The irrigated areas were delineated using land-use data and orthoimagery that were then field verified between June and November 2014. Selected attribute data were collected for the irrigated areas, including crop type, primary water source, and type of irrigation system. Results of the 2014 study indicate that an estimated 31,608 acres were irrigated in Jackson County during 2014. This estimate includes 25,733 acres of field crops, 1,534 acres of ornamentals and grasses (including pasture), and 420 acres of orchards. Specific irrigated crops include cotton (11,759 acres), peanuts (9,909 acres), field corn (2,444 acres), and 3,235 acres of various vegetable (row) crops. The vegetable acreage includes 1,714 acres of which 857 acres were planted with both a spring and fall crop on the same field (double cropped). Overall, groundwater was used to irrigate 98.6 percent of the total irrigated acreage in Jackson County during 2014, whereas surface water and wastewater were used to irrigate the remaining 1.4 percent.

Irrigated cropland totaled 3,060 acres in Calhoun County; 4,547 acres in Gadsden County; and 10,333 acres in Houston County. In Calhoun County, sod accounted for the largest irrigated acreage (1,145 acres) followed by peanuts (886 acres). In Gadsden County, ornamentals accounted for the largest irrigated acreage (1,104 acres) followed by cotton (977 acres). In Houston County, cotton accounted for the largest irrigated acreage (4,310 acres) followed by peanuts (2,493 acres). Overall, an estimated 49,548 acres of land were irrigated during 2014 in the four counties inventoried. About 45,052 acres were irrigated by a center pivot, permanent or solid overhead fixtures, or a portable or traveling gun. In all, 650 center pivot irrigation systems were identified, and the calculated acreage under these pivots totaled 43,070 acres. There were 405 center pivot irrigation systems counted in Jackson County during the 2014 field verification followed by Houston with 197, Gadsden with 48, and Calhoun with 10. An estimated 35,087 acres of field corn, cotton, peanuts, and sorghum were irrigated by center pivot systems during 2014 in these four counties combined. Vegetable acreage for the four counties combined totaled 6,699 acres, with 54 percent being irrigated by a drip irrigation system and the remaining 46 percent irrigated by a center pivot or traveling gun.

The irrigated acreage estimated for Jackson County in 2014 (31,608) is about 47 percent higher than the 2012 estimated acreage published by the USDA (21,508 acres). The estimates of irrigated acreage field verified during 2014 for Calhoun and Gadsden Counties are also higher than those published by the USDA for 2012 (86 percent and 71 percent, respectively). In Calhoun County the USDA reported 1,647 irrigated acres while the current study estimated 3,060 acres, and in Gadsden County the USDA reported 2,650 acres while the current study estimated 4,547 acres. For Houston County the USDA-reported value of 9,138 acres in 2012 was 13 percent below the 10,333 acres field verified in the current study. Differences between the USDA 2012 values and 2014 field verified estimates in these two datasets may occur because (1) irrigated acreage for some specific crops increased or decreased substantially during the 2-year interval due to commodity prices or economic changes, (2) irrigated acreage calculated for the current study may be estimated high because irrigation was assumed if an irrigation system was present and therefore the acreage was counted as irrigated, when in fact that may not have been the case as some farmers may not have used their irrigation systems during this growing period even if they had a crop in the field, or (3) the amount of irrigated acreages published by the USDA for selected crops may be underestimated in some cases.

Introduction

Water withdrawals for agricultural irrigation generally are estimated in counties throughout Florida because most irrigators do not meter or report their usage, or the metered information obtained does not provide a cumulative total. The most common procedure used to estimate water withdrawals for agricultural irrigation in Florida is to multiply the reported or published number of acres of each crop irrigated by a crop-specific net irrigation requirement, also known as an application

rate (Marella, 2014). The acres irrigated and the application rates both are estimated by each of five water management districts (WMD) for the counties within their boundaries. Many assumptions must be made to estimate water withdrawals using irrigated acreage data and application rates, and this report will focus on the irrigated acreage estimates made for Jackson, Calhoun, and Gadsden Counties in Florida, and Houston County in Alabama. Some of the problems associated with obtaining and using reported or published irrigated acreage data include

- variations in definitions, data-collection procedures, and reporting levels between agencies that compile such data, and differences in years published;
- inadequate documentation of accuracy and detail;
- missing data due to incomplete compilations or privacy restrictions or disclosures;
- inability to differentiate between irrigated and non-irrigated crop data on a county level;
- lack of information about irrigation method and water source; and
- lack of spatial data describing the location of irrigated croplands.

Accurate and detailed estimates of irrigated acreage are not available at the level needed to improve current water-use estimates or project future demands. The results of this study will increase the accuracy of water-use estimates and provide a more detailed summary of the irrigated crops within Jackson County and the surrounding counties of Calhoun and Gadsden in Florida and Houston in Alabama than the values published in the past for these counties. Information on crop type, irrigation system, and water source enables water managers and planners to better estimate current and future water needs. An accurate assessment of the spatial distribution of irrigated lands will allow better identification of water use at the local and regional level, and facilitate more reliable assignment of withdrawals for use in predictive groundwater and surface-water models.

Background

In 1998, the five Florida WMDs each prepared a detailed regional water supply plan for areas or counties within their jurisdiction to determine whether existing sources of water were adequate for current and future water needs (Florida Department of Environmental Protection, 2013). Water needs include water for public supply, domestic/small public supply, commercial/industrial/institutional self-supplied, power generation, agricultural irrigation, and recreational irrigation (primarily golf courses). The primary objective of these water supply plans was to project future water demands and develop alternative water supplies to help meet the projected demands.

In 2013, the Florida Legislature mandated that future water demand projections for the agricultural irrigation part of these water supply plans be provided by the Florida Department of Agriculture and Consumer Services (FDACS) for consideration by the WMDs (Marella and Dixon, 2014). The water supply plans typically project 20 years into the future and are updated by the WMDs on a 5-year cycle. Generally, all water supply plans are approved and adopted as policy guides by the governing board of each WMD.

Water withdrawals for agricultural irrigation refer to water used for crop irrigation and for non-irrigation uses associated with agricultural and farming operations (Marella, 2014). Crop irrigation includes the application of water on lands to assist in cultivation of crops or to prevent crop damage caused by harsh weather. Non-irrigation uses include withdrawals for livestock watering, washing of dairy and farm equipment, augmentation of ponds used for fish farming, and other farm uses (Marella, 2014).

Purpose and Scope

The purpose of this report is to present the results of a cooperative study between the U.S. Geological Survey (USGS) and the FDACS to provide a detailed digital map and summary of field-verified irrigated acreage within Jackson County, Florida (fig. 1), for the agricultural growing period of 2014. The report also provides similar data for the surrounding counties of Calhoun and Gadsden in Florida, and most of Houston County in Alabama (excluding the northwest and western panhandle of Houston County) (fig. 1), as part of a separate project with the USGS South Atlantic Water Science Center (http://www.usgs.gov/water/southatlantic/). The irrigated acreage was mapped, digitized, and field verified for the crops grown during the spring, summer, and fall growing seasons of 2014. Attribute data were collected for each irrigated field in all four counties, including crop type, irrigation system type, and primary water source. The field verification was completed primarily during June–November 2014, although a small amount of followup field verification was necessary during December 2014 and January 2015. The 6-month period from June to November most likely represents nearly all of the crops grown in these four counties during 2014, including those planted in February–May, because these crops (mostly vegetables) were either still in the field or evidence of their planting and harvesting was still visibly present in June. The majority of irrigated acreage in these four counties is for field crops (field corn, cotton, peanuts, and sorghum), which are primarily grown between May and October. All other crops, such as orchards (citrus, blueberries, and grapes), ornamentals (container nurseries), and grasses (sod, hay, seeds, rye, and pasture), were also field verified during the same 6-month period, even though most of these crops are grown year round.

