

Water Withdrawals and Their Use in Florida in 2010¹

Tatiana Borisova and Jenna Rogers²

Acknowledgments

The original format of the water use publications was developed by Professor Emeritus Roy Carriker.

Introduction

This publication is based on Florida water use information collected by the United States Geological Service (<http://fl.water.usgs.gov/infodata/wateruse/datatables2010.html/>). This publication expands on EDIS document FE797 that examined Florida water withdrawals data for 2005 (<http://edis.ifas.ufl.edu/fe797>). In addition, in EDIS document FE757 (Florida's Water Resources), the authors describe Florida's abundant water resources—the state receives about 54 inches of rainfall per annum (compared to 30 inches nationwide), and it overlies prolific aquifers (bodies of permeable rock that can contain or transmit groundwater). Whether water is scarce or abundant, however, depends not only upon available supplies, but also upon patterns of water use. To gather this information, the United States Geological Survey (USGS) employs several water-use categories to develop estimates of water withdrawals and water use (Marella 2008, 1999, 1988; Kenny et al 2009).

Overview of Water Use in Florida

According to the estimates for 2010, *total water withdrawals* in Florida averaged about 15.0 billion gallons per day, down about 3.4 billion gallons from 2005 (Marella 2008a,b). This reduction can partially be explained by the implementation of water conservation practices, economic slowdown,



difference in weather conditions, and changes in the acreage for various agricultural crops. Out of the total 15.0 billion gallons per day, withdrawals of *freshwater* for all uses accounted for about 6.4 billion gallons per day, which was slightly lower than the 6.9 billion gallons per day observed in 2005 (Marella 2008b). The rest were *saline water* withdrawals, primarily for thermoelectric power generation (Kenny et al. 2009).

1. This is EDIS document FE943, a publication of the Food and Resource Economics Department, UF/IFAS Extension, Gainesville, FL. Published May 2014. Please visit the EDIS website at <http://edis.ifas.ufl.edu>
2. Tatiana Borisova, assistant professor, and Jenna Rogers, graduate assistant, Food and Resource Economics Department, UF/IFAS Extension, Gainesville, FL 32611.

USGS identifies *six categories of water withdrawals* (referred to as “water use” categories): (1) public supply, (2) self-supplied domestic (primarily private wells [Swihart 2011]), (3) self-supplied commercial-industrial (have their own water withdrawal facilities or purchase water from a public utility [Swihart 2011]), (4) power generation, (5) recreational irrigation (e.g., irrigation for golf courses), and (6) agricultural use. In 2010, agriculture represented the largest freshwater withdrawal category in Florida, followed by public supply, power generation, recreational irrigation, self-supplied commercial-industrial, and domestic water uses (Figure 1).

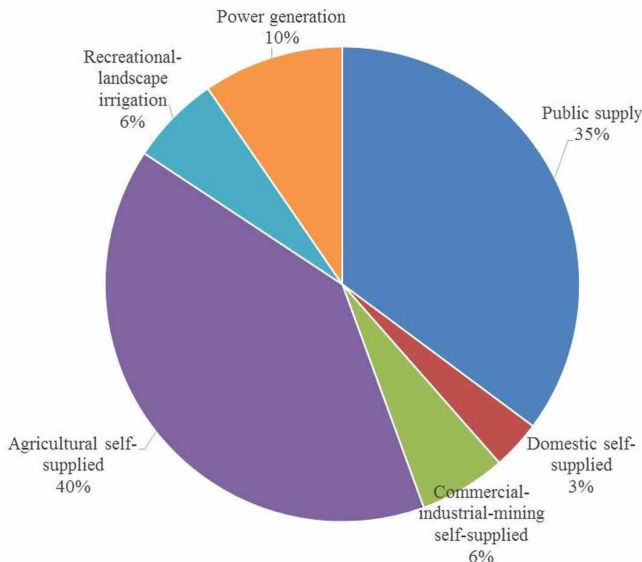


Figure 1. Freshwater withdrawals in Florida, 2010 [Source: USGS (2013)].

The highest rate of total freshwater withdrawals in Florida occurs in Palm Beach County (about 11 percent of state-wide level). Overall, Palm Beach, Miami-Dade, and Hendry Counties account for almost one-quarter of the freshwater withdrawals statewide. Palm Beach and Miami-Dade are Florida’s most populous counties. In addition, Palm Beach and Hendry Counties use large amounts of freshwater for agricultural production.

