

\$4.44 Billion

Contribution of Florida's Golf Course Industry to the State's Economy

By John J. Haydu, Ph.D. and Alan W. Hodges, Ph.D.

Golf is a highly popular recreational activity in the United States. In 2000, there were over 15,000 golf facilities in the country (NGF 2001). Florida has more than 1,300 public and private golf courses, more than any other state. Numerous acclaimed golf courses in Florida are host to prestigious tournaments, including several on the PGA Tour, which is headquartered in the state. Golf courses in the Ft. Myers, Naples, and Ft. Pierce/St. Lucie areas of Florida are among the top five specific golf destinations in the U.S. Florida's warm climate allows golf play throughout the year, and golf is a primary activity for many of the millions of tourists who visit the state each year.

A decade ago, an economic study (Hodges et al, 1994) examined the value of the golf course industry to Florida's economy. The present study updates this information for year 2000 to reflect the growth in the industry and to assess the impact of golf tourism to Florida. Because out-of-state visitors bring new money into the Florida economy, their impact on the golf industry and tourism sector is associated with an economic multiplier effect. This involves three levels of economic activity:

- **direct** expenditures by tourists,
- **indirect** expenditures by golf facilities on inputs used in operations and maintenance, and
- **induced** impacts resulting from personal consumption expenditures by industry employees and allied suppliers.

Water use for landscape irrigation is a critical and growing issue in Florida. Many golf course superintendents are aware of the increasing political pressures to reduce consumption or switch to alternative water sources, such as reclaimed water. Mounting urban populations are placing unprecedented pressures on the natural resource base in many regions of the United States. At the same time, heightened environmental awareness by the public is focusing attention on heavy consumers of water, fertilizers, and pesticides (Haydu et al, 1997).

These pressures are being felt increasingly by agricultural interests and commercial users of these inputs. Golf courses, which are generally located close to or within urban centers, are particularly prone to public scrutiny of resource-use practices. With more golf courses than any other state, and with a rapidly expanding urban population, the Florida golf course industry is often in the spot light with regard to water consumption practices. This is particularly true during periods of drought, which Florida has experienced in recent years. This study

examines water use patterns by golf courses to document irrigation and consumption-related issues.

Methodology

Information to be collected from Florida golf courses and issues of concern to the golf industry were determined based on comments received in two focus group sessions with golf course owners and managers at Apopka and Naples, Florida in July, 2001. These sessions included a total of 12 industry professionals, representing industry associations, individual golf course owners, managers, and superintendents. Based on their recommendations, a mail survey approach was employed rather than a telephone survey, since typically several people in each organization would be required to provide different types of information. Information collected in this survey was for year 2000 and included two major categories:

1. Financial Information

- Business revenues
- Financial expenditures
- Employment
- Value of assets managed

2. Descriptive, Operational and Cultural Information

- Type of golf course
- Number of golf rounds played
- Geographic origin of golfers
- Number and value of associated residential developments
- Golf course area managed
- Types of turfgrass maintained
- Volume and source of irrigation water consumption.

Survey questionnaires were mailed to a list of golf courses that was compiled from three different sources:

- 1) the membership of the Florida Golf Course Superintendents Association,
- 2) the subscribers to *Florida Golf News* magazine, and
- 3) Florida firms listed in the Reference USA data base under Standard Industrial Code 7992 (public golf courses) and 7997 (private membership sports clubs).

These lists were combined, sorted and checked to eliminate duplicates, resulting in a list of 1,334 firms. Surveys were mailed to the listed firms two times, in October and November 2001, with a follow-up reminder postcard mailed one week later. Completed survey questionnaires were received from 223 firms, representing a 17 percent response rate. Results for survey respondents were extrapolated to estimate values for the entire population using expansion factors computed as the population divided by the number of respondents for each major type of variable. For certain types of data that are applicable to only some respondents, an overall expansion factor of 5.8 was used.

Results

Golf Course Characteristics

Florida golf courses fall into eight main categories, but are dominated by three major types - private, semi-private and public (Table 1). From the survey sample, half (50 percent) of the golf courses were privately owned, an additional quarter (27 percent) were semi-private, and 14 percent were public facilities. The remainder was comprised of municipal, residential development, resort and "other". These percentages differ moderately from estimates in the 1991 study that showed 60 percent of courses were classified as private, 17 percent semi-private, and 12 percent were classified as resort.

The decline in the percent of courses that are private is consistent with the findings of the National Golf Foundation. Their 2000 study showed that fully 87 percent of all new openings nationwide were public access facilities, and they expect this trend to continue in the coming years.

Table 1.
Ownership patterns of Florida golf courses, 2000.

Course Type	Number Respondents	Percent Respondents
Private	112	50.2%
Semi-Private	61	27.4%
Resort	12	5.4%
Public	31	13.9%
Military	2	0.9%
Residential		
Development	17	7.6%
Municipal	20	9.0%
Other	1	0.4%

Note: percent does not sum to 100 because some respondents checked more than one category.