This study focused on verifying irrigated acreage by crop type and does not address any application rates or make any estimates of water use. The results published in this report focus on Jackson County; however, data also are presented for Calhoun, Gadsden, and Houston Counties. The maps and acreage totals presented in this report provide estimates of irrigated acreage, additional data on irrigation systems, and spatially accurate locations of irrigation systems within these four counties. The results of the data compiled from this study can be used to help the USGS National Water-Use Information Program with more accurate acreage counts as well as better distribute these acreage totals across hydrologic basins.

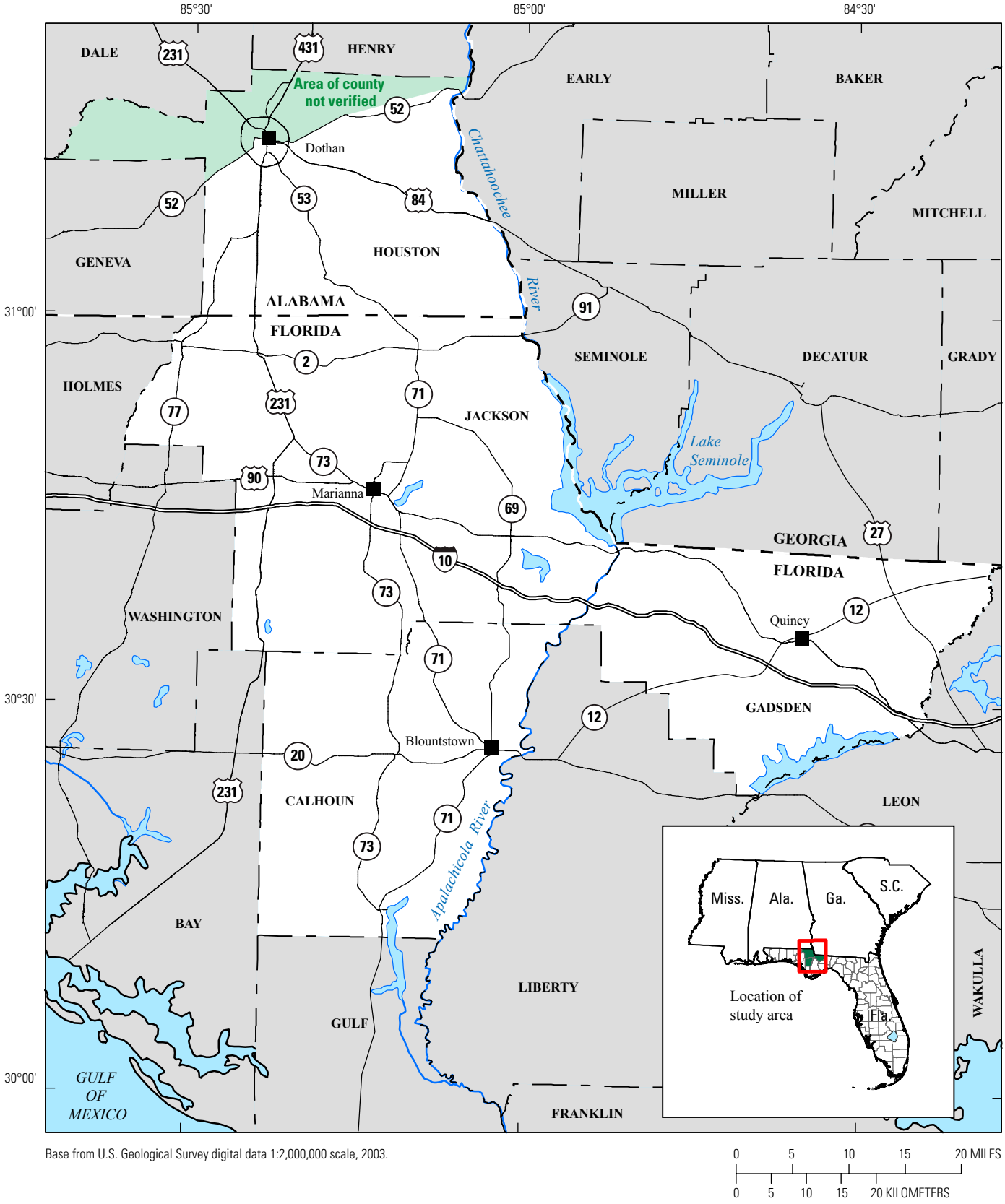

Figure 1. Jackson County, Florida, and selected surrounding counties, including selected features and place names.

County Population, Land Use, and Water Withdrawals

Jackson County is located in northwest Florida and is bordered by Bay, Calhoun, Gadsden, Holmes, and Washington Counties in Florida, Houston County in Alabama, and Seminole County in Georgia (fig. 1). Jackson County encompasses 942 square miles (approximately 603,000 acres; Purdum, 1994) and had a population of 50,231 in 2014 (University of Florida, 2015). Jackson County is predominantly rural, and almost two-thirds of the population resided in unincorporated areas distributed throughout the county in 2014 (University of Florida, 2015) (fig. 2). The population of Jackson County has increased from 39,154 in 1980 (University of Florida, 1981) to 49,761 in 2010 (University of Florida, 2015). Although the population increased by 28 percent during 1980–2014, the increase averaged only about 325 additional residents per year. In 2014, the population of Calhoun County was 14,591, Gadsden County was 48,096 (University of Florida, 2015), and Houston County was 104,193 (U.S. Census Bureau, 2014). A high percentage of the total population in Calhoun and Gadsden Counties also resided in unincorporated areas in 2014 (79 percent and 62 percent, respectively) (University of Florida, 2015) (fig. 2). For Houston County, in contrast, 63 percent of the total population resided in the urban area associated with the City of Dothan (Suburban Stats, Inc., undated a) (figs. 1, 2).

According to the U.S. Department of Agriculture (USDA), agricultural land in Jackson County accounted for 262,300 acres in 2012, or nearly 44 percent of the total amount of land in the county (U.S. Department of Agriculture, 2014a). Of this total agricultural land, 45 percent (117,600 acres) was active cropland while the remaining 55 percent was either pasture land (active or in-active), in forest production, or unused agricultural lands. The majority of the active cropland in Jackson County is generally found north of Interstate-10 (I-10), including areas along Florida State Road (SR) 2, SR 69, and SR 71, and U.S Highway 231 (fig. 1). Although a great deal of agricultural land is found south of I-10, this area does not have the same intensity in active crop production because pasture and timber production are more prevalent in this part of the county. In Calhoun and Gadsden Counties, cropland is scattered throughout the entire county,

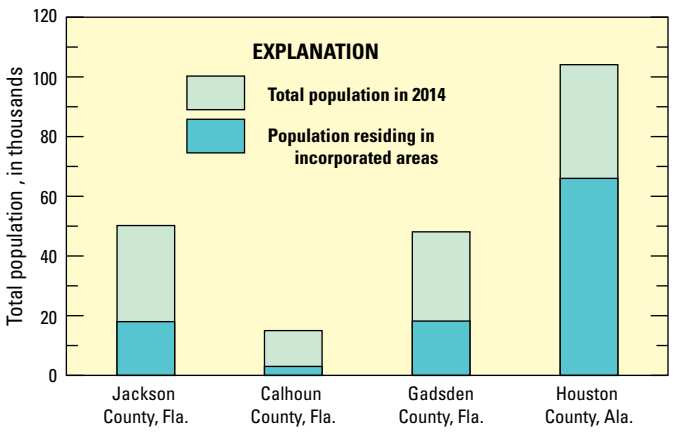

Figure 2. Incorporated and unincorporated populations of Jackson, Calhoun, and Gadsden Counties in Florida, and Houston County in Alabama, 2014 (from University of Florida, 2015, and Suburban Stats, undated b).

