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Office of Agricultural Water Policy

Agricultural Irrigated Land-Use Inventory for Polk County, Florida, 2016

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Abstract

An accurate inventory of irrigated crop acreage is not available at the level of resolution needed to better estimate agricultural water use or to project future water demands in many Florida counties. A detailed digital map and summary of irrigated acreage was developed for Polk County, Florida, during the 2016 growing season. This cooperative project between the U.S. Geological Survey and the Office of Agricultural Water Policy of the Florida Department of Agriculture and Consumer Services is part of an effort to improve estimates of water use and projections of future demands across all counties in the State. The irrigated areas were delineated by using land-use data provided by the Florida Department of Agriculture and Consumer Services, along with information obtained from the South and Southwest Florida Water Management Districts consumptive water-use permits. Delineations were field verified between April and December 2016. Attribute data such as crop type, primary water source, and type of irrigation system were assigned to the irrigated areas.

The results of this inventory and field verification indicate that during the 2016 growing seasons (spring, summer, fall, and winter), an estimated 88,652 acres were irrigated within Polk County. Of the total field-verified crops, 83,995 acres were in citrus; 2,893 acres were in other non-citrus fruit crops (blueberries, grapes, peaches, and strawberries); 621 acres were in row crops (primarily beans and watermelons); 1,117 acres were in nursery (container and tree farms) and sod production; and 26 acres were in field crops including hay and pasture. Of the total inventoried irrigated acreage within Polk County, 98 percent (86,566 acres) was in the Southwest Florida Water Management District, and the remaining 2 percent (2,086 acres) was in the South Florida Water Management District.

About 85,788 acres (96.8 percent of the acreage inventoried) were irrigated by a microirrigation system, including drip, bubblers, and spray emitters. The remaining 3.2 percent of the irrigated acreage was irrigated by a sprinkler system (2,360 acres) or subsurface flood systems (504 acres). Groundwater was the primary source of water used on irrigated acreage (88 percent, or 78,050 acres); the remaining 10,602 acres (12 percent) used groundwater combined with surface water as the irrigation source.

The irrigated acreage estimated by the U.S. Geological Survey (USGS) for this 2016 inventory (88,652 acres) is about 11 percent higher than the 79,869 acres estimated by the U.S. Department of Agriculture (USDA) for 2012. Citrus and pasture in Polk County show the biggest difference in irrigated acreage between the USGS and USDA totals. Irrigated citrus acreage inventoried in 2016 by the USGS totaled 83,996 acres, whereas the USDA reported 78,305 acres of citrus in 2012. The USGS identified 6 acres of irrigated pasture and 20 acres of hay, whereas the USDA reported 6,631 acres of irrigated pasture and 1,349 acres of hay for 2012. In general, differences between the 2016 USGS field-verified acreage totals and acreage published by the USDA for 2012 could be due to (1) irrigated acreage for some specific crops increased or decreased substantially during the 4-year interval between 2012 and 2016 because of production or economic changes, (2) the assumption that if an irrigation system was present, it was used in 2016, when in fact some landowners 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 acreage published by the USDA for selected crops may be underestimated as a result of how information is obtained and formulated by the agency during census compilations.

Introduction

In 2010, agricultural irrigation withdrawals in Florida accounted for 40 percent of the total freshwater withdrawals in the State (Marella, 2014). Many irrigators throughout the State meter and report their water usage to the water management districts (WMDs); however, because not all users are metered or are required to submit their withdrawal amounts, estimates of agricultural irrigation water withdrawals must be made. Water-withdrawal estimates for agricultural irrigation in most counties throughout Florida were made by using irrigated acreage estimates for specific crops multiplied by an irrigation requirement coefficient (often referred to as an “application rate”) for selected crops based on local weather conditions for that year. In all cases, the acres irrigated and the application rates are estimated by each of the five WMDs for their geographic areas.

Several agencies (including the U.S. Department of Agriculture [USDA], the Florida Department of Agriculture and Consumer Services [FDACS], Florida Agricultural Statistics Service, and others) compile acreage data for selected crops by county, which are then used by the WMDs to estimate agricultural irrigation water withdrawals. Although these crop data sources are most often consistent from year to year, they have limitations when used to calculate water-withdrawal estimates because they often have missing or unavailable county totals (primarily because of privacy restrictions on published data), often do not account for double cropping (growing two crops per field per year), and do not differentiate between the types of irrigation systems used. Other potential county crop data sources (for example, number of permitted acres provided by the WMDs) are often incomplete, outdated, or inconsistent. In addition, these sources do not provide information about irrigation methods and water sources, nor do they provide a spatial distribution of irrigation throughout a county.

Accurate and detailed estimates of irrigated acreage are needed to improve current water-use estimates and to project future demands. The results of this study will help increase the accuracy of water-use estimates and provide a more detailed summary of the irrigated crops within Polk County for 2016. Information on crop types, irrigation systems, and water sources 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 hydrologic 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/mining/institutional self-supplied, power generation, agricultural irrigation, and recreational irrigation (mainly 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 the FDACS develop an agricultural water-supply planning program by using consistent methodology, such as collecting metered data, to produce a crop-specific and spatially distributed irrigation water-demand model to determine current and future water needs (The Balmoral Group, 2011). This water-supply planning cycle projects water needs 20 years into the future and is updated every 5 years beginning in 2015.

