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IRRIGATED CROP ACREAGE AND WATER WITHDRAWALS IN FLORIDA, 1990

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INTRODUCTION

Although Florida is frequently perceived as highly urbanized with many large cities, endless beaches, and countless tourist attractions, the State has a large agricultural economy. In 1992, Florida had more than 35,000 farms with nearly 10.8 million acres in agriculture (U.S. Bureau of Census, 1994). Agricultural production in Florida annually contributes about 16 billion dollars to the State's economy (Mulkey and Clouser, 1990); which ranks Florida as one of the 10 largest agricultural states in the Nation (U.S. Department of Agriculture, 1991). The subtropical climate of the State and its close proximity to the east coast markets enable agricultural production to flourish. In central and southern Florida, the mild winters allow for early spring crop production and the potential to harvest multiple crops per year. Agriculture in Florida depends heavily on the availability of adequate water resources. Water demands for agricultural irrigation needs accounted for one-half of the State's total freshwater use in 1990 (Marella, 1992).

OVERVIEW OF AGRICULTURAL WATER WITHDRAWALS

On the average, Florida receives about 53 inches of rainfall annually (Owenby and Ezell, 1992). Despite this amount, irrigation for most crops is still necessary. Several factors contribute to the need to irrigate in Florida: (1) the presence of sandy soils, which have a very low water holding capacity; (2) more than two-thirds of the State's rainfall occurs between June and October, months when most fruits and vegetables are not grown; and (3) rainfall does not occur uniformly within the State (Harrison and others, 1983). Irrigation withdrawals are usually greatest during the spring months of April or May and are lowest during the late fall and winter months of November and December (fig. 1). Water withdrawn for irrigation in Florida during 1990 totaled 3,975 Mgal/d, which was about one-half of the state's total freshwater withdrawals (Marella, 1992). This includes 78 Mgal/d of water withdrawn for nonirrigation purposes such as livestock, dairy, and fish farming. For 1990 (as in previous years), estimates of water use were based on the crop acreage multiplied by a water demand coefficient (usually inches of water applied per acre). These estimates were necessary because most irrigators in Florida do not record their water usage.

Of the total water used for agricultural purposes in Florida during 1990, 51 percent was withdrawn from ground-water sources, 45 percent was from surface-water sources, and 4 percent was obtained from reclaimed water sources (Marella, 1992). Since 1970, ground water has been the primary source for irrigation because it is readily available virtually throughout the State and is highly dependable in both quantity and quality (fig. 2). An estimated 57,000 irrigation wells, ranging in diameter from 4 to 14 inches, were used for irrigation in 1990 (Irrigation Journal, 1991). Major sources of surface water for agricultural needs include Lake Okeechobee and associated canals, Lake Apopka, and the marsh lands associated with the St. Johns River headwaters. Surface water from these sources is diverted through canals or ditches where it is pumped or gravity fed onto fields or groves. Palm Beach and Hendry Counties used the largest amount of water for irrigation purposes in 1990 (fig. 3).

IRRIGATED CROP ACREAGE, WATER WITHDRAWALS, AND PRODUCTION

The acreage irrigated for agriculture in Florida has increased substantially since the 1950's. In 1954, about 400,000 acres were irrigated (Smajstrla and others, 1992). By 1964, the acreage increased nearly 200 percent to 1,200,000 irrigated acres (U.S. Bureau of Census, 1994). Between 1964 and 1992 irrigated acreage increased another 90 percent and totaled nearly 2,300,000 acres. In 1954, only about 12 percent of the farms with cropland had irrigation systems, compared to 25 percent in 1964, and 60 percent in 1992 (U.S. Bureau of Census, 1994). For the most part, increases in irrigated acreage during the 1950's and 1960's occurred because of advancements in irrigation technology, the demands to increase crop production, and the availability of water. Improved irrigation systems have allowed farmers to increase crop production while decreasing the risk of losing crop yield due to prolonged dry conditions. Some decreases in irrigated acreage have also occurred during the 1980's due to several hard freezes and disease infestations that killed or damaged nearly 200,000 acres of citrus.