Golf Course Area, Turf Varieties and Water Use

Total acreage devoted to Florida golf facilities in year 2000 was 207,582 acres, of which 147,927 acres (95%) were maintained turfgrass playing areas, and 140,274 acres (70%) were irrigated (Table 2). The maintained turf area (fertilized, sprayed and mowed) was up from 131,300 acres in 1991, a 13 percent increase for the 10 years. The average area per course was 108 acres irrigated and 114 acres maintained turf. The average area of maintained turf per course has decreased from 125 acres in 1991.

Table 2.
Golf course area in Florida, 2000.

	Respondents (Number)	Mean (Acres)	Standard Error (Acres)	Expanded Total (Acres)
Land owned	214	160	11	207,582
Turf area maintained	217	114	5	147,927
Area irrigated	217	108	5	140,274

Although more than half a dozen varieties of turfgrass are used on Florida golf courses, by far the predominant was bermudagrass (Table 3). Roughly 92 percent of the 147,927 acres of maintained turf area was planted in bermudagrass, or 102 acres per course. This grass is preferred in Florida for its drought resistance, tolerance to heavy traffic, and utility in either the fairways or rough. Far down

Table 3.

Turfgrass varieties used by Florida golf courses, 2000.

Turfgrass Variety	Respondents		Mean	Standard Error	Share of Total		Expanded Total Acres
	Number	Percent	Acres	Acres	Percent	Acres	
Bermudagrass	214	96.0%	102	5	92.5%	136,773	
Bahiagrass	67	30.0%	4	2	3.5%	5,251	
St. Augustinegrass	89	39.9%	3	1	2.7%	3,996	
Mixed/other grasses	25	11.2%	1	1	0.9%	1,351	
Zoysiagrass	25	11.2%	0	0	0.2%	257	
Centipedegrass	6	2.7%	0	1	0.2%	299	
Specific other type(s)	26	11.7%					
Total					100.0%	147,927	

the list in second place was bahiagrass with 5,251 acres, representing 3.5 percent of the total, or 4 acres per course. Bahiagrass is typically limited to the golf course rough. St. Augustinegrass was the only other turf variety that was of significance, with 2.7 percent of the total acreage planted. Each of the remaining varieties constituted less than 1 percent, and are generally limited to the special tee and greens areas.

This study examined three aspects of water use by golf courses - sources of irrigation water, changes in water use per acre, changes in fertilizer use per acre, and whether or not the golf course had installed an automated irrigation control system. Total water use by Florida golf courses in 2000 was estimated at 172 billion gallons. Information related to water sources is shown in

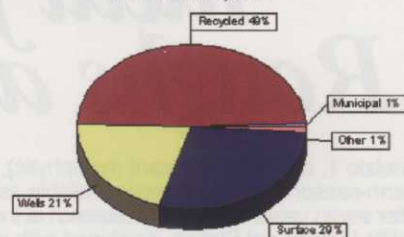
Figure 1. Nearly 85 billion gallons of water came from recycled water, compared to 49 billion for surface water, 35 billion from wells, and 1.5 billion from municipal sources.

Taking total irrigated acres and dividing it into the total amount consumed from all water sources, average consumption by Florida golf courses was 1.23 million gallons per acre, or 3.75 acre feet applied in 2000. The use of recycled water was the primary source for almost half of all golf facilities and has grown from 8 percent in 1974 to 21 percent in 1994 and to 49 percent in 2000. The second most common source was surface water such as canals and lakes (29 percent), followed by groundwater (21 percent) from wells. Use of surface water rose from 23 percent of golf courses in 1974 to 37 percent in 1994, but then declined to 29 percent in

2000. Groundwater as a source declined from 61 percent in 1974 to 41 percent in 1994, falling further to 21 percent in 2000. Clearly, much of the shift from surface and groundwater has been replaced by the dramatic growth in the use of recycled water to irrigate Florida's golf courses.

Survey data on changes in water and fertilizer use indicate that Florida golf courses have markedly reduced (60 percent) consumption of fertilizers and pesticides on a per-acre basis and were increasingly shifting sources of water from ground to recycled. From a water-policy and efficiency standpoint, perhaps even more important than total consumption per acre are changes in water-use patterns over time. To address this issue, golf course superintendents were asked whether irrigation water use per acre over the past five years had increased, decreased or

Figure 1
Irrigation Sources for Florida Golf Courses, 2000



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Table 4.
Changes in Florida golf course consumption of water and fertilizer use, 2000.

Change Variable	Respondents	
	Number	Percent
Irrigation water use per acre over past 5 years		
Increased	20	9.0%
Decreased	94	42.2%
Remained same	93	41.7%
Amount increased	18	8.1%
Amount decreased	83	37.2%
Fertilizer use per acre over past 5 years		
Increased	64	28.7%
Decreased	39	17.5%
Remained same	104	46.6%
Amount increased	64	28.7%
Amount decreased	39	17.5%

remained the same (Table 4). If it increased or decreased, respondents were asked to specify how much it had changed. By a slim margin, the majority (42.2 percent) indicated that their water consumption had decreased and the reduction in water use by this group averaged 37 percent. Slightly fewer (41.7 percent) said per-acre use remained the same. Nine percent of respondents indicated water use increased over the past five years and that it increased by roughly 8 percent.