Water withdrawals for agricultural irrigation include 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 Office of Agricultural Water Policy that was designed to provide a detailed digital map and summary of field-verified irrigated acreage within Polk County for the 2016 calendar year. The map and acreage summary produced by this study will be compared to the Florida Statewide Agricultural Irrigation Demand (FSAID) Irrigated Lands Geodatabase (ILG) prepared by the FDACS and the Balmoral Group in 2014 (The Balmoral Group, 2011). FDACS has created a series of agriculture and irrigated land-use maps for all of the counties in Florida for the purpose of estimating current and projecting future water demands. The most recent version is FSAID 3 (http://www.freshfromflorida.com/content/download/61723/1412321/2015_FSAID_Metadata.pdf), which uses a combination of satellite images and WMD land-use layers developed in 2015–16 (Daniel Dourte, The Balmoral Group, oral commun., April 12, 2017) to estimate irrigated crop acreage. Validating the county irrigated crop acreage totals and irrigated lands on these FSAID maps through USGS field verification provides FDACS a better level of accuracy for estimating water demands.

The irrigated acreage was mapped, digitized, and field verified for the annual and seasonal crops grown during the spring, summer, fall, and winter of 2016 for all of Polk County. Attribute data were collected for each irrigated field, including crop type, irrigation system type, and primary water source (if it could be confirmed from the road). The field verification began in April and was completed in early December 2016. Some additional followup field verification was completed during January 2017. Because field verification did not begin until late April of 2016, many of the seasonal vegetables (primarily beans and watermelons) and strawberries that were planted in late 2015 for a spring 2016 harvest were not inventoried because most, if not all of the fields, were already harvested by late April or early May of 2016; however, all of the vegetable and strawberry fields within the county were revisited between September and December to identify and label a crop for the fall 2016 planting season. Most of the vegetables and strawberries grown in Polk County are planted between September and December (U.S. Department of Agriculture, 2016a). The vegetable and strawberry acreage inventoried between September and December of 2016 will be harvested in the early spring months of 2017. All other

crops such as citrus, blueberries, grapes, peaches, ornamentals (container nurseries and tree farms), and sod were also field verified between April and December, even though these crops are grown year round.

This study focused on verifying irrigated acreage by crop type and field location and did not quantify water-application rates or make any estimates of water use. The maps and acreage totals presented in this report provide estimates of irrigated acreage by irrigation system type for 2016. Additional information on the actual locations of these irrigation systems is also provided. In addition to validating irrigated acreage for FDACS, the data compiled in this study will also be used by the USGS National Water-Use Information Program to help improve the understanding of the accuracy of published estimates of irrigated acreage and to provide a better geographic distribution of irrigated acreage across counties or hydrologic basins.

County Population, Land Use, and Water Withdrawals

Polk County is located in central Florida and is within the jurisdiction of the Southwest Florida Water Management District (SWFWMD) and the South Florida Water Management District (SFWMD) (fig. 1). The county encompasses 1,823 square miles (Purdum, 1994) and had a population of 633,052 in 2015 (University of Florida, 2015). A few of the largest cities within Polk County are Bartow, Lakeland, Lake Wales, and Winter Haven (fig. 1); however, most of the population (62 percent) resides in unincorporated areas throughout the county (University of Florida, 2015). The population of the county has been steadily increasing because of the proximity of the cities of Orlando and Tampa. The population increased 230 percent (440,000) between 1960 and 2015 and is projected to reach nearly 800,000 by 2030 (University of Florida, 2015; fig. 2).

According to the USDA, reported total cropland for Polk County was 125,095 acres in 2012, of which 106,895 acres (85 percent) were labeled as harvested cropland (U.S. Department of Agriculture, 2014). Of this harvested cropland, 79,869 acres (75 percent) were reported as irrigated (U.S. Department of Agriculture, 2014). By far, citrus accounted for the majority (73 percent) of the harvested cropland in 2012 (U.S. Department of Agriculture, 2014). Citrus remains the primary agriculture product within Polk County but has been decreasing in acreage since its peak in the 1970s (fig. 3). Land in agricultural production within the county is primarily in the areas in the proximity of U.S. Route 27; this major highway passes through the county north to south (fig. 1). In addition to citrus acreage, a large amount of acreage in Polk County remains in phosphate production (Purdum, 1994).

In 2015, freshwater withdrawn in Polk County totaled 211 million gallons per day (Mgal/d); 96 percent (203 Mgal/d) was obtained from groundwater sources, and the remaining 4 percent (8 Mgal/d) was obtained from surface-water sources (Ferguson, 2016; South Florida Water Management District, 2017). Water withdrawn for agricultural irrigation accounted for 81 Mgal/d, public supply accounted for 68 Mgal/d, and commercial-industrial-mining self-supplied accounted for 42 Mgal/d, for a combined total of 90 percent of the freshwater withdrawn in 2015. The remaining 10 percent was withdrawn for recreation-landscape irrigation (11 Mgal/d), power generation (6 Mgal/d), and domestic self-supplied (3 Mgal/d) (Ferguson, 2016; South Florida Water Management District, 2017). Water withdrawals for commercial-industrial-mining self-supplied and agriculture self-supplied in Polk County have generally been decreasing since the 1990s (fig. 4), largely because (1) the efficiency of water use for phosphate mining has increased, and (2) agricultural water use has decreased with loss of irrigated citrus acreage because of hurricane damage, urbanization, and diseases (Marella, 2014). Public-supply withdrawals have increased between 1980 and 2000 but decreased slightly between 2005 and 2015 (fig. 4).

Methods of Investigation

A preliminary base map for Polk County was created from data layers obtained from the ILG as part of FSAID 2 (Daniel Dourte, The Balmoral Group, written commun., March 3, 2015, and October 14, 2015). These FSAID 2 maps provided a spatial representation of the location of irrigated lands for 2014–15 created from multiple land-use coverages and images, which provided the most recently available irrigation land-use layer at the beginning of this project. Several other layers of irrigation or permitted information were also added to this preliminary map, which became the working base map that was used for field verification. Once the field verification was completed and changes were made on the working base map (and corresponding shape files) and attribute table, a final field-verified map was produced. All data and results presented in this report are compiled from the final field-verified map.