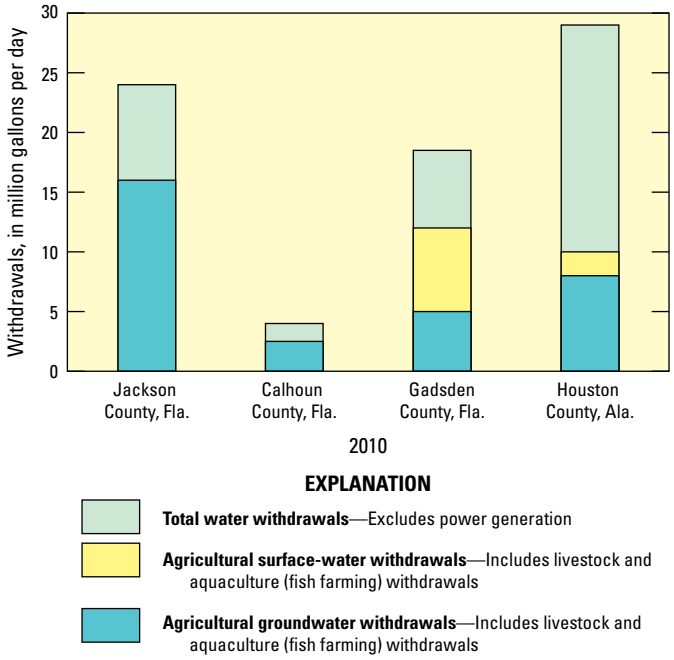

Figure 3. Water withdrawals in Jackson, Calhoun, and Gadsden Counties in Florida, and Houston County in Alabama, 2010 (from Marella, 2014, and Amy C. Gill, USGS, Lower Mississippi Gulf Water Science Center, written commun., May 1, 2015).

whereas in Houston County, cropland is concentrated in the southern and eastern parts of the county.

Excluding surface-water withdrawals for once-through power generation, groundwater is the predominant water source for all other users in Jackson County (Marella, 2014). In 2010, total groundwater withdrawals were 23.6 million gallons per day (Mgal/d), and about 16 Mgal/d (68 percent) were for agricultural needs (Marella, 2014) (fig. 3). The remaining groundwater was withdrawn for domestic self-supplied (12 percent), public supply (11 percent), and commercial-industrial-mining self-supplied or power generation (8 percent). Surface-water withdrawals totaled 41 Mgal/d in Jackson County for 2010, and nearly all of the surface water was withdrawn for power generation (Marella, 2014). All of the groundwater withdrawn in Jackson County is obtained from the Floridan aquifer system, and nearly all of the surface water withdrawn is from the Chattahoochee River (Marella, 2014). Water withdrawn for agriculture in Jackson County is used for crop irrigation as well as for livestock and aquaculture (fish farming) production. Excluding surface water withdrawn for once-through power generation, agricultural irrigation accounted for the largest amount of freshwater withdrawn in Calhoun County (63 percent) and Gadsden County (65 percent), while in Houston County agricultural irrigation only accounted for 34 percent of the total freshwater withdrawn in 2010 but still totaled more than 10 Mgal/d (Amy C. Gill, USGS, Lower Mississippi Gulf Water Science Center, written commun., May 1, 2015) (fig. 3).

Map Development and Data Sources

A preliminary map showing acreage by crop type was developed using land-use data collected for 2009–10. The preliminary map was revised using more recent orthoimages from 2012 and 2013 to produce an adjusted map that was used for

field verification. Orthoimages are a composite of high resolution aerial images (obtained from either an aircraft or a satellite) that combine the visual attributes of an aerial photograph with the spatial accuracy and reliability of a planimetric map (http://nationalmap.gov/ortho.html). Once the field verification was completed and changes were made on the adjusted map and corresponding shape files, a final field-verified map was produced.

The preliminary maps for Jackson, Calhoun, and Gadsden Counties were developed from data obtained from the Northwest Florida Water Management District (NWFWMD). These preliminary maps were developed from a land-use inventory completed by the Florida Department of Environmental Protection (FDEP), Bureau of Watershed Restoration, on the basis of 2009 and (or) 2010 Florida Ortho Quarter Quad Aerial Imagery Color Infrared or True Color Photography and using the Florida Land Use and Cover Classification System (FLUCCS) (http://www.dep.state.fl.us/gis/datadir.htm). The NWFWMD also provided a point coverage of their current agricultural irrigation consumptive water-use permits for these three counties. The locations of permitted wells and surface-water intakes were added to the preliminary maps to help identify the fields or areas that had potential for irrigation, and the preliminary maps for these three counties were digitized. The preliminary map of Houston County was created from scratch for this study because no agriculture land-use map and only limited permit data were available at this time.

Orthoimages were used to revise the preliminary maps produced from the FDEP data for Jackson, Calhoun, and Gadsden Counties. In areas with land-use type or field shape discrepancies, the preliminary maps were adjusted to match the orthoimages. For Houston County, the orthoimages were used to locate and digitize fields that either had an irrigation system visible or that appeared to have irrigation on the basis of the shape of the area; this included the areas along or south of Alabama SR 52 (fig. 1). Orthoimages obtained from the USGS Earth Resources Observation and Science (EROS) Center (https://lta.cr.usgs.gov/high_res_ortho) primarily represent 2012 images for Jackson and Gadsden Counties and 2013 images for Calhoun County. Orthoimages for Houston County in Alabama were obtained from the National Agriculture Imagery Program (http://www.fsa.usda.gov/programs-and-services/aerial-photography/imagery-programs/naip-imagery/index) produced by the USDA Farm Service Agency (FSA), Aerial Photography Field Office in 2013. Google Earth images from January and February of 2012 or 2013 were also used during digitizing. Questions or concerns about several of the digitized field shapes or locations on the adjusted map were answered during field verification or resolved during conversations with local agricultural experts.

The center pivot irrigation is the most common system used throughout the four counties described in this report. This system rotates around a center point (usually where the source water pipe enters the structure) and carries water laterally across multiple spans 10 to 15 feet above the ground that spray water onto the field though multiple sprinkler heads (Izuno and Haman, 1987) (fig. 4). On many center pivots, a large irrigation sprinkler head (often referred to as an end gun) irrigates an area beyond the area that is directly under the center pivot structure. For the purpose of this study, the areas digitized for each center pivot only include the area under the center pivot structure and do not include the area irrigated by the end gun. The area under the center pivot was digitized by using a geographic information system (GIS) to trace a line the length of the center pivot

Figure 4. Center pivot irrigation system, Houston County, Alabama, October 2014.

structure (as seen from the orthoimages) and to draw a circle based on the length of the structure. These center pivot areas were then compared to the orthoimages and modified to fit the shape of the field that the center pivot covered, because in many cases the center pivot did not make a complete circle. Also, some areas under many center pivots did not have the capacity to grow a crop (in most cases they were either wet or under water), and these areas were digitized separately and excluded from the acreage totals if they were large enough to be seen on the orthoimages. Overall, the deliberate exclusion of the non-planted areas and the areas sprayed by the end guns provides a more accurate representation of the actual irrigated crop acreage under each center pivot than would otherwise be obtained. If a portable or traveling gun or drip irrigation system was observed, the entire field was digitized and labeled as irrigated.