A similar set of questions was asked about per-acre fertilizer use patterns over the past five years. Nearly half (46 percent) of all respondents stated that fertilizer use remained the same.

Table 5.
Geographic origin of golfers playing golf in Florida, 2000.

Geographic Origin	Respondent		Mean Rounds	Standard Error	Share of Total Percent	Expanded Total Million Rounds
	Number	Percent				
Local (county) residents	184	82.5%	20,372	1,315	53.7%	31.47
International visitors	133	59.6%	2,049	347	5.4%	3.16
US residents outside Florida	175	78.5%	10,277	980	27.1%	15.88
Non-local Florida residents	146	65.5%	5,209	663	13.7%	8.05
Total					100.0%	58.56

More than a quarter (29 percent) indicated that it had increased and that the average percentage increase was 28 percent. Almost a fifth (18 percent) stated fertilizer use had declined, with the magnitude of reduction a similar percentage (18).

Finally, respondents were asked whether the golf course had automated irrigation systems installed, and whether they were original or retrofitted from a manual system. Nearly all (94 percent) stated that their course had an automated system and more than half (53 percent) indicated it was installed at the time of original construction.

Visitor Originations

Florida is well known for its large influx of winter visitors from many northern states as well as international locations, particularly Europe and South America. The geographic origin of golfers in general tends to be associated with distance to the course. At 54 percent or 31.4

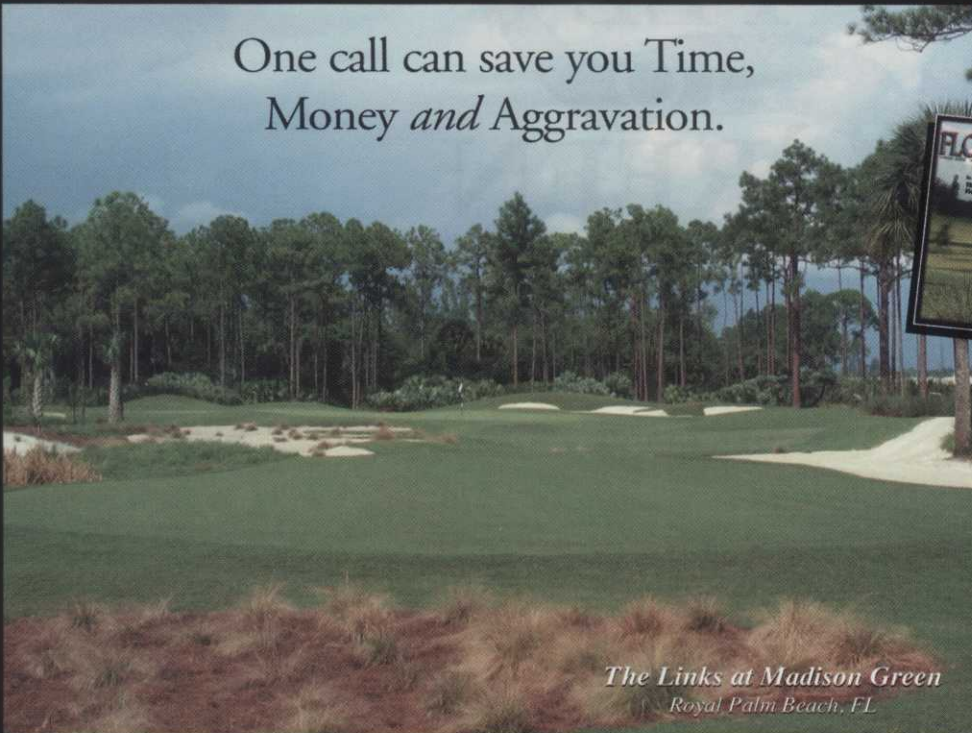
million rounds, local county residents were the group most frequently playing golf (Table 5). The second-most-common group comprised U.S. residents from outside Florida, representing 27 percent of total rounds played. Nonlocal Florida residents were the third-ranked group with 14 percent or 8 million rounds, followed finally by international visitors who accounted for just over 5 percent or 3.2 million rounds of golf. A total of over 19 million rounds (32%) were played by out-of-state visitors to Florida.

Florida Golf Visitors and Expenditure Impacts

One of the objectives of this research was to estimate the total economic impact of golf visitors to the state of Florida. The tourism industry publishes information regarding the impact of tourism to the state, but estimates of the impact of golf-related recreation specifically have not been made. Information was obtained from the National Golf Foundation on golf traveler characteristics in

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the United States, such as the average number of rounds played per day and per year, the number of days spent annually in golf-related travel, the average number of golf trips per year, and average expenditures per trip.

The typical U.S. golf traveler makes 6.6 golf-related trips per year with an average of 3.95 days per trip, or a total of 26 days each year in golf-related travel, and spends an average of \$1,114 per trip or \$282 per day on lodging, local transportation, food, entertainment, golf lessons, gifts, and miscellaneous other expenses, but excluding transportation to the destination (Table 6).

This study assumed that U.S. average golf travel data are representative of golf travelers to Florida since this state is the largest golf travel market in the United States. The U.S. travel data were used together with the survey data on total rounds of golf played in Florida by out-of-state visitors (19,046,060) to estimate a total of 3.12 million golf-playing visitors to Florida in 2000, who made 20.6 million golf-related trips and spent a total of 81.5 million visitor days in Florida.