Map Development and Data Sources

Several additional data sources and layers were added to the FSAID 2 IGL map to create the working base map. These included a point layer of the current agricultural irrigation consumptive water-use permits (CUPs) for the SFWMD (http://apps.sfwmd.gov/gisapps/sfwmdxwebdc/dataview.asp?query=unq_id=1129) and the SWFWMD (http://www.swfwmd.state.fl.us/data/gis/layer_library/category/regulatory), along with a shape file with each permit property boundary. The locations of CUPs (for both wells and surface-water intakes), in addition to the permit property boundary associated with each withdrawal point, helped identify fields that may have been missed on the original FSAID 2 map. Another data layer added to the working base map was obtained from FDACS Division of Plant Industry. This data layer identified abandoned citrus groves in Polk

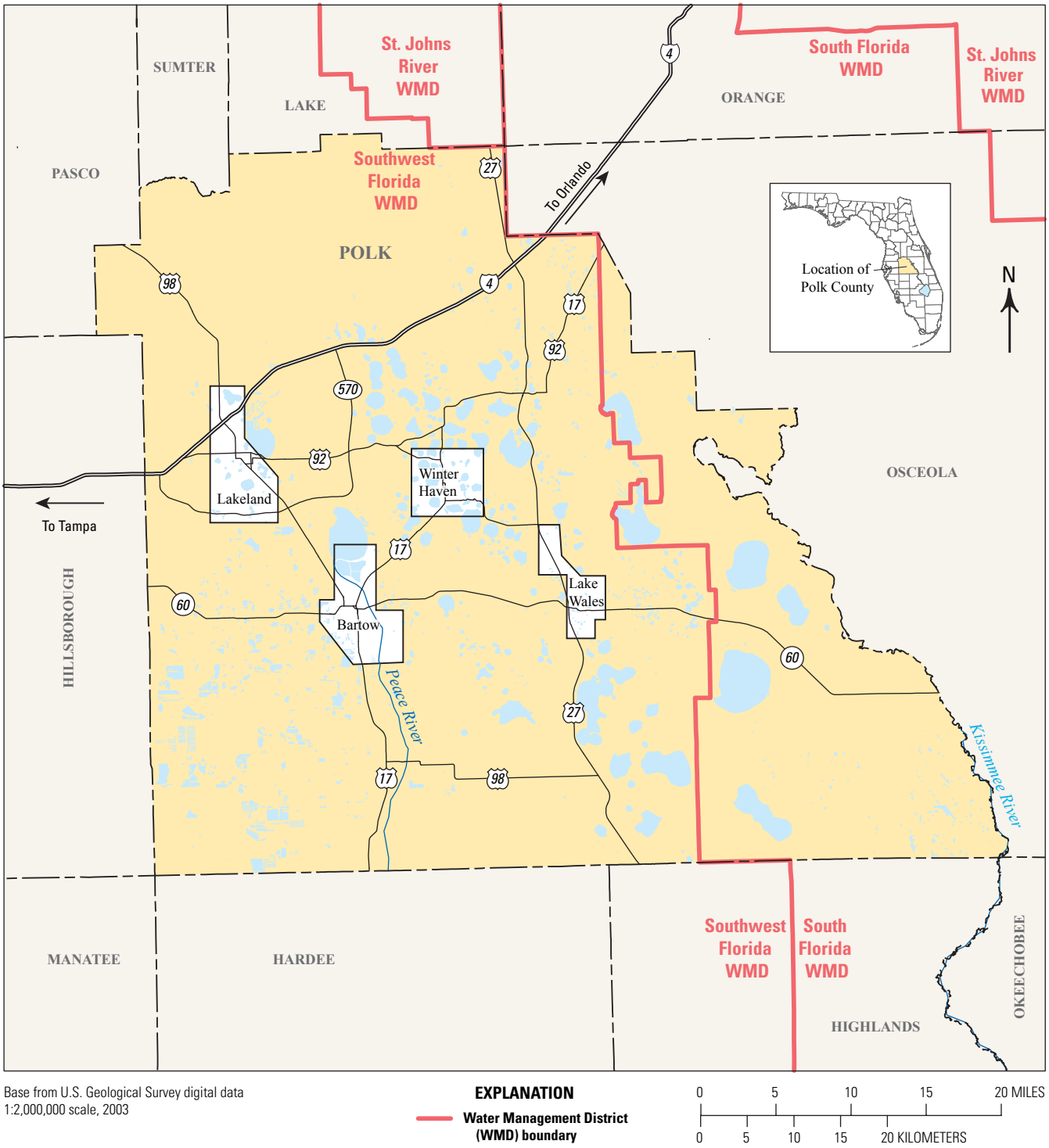

Figure 1. Water management districts (WMDs) and selected features and place names in Polk County, Florida (modified from Purdum, 1994).