For most of the irrigated fields in the three Florida counties, a consumptive water-use permit was provided by the NWFWMD (Craig Freeman, Northwest Florida Water Management District, written commun., January, 3, 2014) and from that permit a water source was identified for each field. For Houston County, a map of permitted irrigators was provided by the Alabama Department of Economic and Community Affairs (Thomas Littlepage, Alabama Office of Water Resources, written commun., August 1, 2014). The map showed a general location of ground and surface-water irrigation permits within the county, and when possible a digitized field was matched against the map to assign a water source. For fields in the four counties for which a water source could not be verified through a permit of a visual observation, groundwater was assigned as the default water source. These assumptions and other limitations were documented in the attribute files.

Field Verification, Limitations, and Crop Delineation

During field verification of the irrigated areas on the adjusted map, specific attributes were recorded for each field. Attributes included crop type, irrigation system (micro, which includes drip systems, and sprinkler, which includes center pivots, portable or traveling guns, and permanent or solid overhead fixtures) (Izuno and Haman, 1987; Marella, 2014), and water source (groundwater, surface water, or wastewater). The field verification was conducted in Jackson County between June and November 2014. Areas of intense vegetable production were located with the assistance of the staff from the NWFWMD, the local USDA office, and the Jackson County Extension Office, University of Florida, Institute of Food and Agricultural Science (IFAS) personnel. These areas were first field verified in June at the beginning of the study to ensure that data from spring vegetable production could be verified and not missed. In Jackson County, most spring vegetables were either harvested or being harvested by June or early July. Those fields that had been harvested weeks or months before the beginning of June were documented as a spring vegetable crop because evidence of irrigation was still visibly present (field plastics, drip lines, portable hoses still visible in the fields, or unpicked crops were still present in or along the field edges), but a specific crop could not be properly identified. Fields that were active during the field-verification visit were labeled as a spring vegetable field, and the specific crop was noted in the attribute file. All of the vegetable fields in Jackson County were visited again in October and November, and if a crop was present during this visit, it was labeled as a fall vegetable field, and the specific crop was noted in the attribute file if it could be identified. Any field that had a crop present during both the spring and fall were labeled as double cropped, and the acreages were accounted for twice and reported in the spring and fall totals. Vegetables observed during field verification in the four counties most commonly included cantaloupes, cucumbers, peppers, tomatoes, watermelons, and several other nonspecific vegetables. Beginning in July 2014, field verification of all other crops began in Jackson County, followed by field verification of Calhoun, Houston, and Gadsden Counties.

Each field shown on the adjusted map with an irrigation system or a withdrawal permit was observed from the road at least once during the study period, and the crop was identified if one was planted. Some fields were plowed and vacant while others were idle with grass cover; however, most fields were active with cotton, peanuts, or field corn in various stages of growth between July and October 2014. During the summer months, some fields could not be viewed or a crop could not be properly identified without accessing private property (at no time was private property entered during field verification). These fields represented less than 5 percent of the total fields and were labeled as unverified; however, with assistance from the NWFWMD, the local USDA office, or IFAS personal, some of these fields were subsequently labeled. A few additional field trips were made during December 2014 and January 2015 when most vegetation was dormant or no longer present to obscure observations. The existence of center pivots could be confirmed, and fields could be easily seen and identified. Evidence of a summer crop type could still be seen on many of these fields during the winter months. Ultimately, a few of the fields could not be visibly verified, and the assumption was made that unverified fields had the same crop type as neighboring fields.

For the purpose of this study, it was assumed that if an irrigation system was observed, the system would be in use for the current crop at some time during its growing period. This assumption was necessary because irrigation systems were observed in operation in only a few (less than 10 percent) of the many fields that were visited between June and November 2014. Therefore, the irrigation totals calculated for this report may be somewhat high because of this assumption. In addition, a small percentage of fields in the four counties either used a portable irrigation system (for example, a portable or traveling gun) or had center pivots that were moved from field to field. In this case, unless the portable or traveling gun was visibly in use or still connected to a pump, the acres would not be counted as irrigated, and if a center pivot was moved from one field to another during the same growing season, only the field where the center pivot was present on the day of the visit would be counted as irrigated.

For this inventory, most of the pasture, hay, or grass fields with an irrigation system present were counted as irrigated unless there was obvious evidence that the irrigation system was not in operation (for example, disconnected center pivot spans, fences, obstructions within the center pivot areas, or showed no sign of movement because weeds had over grown the center pivot structure). Pasture, hay, and grass were defined as follows: pasture included grass that was usually maintained (cut and relatively weed free), had the presence of livestock on the fields in some cases, and had no evidence of bailed or stored

hay around fields; hay was grass grown for the purpose of cutting and bailing and usually had evidence of bailed or stored hay along field edges with no livestock present; grass was most often un-maintained (usually not cut, often with weeds, or had multiple bald spots present) or was recently planted with a grass cover after a field or vegetable crop was harvested. Many of these grass fields had livestock present or were observed as idle at the time of the field verification visit.

Upon completion of the field verification, a draft map was produced. This draft map was reviewed by the NWFWMD, County Extension Office, and the USDA for possible missing fields, and a final verified map was produced for publication (appendix 1). Once these last changes were made and questions resolved, the results of the all field-verified data were totaled and summarized into this report.

Results

The results of data compilation and field verification indicate that during the growing season of 2014, an estimated 31,608 acres were irrigated in Jackson County. This includes 25,733 acres of field crops, 3,235 acres of vegetable crops (sometimes referred to as row crops), 1,534 acres of ornamentals and grasses, and 420 acres of orchards (table 1). Specific irrigated crops include 11,759 acres of cotton (fig. 5), 9,909 acres of peanuts, and 2,444 acres of field corn (table 1). (Values presented in appendix 1 may not match those presented in the text or tables due to rounding.) Vegetable acreage includes 1,714 acres of which 857 acres were (double cropped) planted with both a spring and fall crop on the same field (table 1). About 686 acres of irrigated land were observed on government research lands with experimental plots of various crops or were deemed idle with an irrigation system visible but no crop present at the time of the field verification visit (this acreage is listed as other open land) (table 1).

Groundwater was used to irrigate 98.6 percent of the total irrigated acreage (31,174) in Jackson County, whereas surface water and wastewater were used to irrigate the remaining 1.4 percent (435 acres). Wastewater includes the use of dairy effluent or treated municipal effluent. Center pivots, portable or traveling guns, and permanent or solid overhead fixtures accounted for 91 percent (28,832 acres) of the total acreage irrigated in Jackson County, while drip irrigation systems accounted for the remaining 9 percent (2,776 acres) of the irrigated acreage in the county (table 1).

Irrigated cropland totaled 3,060 acres in Calhoun County; 4,547 acres in Gadsden County; and 10,333 acres in Houston County. Although field crops accounted for the majority of irrigated acreage in Calhoun County (table 2), sod accounted for the largest irrigated acreage for a single crop (1,145 acres) followed by peanuts (886 acres). In Gadsden County, ornamentals and sod accounted for the largest irrigated acreage (table 3), and ornamentals accounted for the largest single crop (1,104 acres) followed by cotton (977 acres). In Houston County, field crops accounted for the largest irrigated acreage (table 4), while cotton accounted for the largest irrigated single crop (4,310 acres) followed by peanuts (2,493 acres). Because field verification did not begin in Gadsden and Houston Counties until well into September or October, spring vegetables were missed (unless evidence was still visible) during field verification; therefore, only fall vegetable acreage was recorded for these two counties for 2014.