Based on the U.S. average golf-travel expenses per day and the estimated number of golf-visitor days in Florida, total golf-travel expenditures

by Florida visitors amounted to nearly \$23 billion (Table 6). Based on the number of travel days and number of rounds of golf played, we estimate that 23.4 percent of the total trip expenditures, or \$5.4Bn, may be attributed to golf.

As noted earlier, visitors to Florida impact the economy at three levels - directly on expenditures such as food, recreation, lodging and entertainment, indirectly by the receiving industries of those dollars as they in turn spend money to purchase goods and services to operate their businesses, and induced impacts from personal consumption expenditures by the employees of these companies and their allied suppliers.

The cross-section of industries influenced by tourist dollars, for the major sectors of the Florida economy, and the three levels of economic impact are shown in Table 7. These impacts (direct, indirect and induced) are extrapolated and classified into three types of impacts - output, value added, and employment.

- **Output impact** is a gross figure that represents total revenues generated from the three levels of economic activity.
- Total **value-added impact** is a net figure that removes all purchased inputs used by the respective industry to generate their goods and services. This is similar to net income after cost of goods sold (COGS) have been subtracted from total income.
- Finally, the **employment impact** represents the jobs that are generated from all the activity across

Table 6.
Travel expenditures by Florida golf visitors, 2000.

Type of Expenditure	Average Per Trip (1)	Average Per Day (2)	Estimated Total Expenses (3)	Estimated Expenses Attributable to Golf (4)
Type of Expenditure	\$	\$	\$ Million	\$
Lodging	403	102	8,303	1,941
Transportation	87	22	1,793	419
Food	203	51	4,183	978
Entertainment	113	29	2,328	544
Golf lessons	106	27	2,184	510
Gifts	87	22	1,793	419
Other	115	29	2,369	554
Total expenses (5)	1,114	282	22,953	5,364

1 National Golf Foundation, 1999. *The U.S. Golf Travel Market, 1998 Edition*. Publication 99MR002.
 2 Average per trip divided by average number travel days per trip.
 3 Average expenditure per day multiplied by estimated number of traveler-days.
 4 Share of trip expenses attributable to golf (23%).
 5 Excludes transportation expenses to destination of \$227 per trip.



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the economy due to golf.

The output impact from golf tourism spending totaled \$12.86Bn. It was dominated by three sectors - services, which accounted for \$5.06Bn, or 39 percent of the total; trade with \$3.05Bn, or 24 percent of the total; and finance, insurance and real estate, which comprised 10 percent or \$1.36Bn. Combined, these three sectors represented more than four-fifths of the total output impact.

A similar dominance by these sectors occurred for total value-added impact, with services accounting for \$3.27Bn (39 percent), trade for

\$2.14Bn (25 percent), and finance, insurance and real estate comprising \$984M (12 percent) of the \$8.46Bn total. Value-added impacts also included an impact on labor income of \$5.58Bn and impact on indirect business taxes paid to local, state, and federal governments of \$792M.

Finally, the number of jobs generated by golf tourism, measured as an employment impact, was 215,873 in 2000. The component responsible for the majority of employment was the service sector with 96,000 jobs, followed by trade with 72,000 jobs, and third was the government, which accounted for nearly 17,000 jobs.

Table 7.
Total economic impacts of golf visitor expenditures in Florida, by industry sector, 2000.

Industry Sector	Total Output Impact (\$million)	Total Value Added Impact (\$million)	Total Employment Impact (jobs)
Services	5,060	3,268	95,641
Trade	3,049	2,144	71,574
Finance, Insurance, Real Estate	1,355	984	7,092
Transportation, Communication, Public Utilities	1,031	649	11,229
Government	971	886	17,109
Construction	779	282	7,509
Manufacturing	534	192	3,321
Agriculture	63	36	1,385
Other	11	11	958
Mining	6	3	55
Total	12,860	8,455	215,873

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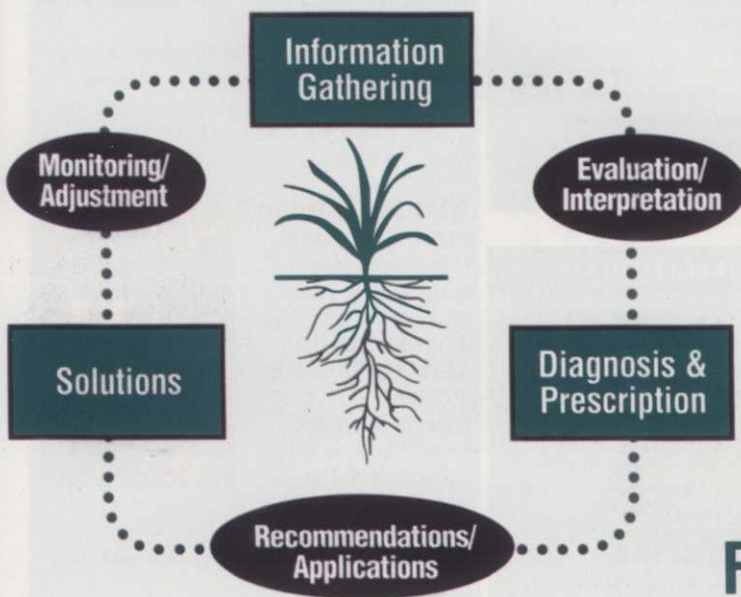
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Table 8.
Employment by Florida golf courses, 2000.