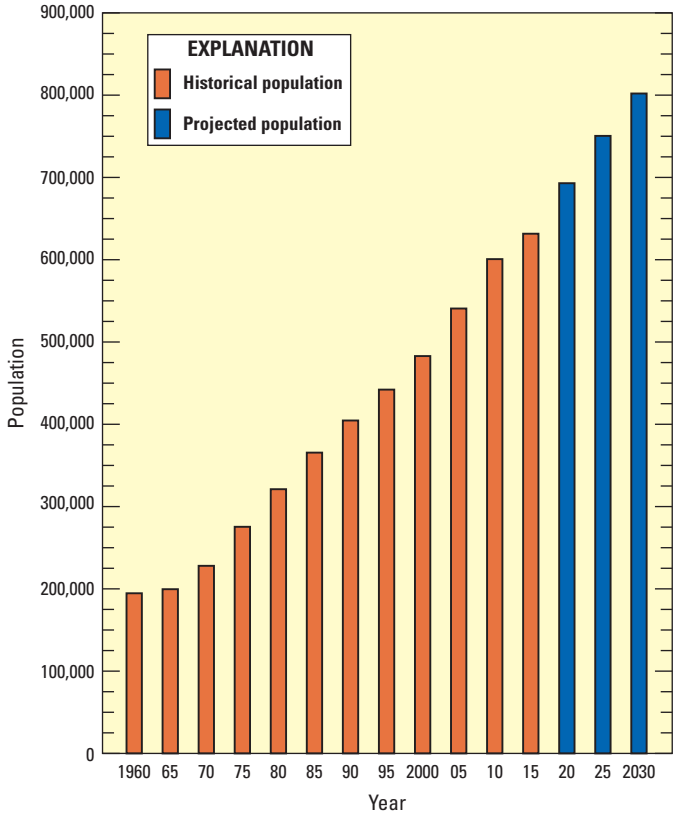

Figure 2. Historical and projected populations of Polk County, Florida, 1960–2030 (Dietrich, 1978; University of Florida, 2015).

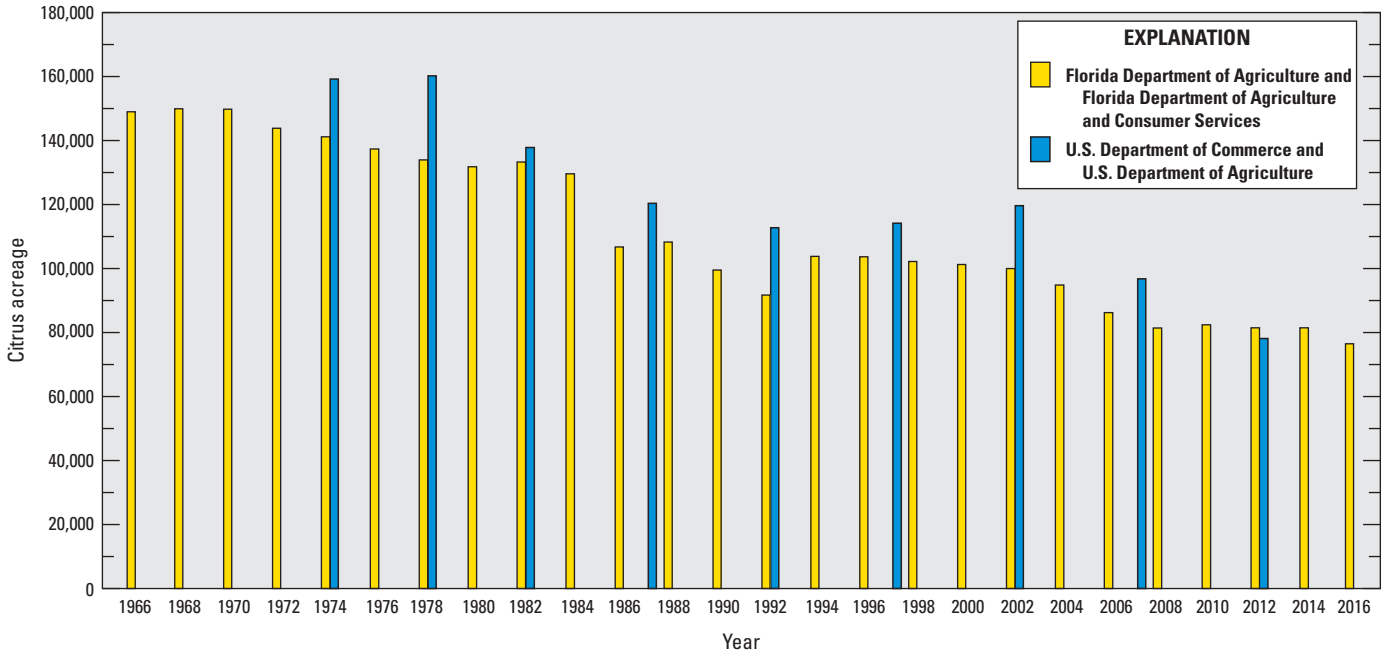

Figure 3. Reported citrus acreage, Polk County, Florida, 1966–2016 (data from U.S. Department of Commerce, 1977, 1984; U.S. Department of Agriculture, 1989, 1994, 1999, 2004, 2009, 2014, 2016b; Florida Department of Agriculture, 1967, 1969, 1971; and Florida Department of Agriculture and Consumer Services, 1973, 1975, 1977, 1979, 1981, 1983, 1985, 1987, 1989, 1991, 1993, 1995, 1997, 1999, 2000, 2002, 2004, 2007, 2009, 2011, 2013, 2015).