Overall, an estimated 49,548 acres of land were irrigated during 2014 in the four counties inventoried. About 45,052 acres were irrigated by a center pivot, permanent or solid overhead fixtures, or a portable or traveling gun. In all, 650 center pivot irrigation systems were identified, and the calculated acreage under these pivots totaled 43,070 acres. There were 405 center pivot irrigation systems counted in Jackson County during the 2014 field verification followed by Houston with 197, Gadsden with 48, and Calhoun with 10. An estimated 35,087 acres of field corn, cotton, peanuts, and sorghum were irrigated by center pivot systems during 2014 in these four counties combined. Vegetable acreage for the four counties combined totaled 6,699 acres, with 54 percent being irrigated by a drip irrigation system and the remaining 46 percent irrigated by a center pivot or traveling gun. All of the sod (1,743 acres) and pasture (1,686 acres) were irrigated by either a center pivot or traveling gun. Ornamental acreage totaled 1,104 acres, with 68 percent being irrigated by a drip system and the remaining 32 percent irrigated by an overhead system (permanent or solid fixture). No flood irrigation systems were observed during field verification in any of the four counties in this study.

Figure 5. Cotton being irrigated in July (left) and ready for harvesting in September (right), Jackson County, Florida, 2014.

Table 1. Reported and inventoried crop and irrigated acreage in Jackson County, Florida, 1974–2014.

[Data were compiled by the U.S. Geological Survey (USGS), Caribbean-Florida Water Science Center, Orlando. D, values were not provided in the U.S. Department of Agriculture (USDA) published tables due to privacy issues; N/A, data not available; USDA acreage values, shown in italics, represent total acreage because the USDA tables do not differ between irrigated and non-irrigated; all other USDA values (in yellow box) reflect what was reported as irrigated. Microirrigation includes drip, spray, jet, and bubbler systems. Sprinkler irrigation includes portable and traveling guns, solid or permanent overhead fixtures, center pivots, and periodic moving systems. Flood irrigation (including seepage systems) include open-field ditch (furrows), semi-closed conveyance, subsurface conduit, crown flood, and continuous flood (Izuno and Haman, 1987; Marella, 2014)]

Crop type	From U.S. Department of Agriculture, Census of Agriculture[1]									2014 U.S. Geological Survey photo images and field verification[2]			
	1974	1978	1982	1987	1992	1997	2002	2007	2012	Total	Micro	Sprinkler	Flood
Row Crops (Vegetables)[3]	**N/A**	**N/A**	**N/A**	**1,566**	**801**	**935**	**933**	**647**	**774**	**3,235**	2,356	**879**	—
Spring grown[4]										**1,457**	1,061	396	
Fall grown[5]										**64**	47	17	
Spring and Fall grown[6]										**1,714**	1,248	466	
Fruit Crops (Land in orchards)	**N/A**	**N/A**	**N/A**	**25**	**D**	**154**	**164**	**93**	**216**	**420**	420	—	—
Blueberries										**10**	10		
Citrus										**393**	393		
Grapes										**17**	17		
Fruit Crops undifferentiated[7]										**0**			
Field Crops	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**25,733**	—	**25,733**	—
Cotton				456	1,620	4,737	2,607	6,915	9,969	**11,759**		11,759	
Field corn				3,567	3,775	3,530	1,529	2,285	2,285	**2,444**		2,444	
Peanuts				6,328	5,265	5,776	4,694	6,379	6,898	**9,909**		9,909	
Sorghum										**272**		272	
Soybeans										**0**			
Field Crops undifferentiated[8]							1,366	2,401	1,218	**1,349**		1,349	
Ornamentals/Grasses	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**1,534**	—	**1,534**	—
Ornamentals[9]						D	D	68	9	**0**			
Pasture (for grazing)[10]				406	671	442	900	1,213	859	**1,534**		1,534	
Sod						D	D	*794*	*340*	**0**			
Other Open Land	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**686**	—	686	—
Idle[11]										**315**		315	
Research[12]										**371**		371	
Irrigated land	**3,030**	**14,607**	**18,077**	**15,541**	**13,365**	**18,314**	**13,374**	**20,275**	**21,508**	**31,608**	**2,776**	**28,832**	**0**
Number of farms	**40**	**94**	**119**	**114**	**113**	**102**	**98**	**121**	**120**	**Percent**	**9**	**91**	—
Harvested cropland	**109,431**	**142,086**	**129,569**	**93,419**	**80,035**	**89,396**	**73,936**	**101,578**	**94,902**				
Number of farms	**1,020**	**951**	**761**	**721**	**677**	**581**	**486**	**588**	**589**				
Total cropland	**167,613**	**194,119**	**173,550**	**162,750**	**151,053**	**136,123**	**114,428**	**144,046**	**117,569**				
Number of farms	**1,141**	**1,061**	**879**	**828**	**758**	**728**	**711**	**856**	**781**				

[1]Data for 1974, 1978, 1982, 1987, 1992, 1997, 2002, 2007, and 2012 were obtained from the Census of Agriculture (U.S. Department of Commerce, 1977a, 1984a; USDA, 1989a, 1994a, 1999a, 2004a, 2009a, 2014a).

[2]The values reported by the USGS represent observed acreage for the spring, summer, and fall growing seasons of 2014. Values shown in this table may differ from those presented in appendix 1 due to rounding.

[3]Acreage may include beans (lima, pole, and snap), broccoli, carrots, cauliflower, celery, collards, garlic, herbs, kale, mustard greens, okra, onions, parsley, peas (black-eyed, crowder, green, and southern), potatoes, pumpkins, spinach, sweet corn, turnip greens, radishes, and watercress.

[4]Acreage includes vegetables that were planted in the spring (primarily between February and May) for a spring or summer harvest (primarily between April and July).

[5]Acreage includes vegetables that were planted in the fall (primarily between August and November) for a fall or winter harvest (primarily between November and February).

[6]Acreage includes vegetables that were planted in the spring and fall on the same field (see above for time frames). This is referred to as double cropped, and actual physical acreage would be one-half of the totals shown.

[7]Acreage includes apples, avocados, bananas, guavas, mangoes, papayas, passion fruit, peaches, pears, pecans, persimmons, plums, strawberries, and other non-citrus fruit.

[8]Acreage includes tobacco, wheat (for grain), oats (for grain), proso millet, rice, rye (for grain), dry southern peas (cowpeas), grass and grass seeds, hay, forage, and silage crops.

[9]Acreage includes container, field, and greenhouse grown nursery stock.

[10]Acreage includes irrigated pastureland as reported by the USDA Census of Agriculture (USDA, 1989a, 1994a, 1999a, 2004a, 2009a, 2014a).

[11]Acreage includes idle land with no specific crop (grass cover in most cases) or vacant with an irrigation system present.

[12]Includes acres with an irrigation system located at a governmental or university research facility with a variety of planted crops.

Table 2. Reported and inventoried crop and irrigated acreage in Calhoun County, Florida, 1974–2014.