Employee Type	Respondents		Mean	Standard Error	Expanded Total
	Number	Percent			
Golf course maintenance, full-time	221	99%	16	1	21,205
Golf course maintenance, part-time/seasonal	156	70%	3	0	2,396
Clubhouse/other, full-time	190	85%	27	3	30,170
Clubhouse/other, part-time/seasonal	167	75%	19	2	18,268
Total Employment	222	100%	56	4	72,038

Golf Course Employment

Employment is a vital indicator of an industry's contribution to a local, regional, or national economy. Wages stimulate an economy when they are spent locally in the purchase of other goods and services. In 2000, Florida's golf-course industry employed a total of 72,038 people, including 51,375 full-time workers and 20,663 part-time workers (Table 8).

Almost one-third (32.7 percent) of these full- and part-time employees worked on golf course maintenance activities, while the remaining two-thirds (67.3 percent) worked for the golf course clubhouse and/or related food service or recreational concerns.

The average golf course employed 16 full-time and three part-time people for its highly intensive maintenance work, which includes both the care of the course and the equipment used to maintain the turf-grass. On a per-acre basis, this translates into roughly one person for every 5 acres of maintained grass.

At two-thirds of the total, the clubhouse component of the golf facility utilizes the larger share of total employment, due primarily to the larger number of separate business activities. For example, depending on the size of the facility, services may include hotel operations, restaurant management and service, and recreational services such as golf and tennis instruction. The average golf course employed 27 full-time people and 19 part-time or seasonal labor for clubhouse-related activities.

On average, total facility employment translates into one employee for every \$150,000 of financial assets - land, vehicles and equipment, irrigation systems, and golf-owned buildings and installations.

These figures attest to the substantial employment impact Florida's golf course industry has on the state's economy. Put in different perspective, golf course industry employment was close to the 80,000 people that work for all the theme and amusement parks in the state and greatly exceeded the 50,000 wage and salaried employees in agriculture (Florida Statistical Abstract 2000).

Summary

Economic impacts of the Florida golf industry were estimated for year 2000 based upon a survey of golf courses, together with other published data and regional economic models. Respondent golf courses were classified as private (50%), semi-private (27%), public (14%), municipal (9%), resort (5%), and military (1%).

Total annual revenues amounted to \$4.44 billion (Bn), including membership and initiation fees (38%), playing fees (27%), food and beverage services (18%), retail sales (6%), lodging (4%), and miscellaneous other activities (9%). The revenues for year

2000 were 49 percent higher than a previous estimate of \$3.0Bn in 1991-92, representing an average annual growth rate of 5 percent in nominal dollar terms.

Total industry employment was 73,000 persons, including clubhouse personnel (68%), and golf course maintenance personnel (32%), with 71 percent as full-time and 29 percent as part-time, temporary or seasonal employees.

Water used for irrigation amounted to 173 billion gallons, of which surface waters were the dominant source (90%), with lesser amounts from recycled water sources (7%) and wells (3%). Compared to 5 years ago, water use per acre was increased by 9 percent of firms, decreased by 42 percent, and remained the same for 42 percent. Fertilizer use per acre was increased by 29 percent of firms, decreased by 18 percent, and remained the same for 47 percent. The irrigation control system was automated by 94 percent of courses.

ACKNOWLEDGMENTS

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PLANTS OF THE YEAR FOR 2002 - PART 3

Editor's Note: This program, sponsored by the Woody Division of the FNGA, introduces purchasers to under-utilized, but proven Florida plant material. Selected each year by a panel of horticulturists, nurserymen, educators, landscape architects and other professional members of the horticulture industry, these plants have attributes which attract wildlife or have minimal maintenance impact on the environment.

Robin Holly

BOTANICAL NAME: *Ilex x 'Robin'* (tm) 9486
HARDINESS: Zones 7-9
MATURE HEIGHT AND SPREAD: 10'-15' tall, 6'-8' wide

CLASSIFICATION: Evergreen shrub
LANDSCAPE USE: Specimen shrub, small tree or hedge

CHARACTERISTICS: large, dark green spiny leaves have a reddish-maroon foliage when new growth emerges. The glossy foliage shows off the red berries of this improved plant.



Hidden Ginger

BOTANICAL NAME: *Curcuma zedoaria*
HARDINESS: Zones 8-11

MATURE HEIGHT AND SPREAD: 4'-5' tall
CLASSIFICATION: Perennial
LANDSCAPE USE: Specimen or ground cover for shade

CHARACTERISTICS: Maroon colored inflorescence with yellow flowers appears in the spring before the foliage. Leaves are tropical looking with a purple midrib. The bloom can be cut for a long-lasting cut flower.