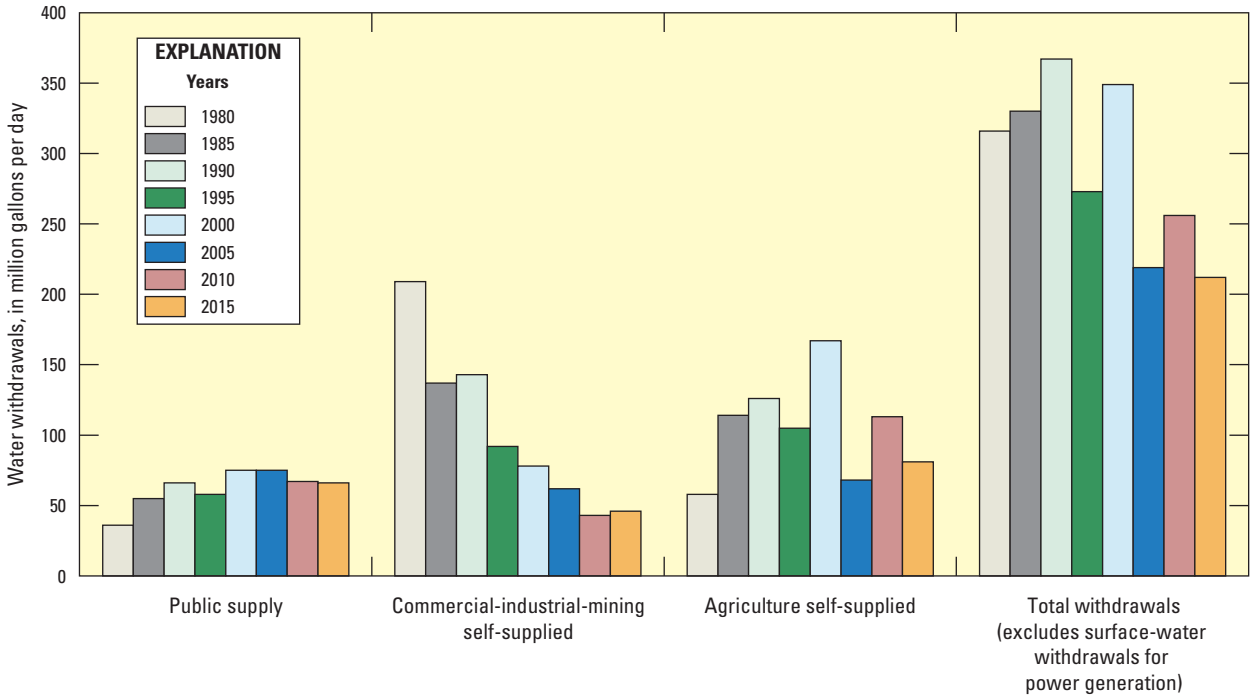

Figure 4. Water withdrawals for selected water-use categories in Polk County, Florida, 1980–2015 (data from Marella, 2004, 2009, 2014; Ferguson, 2016; South Florida Water Management District, 2017).

County where trees were either already removed from the ground (pushed) or were awaiting removal. Since 2011, the Division of Plant Industry has maintained a statewide database of abandoned citrus groves that have been confirmed by local FDACS staff (Alicia Lawrence, FDACS Division of Plant Industry, written commun., February 18, 2016, and December 16, 2016). Abandoned groves documented with this layer were labeled and removed from the working base map. Additional fields were added to the working base map when evidence of irrigation equipment was visible from the orthoimages, a composite of high-resolution aerial images (obtained either from an aircraft or a satellite) that combines the visual attributes of an aerial photograph with the spatial accuracy and reliability of a planimetric map.

Field Verification, Crop Delineation, and Digitizing

Field verification was conducted between April and December of 2016. Each field shown on the working base map that was identified as agriculture (with or without irrigation) or had a CUP from the WMD was observed from a public road (no private property was entered during field verification) at least once during the study period, and the crop type was identified if one was planted. Although most citrus groves could be observed from public roads, it was not always clear if the grove was active, inactive, or abandoned at the time of the visit. Many of the reported pushed or vacant groves had evidence of replanting or still had drip lines visible on the ground, and these groves were labeled as active citrus. In addition, if a grove looked like it was possibly inactive, but new trees had been planted within the grove, the grove was also labeled as active citrus. If a grove could not be determined as active, inactive, or abandoned during the site visit, the grove was labeled CNV (could not verify); CNV groves were later checked against data provided by outside sources or agencies (abandoned groves are defined in the following section).

Vegetables and strawberries planted in late 2015 for a spring 2016 harvest were not inventoried because of the late start in field verification, even if these crops were visible in those fields during the site visits in April, May, and June (field plastics, drip lines, portable hoses, or unpicked crops were still present in or along the field edges in some cases); therefore, no spring 2016 crops were identified in this report. All of these fields were revisited between September and December of 2016, however, and if a crop was present during this fall visit, it was labeled as irrigated and was counted as a vegetable or strawberry crop for 2016. Most strawberries and vegetables within Polk County are planted on the same field from one year to the next.

During field verification of the irrigated areas on the working base map, specific attributes were recorded for each field. Attributes included crop type, irrigation system, and water source. Irrigation systems include microirrigation (drip, bubblers, and spray emitters), sprinkler (center pivots, lateral-move, traveling guns, and permanent or solid overhead fixtures), and flood (subsurface) (Izuno and Haman, 1987; Marella, 2014). Water sources include groundwater, surface

water, and wastewater effluent. Groundwater was assigned as the default water source for fields where a water source could not be verified through a CUP or a visual observation. In some cases, both groundwater and surface water were used for irrigation, and these sources were identified through the WMD permits and labeled in the attribute file. These assumptions and other limitations were documented in the attribute files.

The working base map was digitized and attributed so that each observed field could be delineated. Google Earth images for Polk County (mostly from 2015 and 2016) were also used to aid in digitizing specific fields along the World Imagery base map from Esri ArcGIS online (http://www.arcgis.com/home/item.html?id=10df2279f9684e4a9f6a7f08febac2a9). A data layer from the Polk County Property Appraiser (PCPA) (http://www.polkpa.org) was obtained and used to help delineate property lines, especially for citrus groves.

Upon completion of the field verification, a draft map and crop totals were produced. The draft map was reviewed by The Balmoral Group and FDACS to help identify differences between the FSAID 2 and FSAID 3 (the most recent version) IGL fields and those mapped by means of field verification. Once any differences between maps were resolved, a final verified map was produced. From this final verified map, the attribute table was checked, and acreage totals were compiled and summarized to produce the information provided in this report and map.