[Data were compiled by the U.S. Geological Survey (USGS), Caribbean-Florida Water Science Center, Orlando. D, values were not provided in the U.S. Department of Agriculture (USDA) published tables due to privacy issues; N/A, data not available; USDA acreage values, shown in italics, represent total acreage because the USDA tables do not differ between irrigated and non-irrigated; all other USDA values (in yellow box) reflect what was reported as irrigated. Microirrigation includes drip, spray, jet, and bubbler systems. Sprinkler irrigation includes portable and traveling guns, solid or permanent overhead fixtures, center pivots, and periodic moving systems. Flood irrigation (including seepage systems) include open-field ditch (furrows), semi-closed conveyance, subsurface conduit, crown flood, and continuous flood (Izuno and Haman, 1987; Marella, 2014)]

Crop type	From U.S. Department of Agriculture, Census of Agriculture[1]									2014 U.S. Geological Survey photo images and field verification[2]			
	1974	1978	1982	1987	1992	1997	2002	2007	2012	Total	Micro	Sprinkler	Flood
Row Crops (Vegetables)[3]	N/A	N/A	N/A	D	D	D	D	D	9	99	99	—	—
Spring grown[4]										99	99		
Fall grown[5]										0			
Spring and Fall grown[6]										0			
Fruit Crops (Land in orchards)	N/A	N/A	N/A	D	D	D	D	24	66	0	—	—	—
Blueberries										0			
Citrus										0			
Grapes										0			
Fruit Crops undifferentiated[7]										0			
Field Crops	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	1,816	—	1,816	—
Cotton				D	D	D	730	D	690	651		651	
Field corn				D	D	D	D	D	D	135		135	
Peanuts				D	D	D	450	D	470	886		886	
Sorghum										144		144	
Soybeans										0			
Field Crops undifferentiated[8]									D	0			
Ornamentals/Grasses	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	1,145	—	1,145	—
Ornamentals[9]										0			
Pasture (for grazing)[10]						D	15	155	22	0			
Sod						*265*	D	*534*	*911*	1,145		1,145	
Other Open Land	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0	—	—	—
Idle[11]										0			
Research[12]										0			
Irrigated land	230	261	2,001	805	1,148	1,107	1,765	1,455	1,647	3,060	99	2,961	0
Number of farms	2	3	5	14	12	14	21	19	30	Percent	3	97	—
Harvested cropland	26,444	29,684	32,747	20,288	20,725	19,928	19,186	13,249	16,501				
Number of farms	165	155	130	110	76	88	70	78	104				
Total cropland	37,063	39,787	38,590	32,266	30,422	27,223	24,142	16,553	18,907				
Number of farms	201	188	151	140	110	108	91	132	140				

[1]Data for 1974, 1978, 1982, 1987, 1992, 1997, 2002, 2007, and 2012 were obtained from the Census of Agriculture (U.S. Department of Commerce, 1977a, 1984a; USDA, 1989a, 1994a, 1999a, 2004a, 2009a, 2014a).

[2]The values reported by the USGS represent observed acreage for the spring, summer, and fall growing seasons of 2014. Values shown in this table may differ from those presented in appendix 1 due to rounding.

[3]Acreage may include beans (lima, pole, and snap), broccoli, carrots, cauliflower, celery, collards, garlic, herbs, kale, mustard greens, okra, onions, parsley, peas (black-eyed, crowder, green, and southern), potatoes, pumpkins, spinach, sweet corn, turnip greens, radishes, and watercress.

[4]Acreage includes vegetables that were planted in the spring (primarily between February and May) for a spring or summer harvest (primarily between April and July).

[5]Acreage includes vegetables that were planted in the fall (primarily between August and November) for a fall or winter harvest (primarily between November and February).

[6]Acreage includes vegetables that were planted in the spring and fall on the same field (see above for time frames). This is referred to as double cropped, and actual physical acreage would be one-half of the totals shown.

[7]Acreage includes apples, avocados, bananas, guavas, mangoes, papayas, passion fruit, peaches, pears, pecans, persimmons, plums, strawberries, and other non-citrus fruit.

[8]Acreage includes tobacco, wheat (for grain), oats (for grain), proso millet, rice, rye (for grain), dry southern peas (cowpeas), grass and grass seeds, hay, forage, and silage crops.

[9]Acreage includes container, field, and greenhouse grown nursery stock.

[10]Acreage includes irrigated pastureland as reported by the USDA Census of Agriculture (USDA, 1989a, 1994a, 1999a, 2004a, 2009a, 2014a).

[11]Acreage includes idle land with no specific crop (grass cover in most cases) or vacant with an irrigation system present.

[12]Includes acres with an irrigation system located at a governmental or university research facility with a variety of planted crops.

Table 3. Reported and inventoried crop and irrigated acreage in Gadsden County, Florida, 1974–2014.

[Data were compiled by the U.S. Geological Survey (USGS), Caribbean-Florida Water Science Center, Orlando. D, values were not provided in the U.S. Department of Agriculture (USDA) published tables due to privacy issues; N/A, data not available; USDA acreage values, shown in italics, represent total acreage because the USDA tables do not differ between irrigated and non-irrigated; all other USDA values (in yellow box) reflect what was reported as irrigated. Microirrigation includes drip, spray, jet, and bubbler systems. Sprinkler irrigation includes portable and traveling guns, solid or permanent overhead fixtures, center pivots, and periodic moving systems. Flood irrigation (including seepage systems) include open-field ditch (furrows), semi-closed conveyance, subsurface conduit, crown flood, and continuous flood (Izuno and Haman, 1987; Marella, 2014)]

Crop type	From U.S. Department of Agriculture, Census of Agriculture[1]									2014 U.S. Geological Survey photo images and field verification[2]			
	1974	1978	1982	1987	1992	1997	2002	2007	2012	Total	Micro	Sprinkler	Flood
Row Crops (Vegetables)[3]	N/A	N/A	N/A	1,241	1,987	2,519	2,387	D	D	1,384	1,174	210	—
Spring grown[4]										275	235	40	
Fall grown[5]										1,109	939	170	
Spring and Fall grown[6]										0			
Fruit Crops (Land in orchards)	N/A	N/A	N/A	N/A	N/A	166	21	61	83	50	—	50	—
Blueberries										0			
Citrus										0			
Grapes										50		50	
Fruit Crops undifferentiated[7]										0			
Field Crops	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	1,207	—	1,207	—
Cotton										977		977	
Field corn				63	D			D	107	31		31	
Peanuts						D	D		D	127		127	
Sorghum										0			
Soybeans										0			
Field Crops undifferentiated[8]								D	8	72		72	
Ornamentals/Grasses	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	1,702	356	1,346	—
Ornamentals[9]										1,104	356	748	
Pasture (for grazing)[10]						D	141	38	43	0			
Sod						D	*289*	*983*	*976*	598		598	
Other Open Land	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	204	80	124	—
Idle[11]										0			
Research[12]										204	80	124	
Irrigated land	2,848	4,847	3,198	2,025	3,378	5,253	3,834	2,209	2,650	4,547	1,610	2,937	0
Number of farms	71	75	63	51	67	55	51	53	62	Percent	35	65	—
Harvested cropland	22,571	29,123	23,335	10,684	9,387	14,088	7,616	9,226	9,156				
Number of farms	341	351	300	252	224	187	162	206	208				
Total cropland	45,917	48,285	38,604	28,296	22,244	23,827	15,253	15,152	13,068				
Number of farms	416	419	367	310	290	252	242	276	266				

[1]Data for 1974, 1978, 1982, 1987, 1992, 1997, 2002, 2007, and 2012 were obtained from the Census of Agriculture (U.S. Department of Commerce, 1977a, 1984a; USDA, 1989a, 1994a, 1999a, 2004a, 2009a, 2014a).

[2]The values reported by the USGS represent observed acreage for the spring, summer, and fall growing seasons of 2014. Values shown in this table may differ from those presented in appendix 1 due to rounding.