The U.S. Bureau of the Census has tabulated agricultural production acreage from periodic inventories of farmers by State since 1954, including the total number of acres under production, harvested, and irrigated (fig. 4). The U.S. Geological Survey (USGS) has estimated the number of irrigated acres every 5 years since 1955 (fig. 4), primarily for the purpose of calculating water demands. The USGS data is obtained from many sources, including the University of Florida, County Extension Service; The Florida Department of Agriculture and Consumer Services; the U.S. Department of Agriculture; the five water management districts; and many other agencies and organizations. The discrepancies between the two estimates is primarily attributed to the fact that the surveys are estimated for different years and the inclusion of irrigated acreage for sod production and turf grass for golf courses and parks in the USGS values and exclusion of these in the U.S. Bureau Census values. The Institute of Food and Agricultural Sciences of the University of Florida, also estimated irrigated acreage for the State in 1990, and similarly did not include sod and turf grass acreage. The University of Florida estimate of 2,032,000 acres (Irrigation Journal, 1991) and the USGS estimate of 2,149,600 acres (Marella, 1992) agree within 5 percent. According to the University of Florida estimates for 1990, 48 percent of the irrigated acreage used gravity flow systems (flood or subirrigation), 29 percent used sprinklers systems (solid set, traveling gun, or center pivot), and 23 percent used drip systems (microirrigation) (Irrigation Journal, 1991).

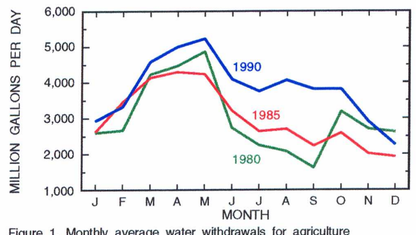

Figure 1. Monthly average water withdrawals for agriculture (irrigation and nonirrigation) in Florida, 1980, 1985, and 1990 (from Leach, 1983 and Marella, 1992)

Fruit Crops

Fruit crop production (including orchards) primarily includes blueberries, citrus, peaches, pecans, strawberries, and watermelons. Fruit crops accounted for nearly 37 percent of both the total irrigated acreage (795,130 acres) and the total agricultural water use (1,426 million gallons per day (Mgal/d)) in 1990. Citrus accounted for about 90 percent of the irrigated acreage (709,240 acres) and water use (1,296 Mgal/d) (Marella, 1992). Citrus production is concentrated in central and southern Florida (fig. 5) and includes oranges, grapefruit, temples, tangelos, tangerines, lemons, and limes. Citrus acreage is present in 31 counties, but was mostly concentrated in Polk (99,700 acres), St. Lucie (94,900 acres), Hendry (73,750 acres), and Indian River (66,100 acres) Counties in 1990 (Florida Agricultural Statistics Service, 1990). Overall, citrus acreage in Florida decreased from 1970 to 1985 but has increased since that time (fig. 6). In addition to increases in acreage, the number of trees per acre has increased from 82 in 1974 to 125 in 1994 (Florida Agricultural Statistics Service, 1994). More than 95 percent of the State's citrus was irrigated in 1990, either by drip, flood, or sprinkler systems.

More than 50,500 acres of melons and 5,550 acres of strawberries were harvested in Florida during 1990 (Marella, 1992). Melons (cantaloupe, honeydew, and watermelons) were grown in more than 30 counties during 1990 with Collier, Manatee, and Alachua Counties leading in acreage. In 1990, nearly 88 percent of the strawberries were grown in Hillsborough and Manatee Counties in south-central Florida; (Florida Agricultural Statistics Service, 1992a). Nearly all of the strawberry acreage and 90 percent of the melons acreage were irrigated in 1990.