Acreage Limitations, Assumptions, and Specific Crops

Several fields or groves could not be seen or were only partially observed during field visits because fields could only be viewed from public roads. These fields or groves were identified as CNA (could not access). In addition, if a crop could not be identified or a citrus grove could not be determined as active or inactive, it was labeled as CNV. After the initial visit to all areas of the county, the CNA and CNV fields or groves represented about 10 percent of the total acreage observed in Polk County. With assistance from the PCPA, the Division of Plant Industry of FDACS, and other sources (local USDA and County Extension offices and the SFWMD and SWFWMD online permit databases), most of these fields were subsequently identified and labeled accordingly. All of the remaining unidentified or unverified fields or groves were revisited for a final time in January, and their WMD permit was examined in an effort to classify them.

For the purpose of this study, it was assumed that if an irrigation system was observed, the system would be in use sometime during this 2016 growing season. This assumption was necessary because only a small number of irrigation systems were observed in actual use during field visits; therefore, the irrigation acreage totals tabulated for this report may be artificially high, because not all irrigation systems observed may have been used during 2016. In addition, a small percentage of fields in Polk County may have used a portable irrigation system (for example, a portable or traveling gun). If so, unless the portable or traveling gun was visibly in use or still connected to a pump at the time of the visit, the acres would not be counted as irrigated.

Because of the large number of dairy and livestock operations within Polk County, many types of grass-growing operations occur. For this study, grasses were divided into three types (hay, pasture, and forage) and were included under field crops. Hay includes grass grown for the purpose of cutting and bailing, and evidence of bailed or stored hay along field edges was usually visible; in some cases, livestock were present. Pasture is defined as grass that was routinely maintained (mowed and relatively weed free), often had livestock on the fields, and had no evidence of bailed or stored hay nearby. Forage grass was most often unmaintained (usually not mowed, often with weeds, or had multiple bare areas present) or was recently planted as a cover crop after a field or vegetable crop was harvested. Many forage grass fields had livestock present or were used to receive spray dairy wastewater effluent. Most of the hay, pasture, or forage fields with an irrigation system present were counted as irrigated unless there was obvious evidence that the irrigation system was not in operation.

Citrus is the main crop in Polk County and has been since the 1960s; the crop reached a peak of nearly 160,000 acres in 1974 and in 1978 (U.S. Department of Commerce, 1977; fig. 3). Since then, however, citrus acreage has decreased steadily to 76,455 acres in 2016 (U.S. Department of Agriculture, 2016b). Acreage losses have resulted from diseases, storm damage, and urbanization, and as a result, many groves in Polk County have either been pushed (the tree and sometimes the root removed from the ground) or left abandoned. A grove is classified as abandoned when it (1) is unattended or not harvested during the previous 2 years, (2) lacks weed control or grass mowing, and (or) (3) has livestock present (U.S. Department of Agriculture, 2016c). According to the USDA, nearly 24,000 acres of citrus groves were abandoned in Polk County between 2013 and 2015 (U.S. Department of Agriculture, 2016c). During field verification, in many cases it was extremely difficult to determine if a poorly maintained grove was active, inactive (but possibly not yet abandoned), or abandoned. In several instances, visible evidence (the presence of livestock, dead trees, cut trees, trees pushed into a pile, or a posted “for sale” sign) provided a definitive answer. In some cases, a grove had an entirely different but obvious land use (such as a commercial or residential building). In many instances, however, a determination could not be made, and groves were labeled as CNV. The PCPA 2016 summer tax appraisal evaluation, conducted by the County Tax Office, was the primary source used to determine if a CNA or CNV grove was active, inactive, or abandoned. These CNA and CNV groves or parcels were compared to the 2016 PCPA tax status, and if they were still receiving an agricultural status for property tax, they were considered active; if not, they were considered inactive and labeled as abandoned.

Results

Results of the inventory and field verification indicate that during the 2016 growing season (spring, summer, fall, and winter), an estimated 88,652 acres were identified as irrigated within Polk County. Of the total field-verified crops, 83,995 acres were in citrus; 2,893 acres were in other non-citrus fruit crops (blueberries, grapes, peaches, and strawberries); 621 acres were in row crops (primarily beans and watermelons); 1,117 acres were in nursery (container and tree farms) and sod production; and 26 acres were in field crops including hay and pasture (fig. 5 and table 1). Of the total inventoried, irrigated acreage within Polk County, 98 percent (86,566 acres) was in the SWFWMD, and the remaining 2 percent (2,086 acres) was in the SFWMD (figs. 1 and 5).

The majority of inventoried acreage (96.8 percent, or 85,788 acres) was irrigated by a microirrigation system, including drip, bubblers, and spray emitters (table 1). The remaining 3.2 percent of the irrigated acreages was irrigated by using a sprinkler system (2,360 acres) or subsurface flood system (504 acres). Sprinkler irrigation systems (including permanent or solid overhead fixtures, traveling guns, and center pivots) were mostly observed on blueberries, container nurseries, and sod operations.

Groundwater was the primary source (88 percent) of water used to irrigate land in Polk County (a total of 78,050 acres). The remaining 12 percent (10,602 acres) was irrigated with a combination of groundwater and surface water. Wastewater effluent (primarily from dairy operations) was used on several fields within the county; however, an estimate of total acreage using effluent could not be determined because groundwater and effluent are often used interchangeably on many fields.

It is difficult to compare the USGS estimates tabulated for 2016 with county estimates published by the USDA for 2012 because of differences in years and methods used to compile or tabulate data. However, such a comparison of data from the two main sources of irrigated acreage for Polk County indicates major differences. Overall, the irrigated acreage estimated by the USGS for 2016 (88,652 acres) is about 11 percent higher than the estimated acreage published by the USDA for 2012 (79,869 acres) (fig. 6 and table 1) (U.S. Department of Agriculture, 2014). In general, differences between the 2016 USGS field-verified acreage totals and those published by the USDA for 2012 may occur because (1) irrigated acreage for some specific crops increased or decreased substantially during the 4-year interval between 2012 and 2016 because of production or economic changes; (2) the assumption that if an irrigation system was present on a field or grove, it was used in 2016, when in fact some land owners 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 acreage published by the USDA for selected crops may be underestimated or overestimated as a result of how information is obtained and formulated by the agency during census compilations.