Similar to previous years, *about 65 percent of Florida’s total freshwater withdrawals in 2010 were from groundwater* (i.e., 4.2 billion gallons per day, out of 6.4 billion gallons of total freshwater withdrawals). *Surface water is primarily used for agricultural irrigation (51%) and power generation (26%)* in Florida, with Palm Beach, Hendry, and Escambia Counties accounting for 45 percent of the statewide surface water withdrawals. Statewide, *approximately 48 percent of the*

groundwater withdrawals are used for public water supply, and another 34 percent are used for agricultural irrigation.

In addition to traditional ground and surface water, reclaimed wastewater and desalinated brackish groundwater are small but growing sources of freshwater in Florida (SFWMD 2009). In 2008, about 1.5 billion gallons per day of reclaimed water were produced by 508 domestic wastewater treatment facilities with permitted capacities of 0.1 million gallons per day (mgd) or above (FDEP 2012). Approximately one-half of the reclaimed water was used for agricultural and urban irrigation and for industrial purposes (Marella 2008a,b). In 2010, 165 million gallons per day of reclaimed water were used for public water supply, which is 7 percent of total water use for public supply (USGS 2010).

Agricultural Irrigation

Freshwater withdrawals for agricultural use were 2,551 mgd, which is 8 percent lower than in 2005, 35 percent lower than in 2000 (USGS 2010). This reduction can be explained by variations in annual precipitation, reduction in irrigated acreage, improved water conservation methods, and changes in estimation methodology (Marella 2008a,b).

Withdrawals of freshwater for agricultural use constituted 40 percent of total withdrawals for the state, totaling 2,551 mgd. Fifty-five percent of agricultural freshwater withdrawals were from groundwater sources, and 45 percent were from surface water sources (primarily Lake Okeechobee and the water channels in South Florida).

Four counties accounted for 44 percent of agricultural crop freshwater irrigation in Florida: Hendry (418 Mgal/day), Palm Beach (397 Mgal/day), Collier (156 Mgal/day), and Glades (153 Mgal/day) (USGS 2010). For comparison, in 2005, the leading counties by water use were Palm Beach (793 Mgal/day), Hendry (386 Mgal/day), Indian River (158 Mgal/day), and St. Lucie (147 Mgal/day) (USGS 2005).

Public Supply

Water withdrawn for public supply in Florida totaled 2,268 mgd in 2010. Out of this, freshwater withdrawals accounted for 2,251 mgd, or 35 percent of total freshwater withdrawals in the state.

When considering total water withdrawals (which include freshwater and saline water), between 1990 and 2010, withdrawals for public supply increased by 18 percent. For comparison, Florida’s population increased by 45 percent over this period. Moreover, water withdrawals for public

water supply reduced by 11 percent between 2005 and 2010, while total population increased by approximately 5 percent. Total population combines the populations served by public supply and self-supply (FDOH 2012); in addition, many commercial and industrial facilities are also supplied by public water systems. Still, decoupling in the population growth and increase in withdrawals for public water supply indicate that water is being used more efficiently. Further increases in water-use efficiency are possible. For example, a large proportion of the water supplied to residential properties is used for outdoor irrigation of lawns and gardens, and often irrigation levels are above plants' needs.



Geographically, Miami-Dade County was the largest user (339 mgd), accounting for 15 percent of the freshwater withdrawals for public supply for the entire state (Note: total water use in the county showed a downward trend, dropping from 400 mgd in 2005]. Overall, six counties report total water withdrawals for public water supply of more than 100 mgd: Miami-Dade (339 mgd), Broward (231 mgd), Palm Beach (227 mgd), Orange (193 mgd), Hillsborough (170 mgd), and Duval (122 mgd). These high water-use levels are not surprising since all these counties include large urban centers, such as Miami, West Palm Beach, Fort Lauderdale, Orlando, Tampa, and Jacksonville.

Groundwater sources supply most of the water needed by every county. A notable exception is Hillsborough County, which is ranked fifth in the overall withdrawals for public supply. In this county, 61 percent of the public water supply

is from surface water sources (such as the surface water reservoir, Hillsborough River, Alafia River, and Tampa Bypass Canal). The largest North American sea water desalination plant also operates in Hillsborough County (USGS 2010).