Vegetables

Vegetable production in Florida includes cabbage, carrots, celery, cucumbers, eggplant, lettuce, peppers, potatoes, radishes, snap beans, squash, sweet corn, tomatoes, and several others. Nearly all of the vegetable acreage is irrigated, primarily by flood or subsurface irrigation systems, with some use of traveling guns or drip systems. Vegetable crops (sometimes referred to as truck crops) accounted for 18 percent of the total irrigated acreage (379,460 acres) and 13 percent of the total agricultural water use (505 Mgal/d) in 1990. Tomatoes accounted for the largest amount of irrigated acreage (78,440 acres) and water use (154 Mgal/d) of all vegetable crops in 1990 (Marella, 1992). Two of Florida's major assets for vegetable production include the extended growing season and Florida's close proximity to markets. In central and southern Florida, the growing seasons can be year round, thus enabling growers to harvest their crops as early as February with the potential each year to harvest more than one crop per field.

Several concentrated areas of vegetable production are present throughout Florida (fig. 5). These include the Hastings area (Flagler, Putnam and St. Johns Counties) for cabbage and potatoes; the Palmetto-Ruskin area (Hillsborough and Manatee Counties) for peppers and tomatoes; the Sanford-Oveido-Zellwood area (Lake, Orange, and Seminole Counties) for carrots, celery, and sweet corn; the Fort Myers-Immokalee area (Collier, Hendry, and Lee Counties) for peppers, sweet corn and tomatoes, the Everglades Agricultural Area (Palm Beach County) for lettuce, radishes, snap beans, and sweet corn, and the Homestead area (Dade County) for beans, cucumbers, peppers, and tomatoes (Florida Agricultural Statistics Service, 1992a). Vegetable acreage in Florida has remained about the same between 1970 and 1990 (fig. 6).

Field Crops

Field crop production in Florida includes cotton, field corn, peanuts, rice, sorghum, soybeans, sugarcane, tobacco, and wheat. Several of these crops are produced for silage (livestock consumption) or as a cover crop during the summer months. About 75 percent of the field corn is harvested for grain (Florida Agricultural Statistics Service, 1991). Only about one-third of the field crops grown for grain are irrigated, mostly by center pivots or traveling guns. Field crops accounted for about 26 percent (552,990 acres) of the total irrigated acreage and 24 percent (956 Mgal/d) of the total agricultural water use in 1990.

Sugarcane accounted for 78 percent (432,970 acres) of the field crop irrigated acreage and 86 percent (823 Mgal/d) of the water use for field crops in 1990 (Marella, 1992). Sugarcane acreage was present in four counties along the southern part of Lake Okeechobee (fig. 5) during 1990 (Hendry, Glades, Martin, and Palm Beach Counties). Sugarcane acreage in Florida increased more than 140 percent between 1970 and 1990 (fig. 6). Nearly all of the sugarcane is irrigated, primarily by flood systems.

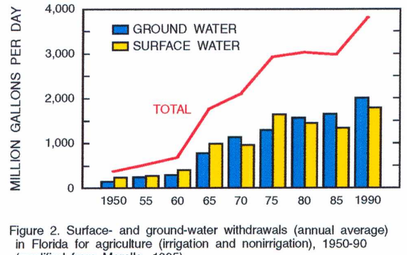

Figure 2. Surface- and ground-water withdrawals (annual average) in Florida for agriculture (irrigation and nonirrigation), 1950-90 (modified from Marella, 1995)

Ornamentals and Grasses

Ornamentals grown in Florida include ferns, flowers, foliage, or woody ornamentals (including nursery plants). Grasses include pasture, sod, and turf grass for golf courses and other uses. Ornamentals and grasses accounted for about 19 percent of the total irrigated acreage (421,100 acres) and 25 percent of the total agricultural water use (1,005 Mgal/d) in 1990. Also, in 1990, more than 7,300 commercial nurseries were in operation incorporating nearly 35,000 acres of nursery plants, shrubs, flowers and other foliage grown (Florida Department of Agriculture and Consumer Services, 1990). An additional 7,500 acres of ferns were grown commercially in Florida during 1990. A substantial amount of the water used for ornamentals was applied during extreme cold conditions to protect plants from freezing.