Specifically, the biggest differences between the USGS and USDA for irrigated acreage in Polk County were citrus and pasture irrigation (table 1). For 2016, irrigated citrus acreage inventoried by the USGS totaled 83,995 acres, whereas the USDA reported a total 78,305 acres of citrus for 2012 (table 1), with 66,697 acres reported as irrigated (U.S. Department of Agriculture, 2014). Differences between these two sets of acreage could be due to (1) an incorrect assumption from the 2016 site visit; not all observed irrigation systems may have been in use because the grove may have been inactive or abandoned; (2) a change in the status of the grove between 2012 and 2016 because many groves listed as pushed or abandoned by the Division of Plant Industry were replanted or in the process of being replanted during this 4-year period; or (3) the transient status of many groves, including 1,277 acres that were listed under the Abandoned Grove Initiative Program (AGIP) offered by PCPA for tax purposes on their property assessment between 2012 and 2016 (Paul D. Bell, written commun., PCPA, February 3, 2017). Under the AGIP, the property owner can maintain an active agricultural status for tax purposes on an inactive grove for up to 5 years before having to declare another use on that property or continue in agricultural status by replanting a crop. For many of the groves that could not be verified from site visits, the property appraiser's records were used to determine their status (active or abandoned).

Very little irrigated pasture (6 acres) was observed during the 2016 field verification, whereas an estimated 6,631 acres of pasture were reported as irrigated by the USDA for 2012 in Polk County (U.S. Department of Agriculture, 2014; table 1). Several possible explanations for such a low number of acres from this 2016 inventory would include the use of portable irrigation systems that were not present or seen while driving by a potentially irrigated field, or the possibility that the actual irrigated field is far back on the property and, therefore, not visible from the road. In addition, irrigated acreage estimates of pasture were obtained from the SWFWMD 2015 Estimated Water Use Report in an effort to better validate pasture irrigation in Polk County (not including commercial hay acreage, which is sometimes combined with pasture in the CUPs). From the list of CUPs for pasture irrigation in Polk County in table A-7 of Ferguson (2016), a total of 270 acres of pasture was reported as irrigated in 2015 within the SWFWMD portion of the county. For commercial hay, the USDA reported 1,349 acres irrigated in 2012, the SWFWMD CUPs totaled 412 acres irrigated in 2015, and the USGS inventory identified only 20 acres irrigated in 2016. This discrepancy further highlights the difficulty in determining irrigated pasture and hay acreage because many farmers with the potential to irrigate pasture or hay may claim their acreage as irrigated when in fact they may not irrigate during any given year.

The differences between irrigated acreage reported by various agencies indicate the value of conducting a field-verified inventory such as the inventory completed by the USGS in 2016. The USDA will publish a new set of irrigated acreage estimates for Polk County in 2019 representing the 2017 growing season; another USGS/FDACS inventory of Polk County is tentatively scheduled for 2021 or 2022.

Figure 5. Irrigated acreage by crop type and water management district for Polk County, Florida, 2016.

Table 1. Reported and inventoried crop and irrigated acreage in Polk County, Florida, 1974–2016.

[Acreage values shown in *italics* represent total acreage, as the U.S. Department of Agriculture (USDA) tables do not differentiate between irrigated and non-irrigated for these crops. All other values (in yellow box) reflect what was reported as irrigated. N/A, data not available; "D" indicates that the values were not provided in the USDA published tables because of privacy issues; –, no data. Source: U.S. Geological Survey, 2017]

Crop type	From U.S. Department of Agriculture, Census of Agriculture[a]									USGS field-verified irrigated acreage[b, c]			
	1974	1978	1982	1987	1992	1997	2002	2007	2012	2016	Micro	Sprinkler	Flood
Row crops - vegetables[1]	N/A	N/A	N/A	885	910	537	421	2,266	1,034	621	72	45	504
Spring[2]										0			
Fall[3]										621	72	45	504
Fruit crops[4]	N/A	N/A	N/A	103,966	103,710	108,018	109,168	89,531	69,472	86,888	85,546	1,342	–
Berries[5]					75	D	224	838	1,775	1,727	538	1,189	
Fruits (all) and nuts[6]							D		501	1,166	1,040	126	
Citrus	*159,556*	*150,576*	*138,143*	*120,677*	*112,981*	*114,433*	*119,901*	*96,999*	*78,305*	83,995	83,968	27	
Field crops	N/A	N/A	N/A	8,513	9,300	6,322	2,754	3,304	7,980	26	–	26	–
Corn								D	D	0			
Cotton										0			
Peanuts										0			
Sorghum										0			
Soybeans									D	0			
Hay										20		20	
Pasture (for grazing)[7]				7,170	8,197	5,924	1,914	2,424	6,631	6		6	
Other field crops[8]				1,343	1,103	398	840	880	1,349	0			
Ornamentals/sod	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	1,117	170	947	–
Container nursery[9, 10]					182	*97*	*86*	*31*	*67*	115	9	106	
Tree nursery[10]				*665*	*773*	*566*	*928*	*896*	*760*	177	161	16	
Sod farms[10]					*2,179*	*4,952*	*2,017*	*3,442*	*1,822*	825		825	
All other	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0	–	–	–
Idle[11]										0			
Crop not verified[12]										0			
Irrigated land	118,993	142,132	122,748	114,996	116,734	118,085	116,094	98,404	79,869	88,652	85,788	2,360	504
Number of farms	991	1,082	1,107	1,369	1,276	1,387	1,681	1,479	914	Percent	96.8	2.7	0.5
Harvested cropland	169,282	171,957	152,383	137,879	125,944	129,262	134,101	115,721	106,895				
Number of farms	1,884	1,827	1,736	1,877	1,619	1,703	2,012	1,781	1,219				
Total cropland	236,371	234,354	210,519	200,706	201,621	186,878	189,970	136,281	125,095				
Number of farms	2,142	2,046	1,995	2,168	1,895	2,006	2,286	1,946	1,322				