Power Generation

Water withdrawals for self-supplied power plants in Florida total about 9 billion gallons per day, but only 7 percent of the total (613 mgd) is freshwater withdrawals. Of the total fresh water withdrawn, 99 percent is surface water (USGS 2010). Almost all of the water used for power generation is for cooling purposes. Because most of the water used for cooling is returned to its source, actual consumptive water use for power generation is quite low. Total water withdrawals are highest in Hillsborough, Pasco, Citrus, St. Lucie, and Broward Counties, but most of this is saline water. The largest freshwater withdrawals occur in Escambia (212 mgd), Volusia (119 mgd), and Suwannee (108 mgd) Counties.

Commercial, Industrial, and Mining Use

In 2010, total water withdrawn by self-supplied commercial-industrial systems was 378 mgd. No saline water was withdrawn, and 78 percent of total water withdrawals were from groundwater sources. The highest freshwater withdrawals were in Polk County (43 mgd; industries such as phosphate mining) and Escambia County (54 mgd; paper mills and other industrial facilities), which together accounted for 26 percent of total commercial-industrial withdrawals in the state.

Between 2000 and 2010, withdrawals for the commercial-industrial sector decreased, which is similar to the trend observed in the previous decade. Possible causes of the decrease in commercial and industrial withdrawals are conversion of self-supplied users to public water supplies and a greater reliance on more water-efficient technologies.

Recreational Irrigation

Recreational irrigation is used for golf courses, public-place landscapes, and ball fields (Marella 2008; Swihart 2011). Florida has more golf courses than any other US state, with most courses being irrigated (Swihart 2011; Haydu et al 2006).

Approximately 392 mgd of freshwater was withdrawn for recreational irrigation purposes in 2010 (that is up from 330 mgd in 2005). Nearly 48 percent was from groundwater

and the remaining 52 percent was from surface water. Palm Beach (62 mgd) and Lee (55 mgd) Counties are among the largest recreational water users, accounting for over one-quarter of total recreation irrigation withdrawals.

Domestic Self-Supplied

Self-supplied domestic water is primarily provided by individual domestic wells (with a small proportion provided by small utility companies). In 2010, users of self-supplied water systems withdrew about 214 mgd, entirely groundwater. The largest withdrawals occurred in Marion (13 mgd), Polk (13 mgd) and Orange (12 mgd) Counties.

For self-supplied domestic use, the increasing trend observed during the 1985–1995 period reversed during the 1995–2005 period, with water withdrawals for this category decreasing by 37 percent, which can be partially explained by changes in the USGS estimation methodology. However, withdrawals increased between 2005 and 2010 by 12 percent.

Water Conservation

Overall, a comparison of the water withdrawal data collected every five years by the USGS shows that total freshwater withdrawals in Florida have been decreasing. Still, further water conservation efforts and reductions in water withdrawals are important. In many areas, the rate of groundwater withdrawals has been exceeding the rate of aquifer recharge, leading to reductions in groundwater levels. For example, the flow in Florida's springs is highly dependent on the water level and pressure in the Floridan aquifer system. It has been estimated that the average spring water flow in Florida has declined by 21 percent (Knight and Knight 2014). Reductions in aquifer levels have also been linked with saltwater intrusion, impacting water supply wells for public suppliers and agricultural producers. A large proportion of the state is also classified by the state agencies as “water resource caution areas” that have critical water supply problems or are projected to have future critical water supply problems within the next 20 years (Figure 2). Water conservation continues to be a priority for state and local agencies, and for all citizens of Florida.

Conclusions

Florida is rich in water resources. Annually, it receives about 54 inches of rainfall (compared to 30 inches nationwide), and it overlies prolific aquifers. Even so, high levels of water withdrawals put Florida's rich water resources under significant stress. A balanced approach to water resource management is required to address water demands

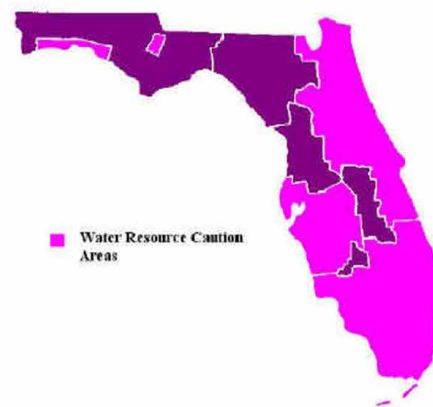


Figure 2. Water resource caution areas [Source: FDEP (2011)].

for public supply and economic activities without compromising the integrity of the environment. And in order to have such balanced approach, consistent data and regular analyses of water withdrawal and uses are needed.