[3]Acreage may include beans (lima, pole, and snap), broccoli, carrots, cauliflower, celery, collards, garlic, herbs, kale, mustard greens, okra, onions, parsley, peas (black-eyed, crowder, green, and southern), potatoes, pumpkins, spinach, sweet corn, turnip greens, radishes, and watercress.

[4]Acreage includes vegetables that were planted in the spring (primarily between February and May) for a spring or summer harvest (primarily between April and July).

[5]Acreage includes vegetables that were planted in the fall (primarily between August and November) for a fall or winter harvest (primarily between November and February).

[6]Acreage includes vegetables that were planted in the spring and fall on the same field (see above for time frames). This is referred to as double cropped, and actual physical acreage would be one-half of the totals shown.

[7]Acreage includes apples, avocados, bananas, guavas, mangoes, papayas, passion fruit, peaches, pears, pecans, persimmons, plums, strawberries, and other non-citrus fruit.

[8]Acreage includes tobacco, wheat (for grain), oats (for grain), proso millet, rice, rye (for grain), dry southern peas (cowpeas), grass and grass seeds, hay, forage, and silage crops.

[9]Acreage includes container, field, and greenhouse grown nursery stock.

[10]Acreage includes irrigated pastureland as reported by the USDA Census of Agriculture (USDA, 1989a, 1994a, 1999a, 2004a, 2009a, 2014a).

[11]Acreage includes idle land with no specific crop (grass cover in most cases) or vacant with an irrigation system present.

[12]Includes acres with an irrigation system located at a governmental or university research facility with a variety of planted crops.

Table 4. Reported and inventoried crop and irrigated acreage in Houston County, Alabama, 1974–2014.

[Data were compiled by the U.S. Geological Survey (USGS), Caribbean-Florida Water Science Center, Orlando. D, values were not provided in the U.S. Department of Agriculture (USDA) published tables due to privacy issues; N/A, data not available; USDA acreage values, shown in italics, represent total acreage because the USDA tables do not differ between irrigated and non-irrigated; all other USDA values (in yellow box) reflect what was reported as irrigated. Microirrigation includes drip, spray, jet, and bubbler systems. Sprinkler irrigation includes portable and traveling guns, solid or permanent overhead fixtures, center pivots, and periodic moving systems. Flood irrigation (including seepage systems) include open-field ditch (furrows), semi-closed conveyance, subsurface conduit, crown flood, and continuous flood (Izuno and Haman, 1987; Marella, 2014)]

Crop type	From U.S. Department of Agriculture, Census of Agriculture[1]									2014 U.S. Geological Survey photo images and field verification[2]			
	1974	1978	1982	1987	1992	1997	2002	2007	2012	Total	Micro	Sprinkler	Flood
Row Crops (Vegetables)[3]	N/A	N/A	N/A	148	2,607	3,046	2,344	3,860	D	1,981	—	1,981	—
Spring grown[4]										0[4]			
Fall grown[5]										1,981		1,981	
Spring and Fall grown[6]										0			
Fruit Crops (Land in orchards)	N/A	N/A	N/A	116	76	78	86	22	40	11	11	—	—
Blueberries										11	11		
Citrus										0			
Grapes										0			
Fruit Crops undifferentiated[7]										0			
Field Crops	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	8,076	—	8,076	—
Cotton				D	D	2,185	2,525	3,923	2,769	4,310		4,310	
Field corn						1,837	679	1,176	813	560		560	
Peanuts				3,477	2,944	2,611	4,272	3,709	2,482	2,493		2,493	
Sorghum										389		389	
Soybeans				397	465	130	473	D	D	0			
Field Crops undifferentiated[8]				80	235	D	377	704	189	324		324	
Ornamentals/Grasses	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	152	—	152	—
Ornamentals[9]										0			
Pasture (for grazing)[10]								108	103	152		152	
Sod										0			
Other Open Land	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	113	—	113	—
Idle[11]										113		113	
Research[12]										0			
Irrigated land	2,158	6,744	5,828	7,276	7,731	9,896	9,174	13,368	9,138	10,333	11	10,322	0
Number of farms	27	76	72	64	63	55	54	69	75	Percent	—	100	—
Harvested cropland	110,056	113,908	106,470	85,557	91,289	103,444	85,920	83,890	86,755				
Number of farms	934	925	747	688	602	501	414	411	402				
Total cropland	150,310	151,684	133,950	141,755	134,033	137,415	117,599	114,896	97,381				
Number of farms	1,208	1,024	852	762	694	600	551	582	538				

[1]Data for 1974, 1978, 1982, 1987, 1992, 1997, 2002, 2007, and 2012 were obtained from the Census of Agriculture (U.S. Department of Commerce, 1977b, 1984b; USDA, 1989b, 1994b, 1999b, 2004b, 2009b, 2014b).

[2]The values reported by the USGS represent observed acreage for the spring, summer, and fall growing seasons of 2014. Values shown in this table may differ from those presented in appendix 1 due to rounding.

[3]Acreage may include beans (lima, pole, and snap), broccoli, carrots, cauliflower, celery, collards, garlic, herbs, kale, mustard greens, okra, onions, parsley, peas (black-eyed, crowder, green, and southern), potatoes, pumpkins, spinach, sweet corn, turnip greens, radishes, and watercress.

[4]Acreage includes vegetables that were planted in the spring (primarily between February and May) for a spring or summer harvest (primarily between April and July). This period was not field verified for Houston County for this study, therefore, no data were collected for the 2014 spring growing period.

[5]Acreage includes vegetables that were planted in the fall (primarily between August and November) for a fall or winter harvest (primarily between November and February).

[6]Acreage includes vegetables that were planted in the spring and fall on the same field (see above for time frames). This is referred to as double cropped, and actual physical acreage would be one-half of the totals shown.

[7]Acreage includes apples, avocados, bananas, guavas, mangoes, papayas, passion fruit, peaches, pears, pecans, persimmons, plums, strawberries, and other non-citrus fruit.

[8]Acreage includes tobacco, wheat (for grain), oats (for grain), proso millet, rice, rye (for grain), dry southern peas (cowpeas), grass and grass seeds, hay, forage, and silage crops.

[9]Acreage includes container, field, and greenhouse grown nursery stock.

[10]Acreage includes irrigated pastureland as reported by the USDA Census of Agriculture (USDA, 1989b, 1994b, 1999b, 2004b, 2009b, 2014b).

[11]Acreage includes idle land with no specific crop (grass cover in most cases) or vacant with an irrigation system present.

[12]Includes acres with an irrigation system located at a governmental or university research facility with a variety of planted crops.