Table 1. Reported and inventoried crop and irrigated acreage in Polk County, Florida, 1974–2016.—Continued

[Acreage values shown in *italics* represent total acreage, as the U.S. Department of Agriculture (USDA) tables do not differentiate between irrigated and non-irrigated for these crops. All other values (in yellow box) reflect what was reported as irrigated. N/A, data not available; "D" indicates that the values were not provided in the USDA published tables because of privacy issues; –, no data. Source: U.S. Geological Survey, 2017]

[a]Data for 1974, 1978, 1982, 1987, 1992, 1997, 2002, 2007, and 2012 for Florida was obtained from the Census of Agriculture (U.S. Department of Commerce, 1977, 1984; the U.S. Department of Agriculture, 1989, 1994, 1999, 2004, 2009, 2014). The values shown represent the entire county totals.

[b]The values reported by the USGS represent observed acreage for the late spring, summer, fall, and winter growing seasons of 2016 (April–December).

[c]Micro irrigation includes drip, spray, jet, and bubbler systems; Sprinkler irrigation includes portable and traveling guns, solid or permanent overhead fixtures, center pivots, and lateral moving systems; Flood irrigation (including seepage systems) includes open-field ditch (furrows), semi-closed conveyance, subsurface conduit, crown flood, and continues flood (Izuno and Haman, 1987; Marella, 2014).

[1]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, sweat corn, turnip greens, radishes, and watercress (as listed in table 28 and 29, USDA Census of Agriculture).

[2]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). No crops were accounted for during this time period.

[3]Acreage includes vegetables that were planted in the fall (primarily between September and December) for an early spring harvest (February–April).

[4]Includes acreage reported in the USDA Census of Agriculture as irrigated from the "Land in Orchards" and the "Land in Berries" tables for the respective years.

[5]Acreage includes blackberries, dewberries, blueberries (tame and wild), loganberries, raspberries, and strawberries (as listed in table 33, USDA Census of Agriculture).

[6]Acreage includes apples, avocados, bananas, cherries, figs, grapes, guavas, mangoes, papayas, passion fruit, peaches, pears, pecans, persimmons, plums, and all citrus fruit (as listed in table 31, USDA Census of Agriculture).

[7]Acreage includes pasture and other land listed under "Irrigated Land" (as listed in table 10, USDA Census of Agriculture).

[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 (listed as forage in table 26, USDA Census of Agriculture).

[9]Acreage includes floriculture and bedding crops reported as "acres in the open" but does not include "square footage under glass or protection" (as listed in table 34, USDA Census of Agriculture).

[10]Acreage includes all outdoor container nursery crops and tree farms (as listed in table 34, USDA Census of Agriculture). Sod is also listed in table 34 but is listed separately here.

[11]Acreage includes idle land with no specific crop (a grass cover was most often observed) or vacant with an irrigation system present.

[12]Crop could not be verified, however, an irrigation system was observed.

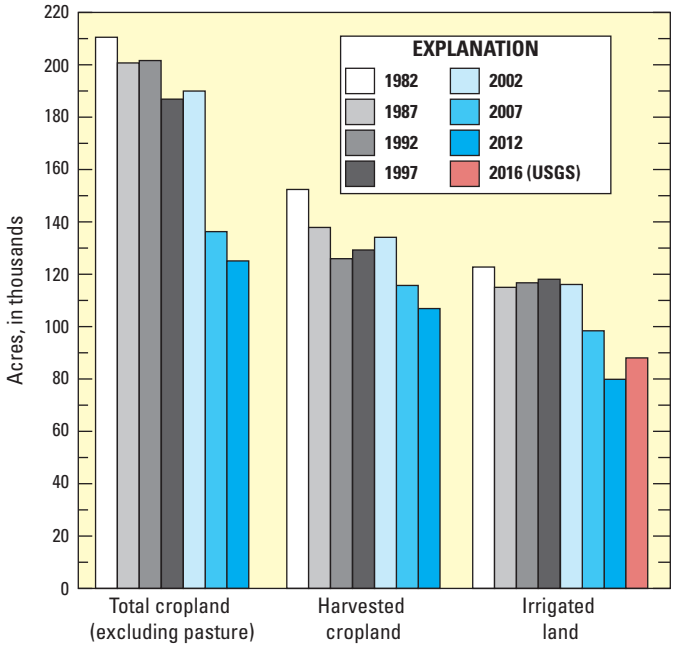

Figure 6. Reported and inventoried total cropland, harvested cropland, and irrigated land in Polk County, Florida, 1982–2016 (from U.S. Department of Commerce, 1977, 1984; U.S. Department of Agriculture, 1989, 1994, 1999, 2004, 2009, 2014).

Further Information

Additional information about current and future water demands for agricultural irrigation in Florida can be obtained by contacting the FDACS Office of Agricultural Water Policy (http://www.freshfromflorida.com/Divisions-Offices/Agricultural-Water-Policy), the SFWMD (https://www.sfwmd.gov/our-work/water-supply), or the SWFWMD (http://www.swfwmd.state.fl.us/documents/plans/RWSP/). The final field-verified map (appendix 1), along with digital layers and attribute files described in this report, is available for download from the USGS ScienceBase-Catalog website (https://doi.org/10.5066/F76W98BN) or by contacting the USGS Caribbean-Florida Water Science Center offices in Davie, Lutz, or Orlando, Florida.

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