Mammy Croton

BOTANICAL NAME: *Codiaeum 'Mommy'*
HARDINESS: Zones 9B-11

MATURE HEIGHT AND SPREAD: 3'-5' tall, 2'-3' wide
CLASSIFICATION: Colorful shrub for full sun
LANDSCAPE USE: Accent, hedge or specimen

INTERIORESCAPE USE: Color specimen in very high light
CHARACTERISTICS: Leaves are a fiery orangish-red with variegation of green and yellow. The narrow leaves form a slight twist to give this plant a different look from the ordinary croton.



Alternative Water Sources

Editor's Note: Water quality and availability remains the number-one issue facing golf today and the near future. The following articles discuss how two clubs sought solutions to those challenges.)

'Horizontal Well' Taps Surficial Aquifer, Returns Investment

By Tom Trammell, CGCS

In August of 2000, I was facing quite a dilemma at Hawks Nest in Vero Beach. My charge was maintaining one of the top golf courses in Florida, we were already in a drought, we were going into the dry season (and the busy season) and



Tom Trammell, CGCS, stands in front of the horizontal well installed more than one year ago. The well provides more than 300,000 gallons of water per day for irrigation usage. Trammell notes that he has made sizeable savings over the last year due to improved water quality and reduced electrical cost for pumping from the shallow source. Hawk's Nest is scheduled to add one more well in the summer of 2002.

my water supply was terribly inadequate. My two conventional vertical wells were yielding approximately 40 gallons per minute and the effluent that I had been promised by the county was not arriving. Even though the two existing wells were running 24 hours a day, the course was still short 400,000 to 500,000 gallons per day.

Some effluent arrived, but not nearly enough. Fortunately, I remembered a presentation that I had attended in 1990. The subject was "horizontal wells" that tap the surficial aquifer a few feet below the surface.

In my files were the brochures that I had stored away from the presentation with the appropriate phone numbers. To make a long story short, I called and received a "re-education" on horizontal wells and decided that they may be the answer for our golf course. My green committee was a little suspect at first, because no one had heard of a "horizontal well."

I asked the company to come in and give a presentation to the committee. The company presented a short video, made a presentation, answered questions, and the committee said, "Go ahead." I was a little nervous, because it was all on my recommendation, but I plunged forward and had the well installed.

I am writing this article in March of 2002 and, here in Florida, we were still in the midst of a drought. The horizontal well not only has provided ample, good quality water (and continues to do so), I am using less electricity because the well is only 18 feet deep. Additionally, I am applying fewer soil supplements because of the quality of the water, and I am recycling anything that is unused. I was able to make a presentation to my green committee that demonstrated our horizontal well would pay for itself in 10 years.

The horizontal well taps the water that lies near the surface and directly beneath the golf course in a surficial water zone. This technology has the ability to recover water from this resource and deliver it in sufficient quantity to satisfy irrigation and lake augmentation needs. Surplus water that is not used in actual irrigation is returned to the surficial aquifer to be reused later. The system can be permitted to be used as a stand-alone water supply source or to supplement existing water supplies.

The horizontal wells are site specific. However, they work in most places in Florida. To determine if a horizontal well will work at your golf course, you need to spend approximately \$2,500 to \$3,000 for a 25- to 30-foot boring and have a hydrologist run computer models. The report will be pretty accurate and give you a much better idea of what you will get with the horizontal well than you

will ever have when you drill a conventional vertical well.

This is a technology whose day has come. If your site will accommodate a horizontal well, then chances are you will not only have a more-than-adequate supply of good quality water; you will also have a return on your investment.

Club Taps Surficial, Floridan Aquifers, Processes in Own RO Plant

By Michael Caglioni, P.G. and Peter Brooks, CGCS

The Everglades Club is located in the Town of Palm Beach, which is located on an elongated barrier island, the Island of Palm Beach, bounded to the west by the man-made saline estuary of Lake Worth/Intracoastal Waterway, to the east by the Atlantic Ocean, and to the north and south by man-made inlets. The Everglades Club is a private, par 70, 18-hole golf club that covers 70 acres.

The original irrigation water supply was potable drinking water purchased from the Town of Palm Beach Utilities, which purchases its bulk water from the City of West Palm Beach. The City of West Palm Beach obtains its raw water from a surface water body, Clear Lake, and is treated mainly through green sand filtration. The Everglades Club irrigation water was supplied by transferring a drinking water source to the barrier island and then to the golf course. When using potable water purchased from the Town of Palm Beach, The Everglades Club Golf Course had an average monthly water bill of \$20,000.

Alternative Water Source No. 1: Surficial Aquifer

In order to reduce the irrigation costs to the golf course, the Everglades Club investigated the potential of installing its own well field for irrigation purposes. Hydrogeologic investigations indicated that the Everglades Club could install a shallow, surficial aquifer well field that would supply brackish raw water with a total dissolved solids range of 2,000 to 6,000 milligrams per liter to an on-site, reverse osmosis plant for treatment. The finished water is to be utilized for irrigation of the golf course. The Everglades Club received a permit from the South Florida Water Management District to withdraw 146 million gallons per year total from both surface water and ground water (surficial aquifer) sources.