Pasture, sod, and turf grass accounted for nearly 80 percent of the water used for this category (790 Mgal/d) (Marella, 1992). Pasture and rangeland, totaling about 5.4 million acres in Florida (U.S. Bureau of Census, 1994) had only 3 percent of its acreage irrigated in 1990. Irrigated pasture acreage has decreased from 445,000 acres in 1970 (Pride, 1973) to 158,300 acres in 1990 (Marella, 1992), mostly as the result of an increase in fuel cost for pumping coupled with a decrease in livestock prices (Florida Agricultural Statistics Service, 1992b). During 1990, most pasture was flood irrigated by gravity flow from canals or from free-flowing wells where little or no pumping cost was involved. About 75 percent of the pasture irrigation during 1990 occurred in Brevard, Indian River, and Osceola Counties (fig. 5). Water used for turf grass accounted for nearly 40 percent of the irrigation for ornamentals and grasses. About two-thirds of this was used for golf-course irrigation; the remaining was used for parks, athletic fields, cemeteries, and large nonresidential lawns. In 1990, Florida had more than 1,000 golf courses (Florida Department of Commerce, 1990) that irrigated an estimated 77,100 acres (Marella, 1992). Most of these golf courses are located in the urban areas throughout the State with more than 100 courses located in Palm Beach County.

FUTURE OUTLOOK

Total freshwater withdrawals in Florida increased 245 percent between 1955 and 1990, and 14 percent from 1980 to 1990 (Marella, 1995). Between 1950 and 1990, freshwater withdrawals for agricultural purposes increased 915 percent, and 26 percent between 1980 and 1990 (Marella, 1995). The resident population for Florida increased from 2.8 million in 1950 to 12.9 million in 1990 (University of Florida, 1991), and is projected to reach 20 million by the year 2020 (Smith and Nogle, 1996). Because of the growth in population, tourism, and agriculture, demands on the water resources of Florida are increasing and competition for water will become greater.

Water conservation measures in the agricultural industry have been instituted. The use of more efficient drip irrigation systems instead of flood or sprinkler systems has decreased water usage. In 1990, nearly one-half of the citrus acreage and 80 percent of the strawberry acreage was irrigated by drip systems (Smajstrla and others, 1993). The use of reclaimed wastewater, captured rainfall, and unused irrigation water (tailwater runoff) as alternative sources have helped off-set additional freshwater demands. These measures have reduced the rate of increase in water withdrawals as irrigated crop acreage has increased.

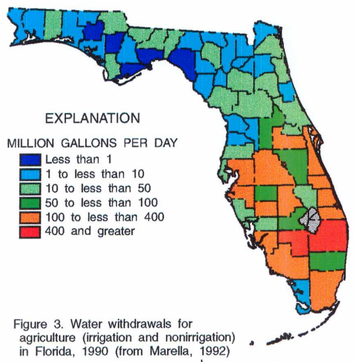

Figure 3. Water withdrawals for agriculture (irrigation and nonirrigation) in Florida, 1990 (from Marella, 1992)

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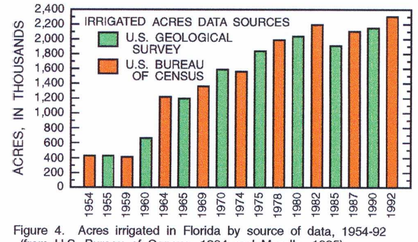

Figure 4. Acres irrigated in Florida by source of data, 1954-92 (from U.S. Bureau of Census, 1994 and Marella, 1995)

Figure 5. Generalized irrigated acreage in Florida, 1989-92 (data compiled from field surveys conducted by the U.S. Department of Agriculture, Natural Resource Conservation Service county field offices, between 1989 and 1992, with some revisions made in 1994 and 1995).

Figure 6. Crop acreage in Florida by type, 1970-92 (modified from Florida Agricultural Statistics Service, 1986, 1991, 1992a, 1994, and Marella, 1992)

0 20 40 60 80 100 MILES

Base map sacle 1:2,000,000, digital data source from state of Florida counties at 1:100,000, 1995
Albers Equal-Area Conic projection
Standard Parallels 29°30' and 45°30', central meridian -83°00'

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