References

- FDEP. 2012. *2012 Reuse Inventory*. Florida Department of Environmental Protection, Tallahassee, FL. <http://www.dep.state.fl.us/water/reuse/inventory.htm>
- FDEP. 2011. *Water resource caution areas*. Florida Department of Environmental Protection, Tallahassee, FL. <http://www.dep.state.fl.us/water/reuse/wrca.htm>
- FDOH. 2012. *Florida Population Atlas*. Florida Department of Health, Tallahassee, FL. http://www.floridacharts.com/Charts/atlas/Population/PopAtlas2012/Complete_Population_Atlas_2012.pdf
- Haydu, J.J., A.W. Hodges, and C.R. Hall. 2006. Economic impacts of the turfgrass and lawncare industry in the United States. EDIS #FE632. UF/IFAS Extension, Gainesville, FL. <http://edis.ifas.ufl.edu/fe632>.
- Kenny, J.F., N.L. Barber, S.S. Hutson, K.S. Linsey, J.K. Lovelace, and M.A. Maupin, M.A. 2009. Estimated use of water in the United States in 2005. USGS Circular 1344. United States Geological Survey, Washington, D.C. <http://pubs.usgs.gov/circ/1344/pdf/c1344.pdf>
- Knight, R. and S. Knight. 2014. The effect of groundwater pumping on spring flow declines in North Florida. *UF Water Institute Symposium*, Gainesville, FL (February),

http://waterinstitute.ufl.edu/symposium2014/abstract_detail.asp?AssignmentID=673.

Marella, R.L. 2008a. *Water Use in Florida, 2005 and Trends 1950–2005*. Report prepared in cooperation with the Florida Department of Environmental Protection (Florida Water Management District Fact Sheet 2008–3080). U.S. Geological Service, Florida Department of Environmental Protection and Florida Water Management District Headquarters, Tallahassee, FL. <http://pubs.usgs.gov/fs/2008/3080/>.

Marella, R.L. 2008b. *Water Use in Florida, 2005 and Trends 1950–2005*. Report prepared in cooperation with the Florida Department of Environmental Protection (Scientific Investigations Report 2009–5125). U.S. Geological Service, Tallahassee, FL. <http://pubs.usgs.gov/sir/2009/5125/pdf/sir2009-5125.pdf>.

Marella, R.L. 1999. *Water Withdrawals, Use, Discharge, and Trends in Florida, 1995*. Water Resources Investigations Report 99-4002. United States Department of the Interior, United States Geological Survey, Reston, VA. http://fl.water.usgs.gov/PDF_files/wri99_4002_marella.pdf.

Marella, R.L. 1988. *Water Withdrawals, Use, and Trends in Florida, 1985*. Water Resources Investigations Report 88-4103. United States Department of the Interior, United States Geological Survey, Reston, VA. <http://sofia.usgs.gov/publications/wri/88-4103/wri-88-4103.pdf>.

SFWMD. 2009. *Water Desalination Overview*. South Florida Water Management District (SFWMD), West Palm Beach, FL. https://my.sfwmd.gov/pls/portal/url/page/PG_GRP_SFWMD_WATERSUPPLY/PG_SFWMD_WATERSUPPLY_DESALINATION.

Swihart, T. 2011. *Florida's Water: A Fragile Resource in a Vulnerable State*. New York: RFF Press.

USGS. 2013. *Estimated Use of Water in the United States County-Level Data for 2010*. United States Geological Survey (USGS), Reston, VA. <http://fl.water.usgs.gov/infodata/data/2010>.

USGS. 2010. *Water Use Data Tables, 2010*. United States Geological Survey (USGS), Reston, VA. <http://fl.water.usgs.gov/infodata/wateruse/datatables2010.html>.

USGS. 2005. *Water Use Data Tables, 2005*. United States Geological Survey (USGS), Reston, VA. <http://fl.water.usgs.gov/infodata/wateruse/datatables2005.html>.