Topography plays an important part in the surficial hydraulic regime of a barrier island and, therefore, the Everglades Club. Normally, the water table will approximate the topography (contours) of the land surface. The height of the water table above mean sea level is a function of the elevation of the land surface, the nature of the hydrogeology (aquifer characteristics), and the amount of rainfall. The topography of the Everglades Club golf course is relatively low, approximately six feet above mean sea level at the eastern edge of the property. To the east of the golf course is a topographic high (consolidated and unconsolidated sand dune to ± 15 feet MSL) on which housing and roadways have been



The top of the Floridan Aquifer is more than 1000 feet below the surface of the Everglades Club.

developed. This topographic high increases the height of the freshwater head between the golf course and the Atlantic Ocean and impedes the potential of lateral saltwater movement from the Atlantic Ocean to the golf course.

The hydrogeologic investigation (which included the drilling of a test well and collection of lithologic and water quality samples) indicated the presence of a really extensive, clay unit, approximately 1-2 feet thick, from a depth of approximately 29 feet to 31 feet below MSL. The clay unit impedes the upward movement of saline water. As is expected on a barrier island, the water increased in salinity (conductivity) with depth. Below the clay unit, the water quality decreased significantly (more saline).

Twelve irrigation wells were constructed along the eastern edge of the golf course and withdraw water from approximately 19 to 29 feet MSL. This water is pumped and treated through a reverse osmosis membrane plant designed to treat brackish ground water with TDS levels of 2,000 to 6,000 mg/L.

The average TDS concentration of the production wells is 1,500 mg/L. This treated water is pumped into lakes for storage and is then pumped from the lakes to the irrigation system for distribution.

The brackish water lens and the well field are monitored by six saltwater monitor wells. The wells are used to monitor for saline intrusion,

both lateral intrusion and upconing of saline water from greater depths.

The RO water treatment plant at the Everglades Club is designed to output (permeate) 75% of the raw water intake. Each RO plant must consider the raw water quality for proper design and efficiency.

In addition, the disposal method of the reject water (concentrate) must also be considered. The Everglades Club currently discharges its concentrate water to a pond for percolation and evaporation near the Intracoastal Waterway. This pond naturally has a higher salinity than the concentrate water. This disposal option is available to the Everglades Club because of its proximity to saltwater bodies. Other options for concentrate disposal in South Florida include infiltration trenches, injection wells, and discharge to a sanitary sewer system. Each option has its associated regulations and costs. Each of these options should be investigated prior to installation of an RO plant.

The surficial aquifer has limitations of use during drought conditions because of upconing and lateral saltwater encroachment. Computer groundwater modeling was performed to assess the limitations of the surficial aquifer. The model predicted that lateral saltwater encroachment would occur after 10 days of continuous pumping with no recharge.

The Everglades Club is able to minimize the potential for the lateral encroachment of saltwater

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by adhering to a 12-hour pumping schedule (12 hours on and 12 hours off). The model also indicated that without proper, self-imposed, well field management, the Everglades Club could potentially alter the water quality by increasing chlorides, sulfates, and TDS through upconing. The Everglades Club has voluntarily monitored water quality and water levels in the monitor wells and the production wells.

Regional Drought Conditions

In April 2000, due to regional drought conditions, the SFWMD imposed Phase II (severe) water restrictions in Palm Beach County, among others. These restrictions apply to all surface water and surficial ground water sources. Because the Everglades Club's well field withdraws water from a shallow surficial aquifer, it was included in the restrictions. Due to the uniqueness of the Everglades Club's well field (located on a barrier island with brackish water), the Everglades Club requested from the SFWMD a variance/exception to the water restrictions. The variance was denied based on the reasoning that "under the modified phase 2 water shortage rules, the surficial aquifer system is a restricted source regardless of location, treatment system, or water quality up to that of seawater."

Alternative Water Source No. 2 - Floridan Aquifer

In anticipation of water restrictions during drought conditions, the Everglades Club submitted an

application for, and received, a well construction permit from the SFWMD to install one well into the deeper Floridan aquifer. Based on the denial from the SFWMD regarding the variance/exception to the use of the surficial aquifer, the Everglades Club contracted to have the Floridan aquifer well installed. Under the current SFWMD rules, the Floridan aquifer is an unrestricted water source.

No increase in water-use permit allocation was requested, only the transfer of the Surficial aquifer allocation to the Floridan aquifer during drought conditions. This would eliminate the need to utilize the Town of Palm Beach's potable water supply for irrigation purposes during drought conditions and therefore constitutes a reasonable and beneficial use of the state's resources.

At the Everglades Club site, the top of the Floridan aquifer occurs at approximately 1,050 feet below land surface. The water in the Floridan aquifer is brackish, having a chloride concentration of approximately 1,800 mg/L, sulfates of approximately 370 mg/L, and total dissolved solids of approximately 2,900 mg/L.

This water quality is similar to the brackish water from the existing surficial water supply system being treated by the Everglades Club. No modifications to the existing RO plant or discharge will be required.