It is difficult to compare the field-verified results compiled in this study to results published by the USDA because of differences in methodologies used to compile these totals as well as the differences in reporting years. Nevertheless, the irrigated acreage estimated for Jackson County in 2014 (31,608) is about 47 percent higher than the 2012 estimated acreage published by the USDA (21,508 acres) (U.S. Department of Agriculture, 2014a) (fig. 6; table 1). The estimates of irrigated acreage field verified for 2014 for Calhoun and Gadsden Counties are also higher than those published by the USDA for 2012 (86 percent and 71 percent, respectively). In Calhoun County the USDA reported 1,647 irrigated acres while this study estimated 3,060 acres (fig. 7; table 2), and in Gadsden County the USDA reported 2,650 acres while this study estimated 4,547 acres (fig. 8; table 3). For Houston County the USDA-reported value of 9,138 acres in 2012 was 13 percent below the 10,333 acres field verified in this study (fig. 9; table 4); however, the field-verified acreage estimated for 2014 and reported for Houston County does not include any spring vegetable acreage because this area was not visited until the fall months. Differences between the USDA 2012 values and 2014 field-verified estimates in these two datasets may occur because (1) irrigated acreage for some specific crops increased or decreased substantially during the 2-year interval due to commodity prices or economic changes, (2) irrigated acreage calculated for this study may be estimated high because irrigation was assumed if an irrigation system was present and therefore the acreage was counted as irrigated, when in fact that may not have been the case as some farmers may not have used their irrigation systems during the growing period even if they had a crop in the field, or (3) the amount of irrigated acreages published by the USDA for selected crops may be underestimated in some cases. In addition, according to the NWFWMD, a noticeable increase in well construction permits issued for agriculture wells has been occurring in Jackson County between 2010 and 2015 (Angela Chelette, Northwest Florida Water Management District, written commun., August, 26, 2015).

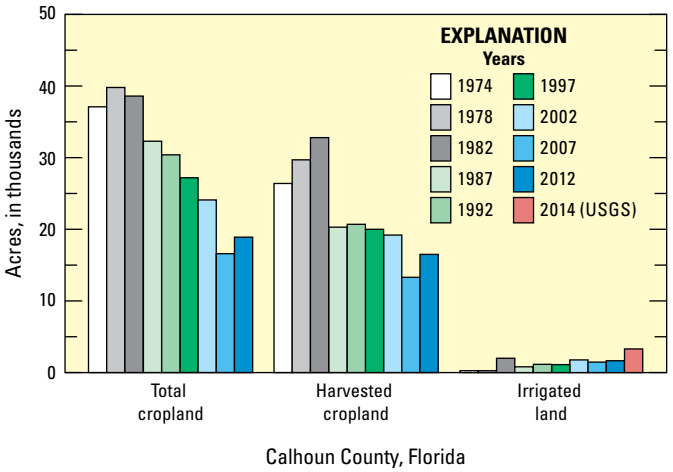

Figure 7. Reported and inventoried total cropland, harvested cropland, and irrigated land in Calhoun County, Florida, 1974–2014 (from U.S. Department of Commerce, 1977a, 1984a; U.S. Department of Agriculture, 1989a, 1994a, 1999a, 2004a, 2009a, 2014a).

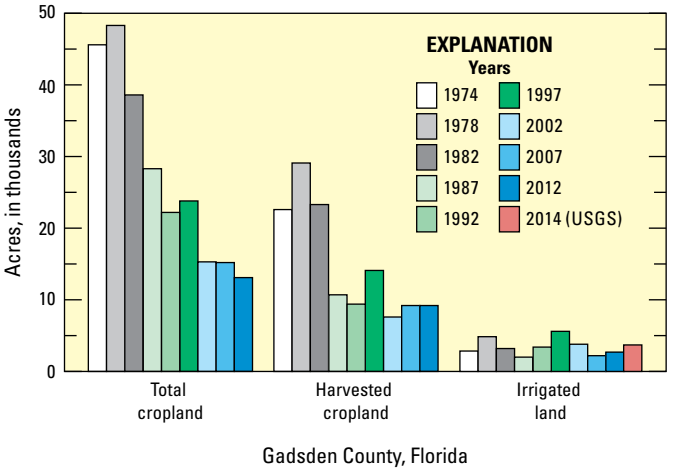

Figure 8. Reported and inventoried total cropland, harvested cropland, and irrigated land in Gadsden County, Florida, 1974–2014 (from U.S. Department of Commerce, 1977a, 1984a; U.S. Department of Agriculture, 1989a, 1994a, 1999a, 2004a, 2009a, 2014a).

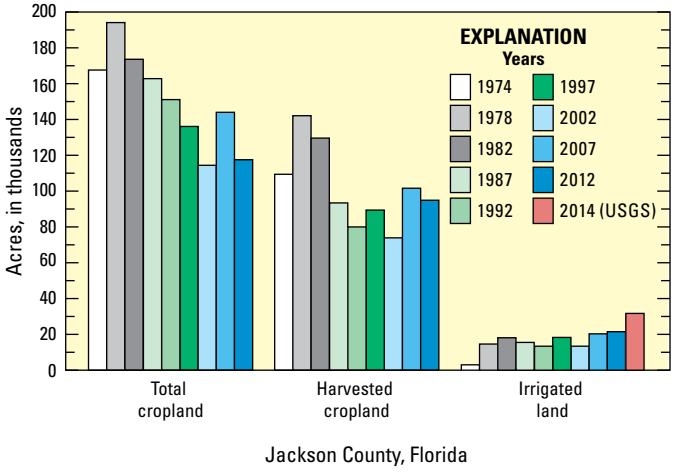

Figure 6. Reported and inventoried total cropland, harvested cropland, and irrigated land in Jackson County, Florida, 1974–2014 (from U.S. Department of Commerce, 1977a, 1984a; U.S. Department of Agriculture, 1989a, 1994a, 1999a, 2004a, 2009a, 2014a).

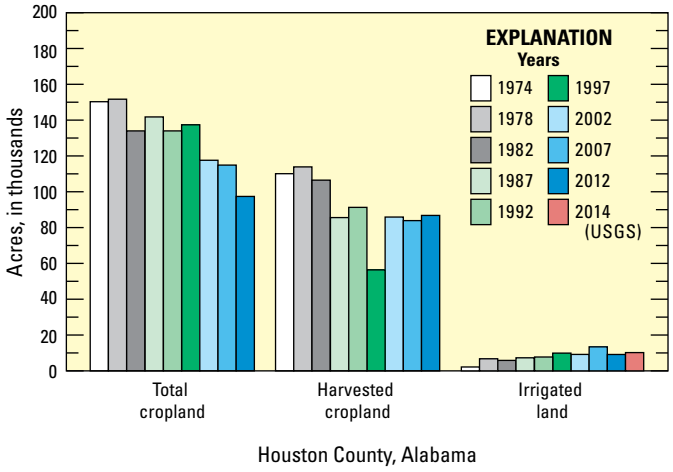

Figure 9. Reported and inventoried total cropland, harvested cropland, and irrigated land in Houston County, Alabama, 1974–2014 (from U.S. Department of Commerce, 1977b, 1984b; U.S. Department of Agriculture, 1989b, 1994b, 1999b, 2004b, 2009b, 2014b).

According to the USDA, irrigated cropland estimated during the past nine published census periods (1974–2012) has increased slightly in Jackson County (fig. 6), remained about the same in Calhoun and Houston Counties (figs. 7 and 9), and decreased in Gadsden County (fig. 8). Large differences in estimated acreage for some specific crops also occur between the USGS and the USDA, although some crop acreage estimates are relatively similar.

Further Information

Additional information about current and future water demands for agricultural irrigation in Jackson, Calhoun, and Gadsden Counties can be obtained by contacting the NWFWMD (http://www.nwfwmd.state.fl.us) or the FDACS (http://www.freshfromflorida.com/Divisions-Offices/Agricultural-Water-Policy/Agricultural-Water-Supply-Planning). No additional information was available at the time of publication about current and future water demands for agricultural irrigation in Houston County. The final field-verified map (appendix 1) along with digital layers and attribute files described in this report are available for download from the USGS Florida Water-Use Program Web site (http://fl.water.usgs.gov/infodata/wateruse.html) or by contacting the USGS Caribbean-Florida Water Science Center offices in Davie, Lutz, or Orlando, Florida, or Guaynabo, Puerto Rico.

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