However, there are minor modifications to monitoring requirements when the Floridan aquifer is being used. Two additional parameters, hydrogen sul-

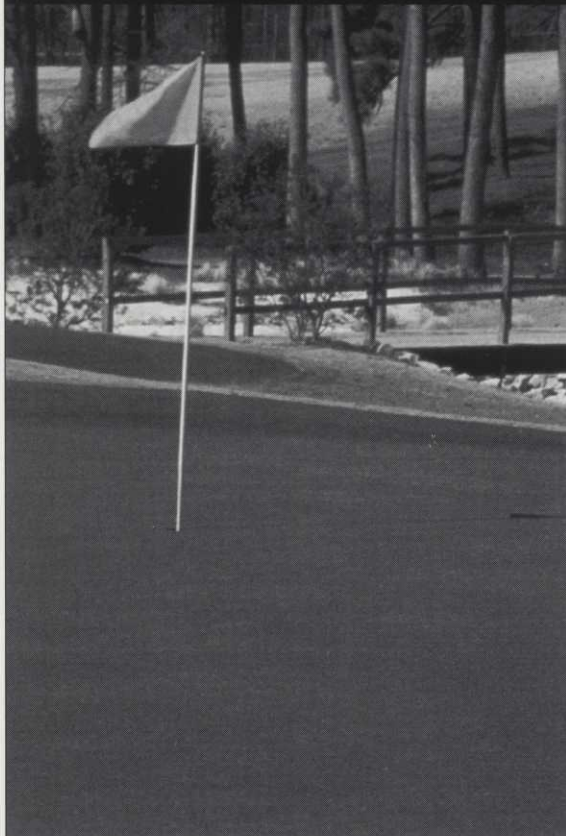
fide and un-ionized ammonia, must be monitored and reported.

The Everglades Club golf course irrigation well field can be operated successfully with a withdrawal rate of 800,000 gallons per day withdrawn from one 10-inch-diameter irrigation well designed to produce 556 gallons per minute. This well was recently constructed and should be on line in November 2001.

Cost effectiveness

The Everglades Club was paying \$3.15 per 1,000 gallons for potable water supplied by the Town of Palm Beach. This irrigation water source was costly and subject to mandatory water restrictions. The RO plant was a cost-effective means of reducing the water bill, whether using the surficial aquifer or the Floridan aquifer as the source. The surficial aquifer supplies water for irrigation under non-drought conditions and provided the initial alternative water supply at a lesser cost for installation. However, the surficial aquifer well field was also subject to mandatory water restrictions. The Floridan aquifer well was then constructed at a higher installation cost but has the advantage of not being subject to mandatory water restrictions.

The R.O. water treatment plant at the Everglades Club produces 1,000 gallons of water for \$0.40. Based on the rate the Everglades Club was charged to irrigate with potable water, a 200-acre golf course irrigating 0.20 inches per acre per night (hot,



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To comply with restrictions on withdrawing brackish water from the surficial aquifer during drought conditions, The Everglades Club installed a well into the deeper saline Floridan aquifer to provide water for its reverse osmosis plant to irrigate the golf course.

dry season) would equal a monthly cost savings of \$89,620. Likewise, to irrigate with 0.10 inches per acre per night (cool, wet season) the monthly cost savings would be \$44,814.

Summary

The Everglades Club was paying \$3.15 per 1,000 gallons of potable water used for irrigation. The Everglades Club then built an RO plant and constructed its own well field into the surficial aquifer system. Regional drought conditions caused the Everglades Club to adhere to mandatory water restrictions and once again rely on potable water treated by the City of West Palm Beach. The Everglades Club then installed a Floridan aquifer well, currently an unrestricted water supply source.

The water treatment plant at the Everglades Club now produces water at a cost of \$0.40 per 1,000 gallons. The benefits of switching to the Floridan aquifer during drought conditions are that potable water or surficial aquifer water prone to salt water intrusion is not used and the Everglades Club can irrigate during drought conditions.

To date, the Everglades Club has investigated and used all potential water supply sources currently available. The use of each source has evolved as the requirements and costs of irrigation have changed. The Everglades Club has successfully withdrawn and treated surficial aquifer ground water by skimming a brackish water lens on a barrier island. This was

accomplished through proper well field design, installation, monitoring, and management. Through the use of the newly completed Floridan aquifer well, the Everglades Club will be able to keep its greens alive during drought conditions and will have lessened the impact to the surficial aquifers of the state.

The Suncoast Scramble Began Research Fundraising in 1982

On March 19th, Joel Jackson and I attended the Suncoast Scramble at Misty Creek Golf Club. A check for \$2,500 was presented to me for the

BENHAM'S BEAT



Don Benham

FTGA's Research Foundation. Another check was also presented specially for the Florida Golf Economic Impact Study (see page 40) initiated by WCI Communities through the FTGA.

When I learned that this was the 20th annual Suncoast Scramble, I went to James Svabek, superintendent of Bradenton Country Club to see what information I could find on

the history of this event. Boy! Did I go to the right source. Jim had a complete folder on the scramble.

It was started in 1982 to provide funds for research and scholarship for the betterment of golf. Allen Hanchey, was president of the chapter golf program at Sarasota Jr. College. This teaching program was receiving national recognition for its outstanding program of teaching golf to the students. The Suncoast chapter also wanted to be involved with research funding to the FTGA. This certainly was forward thinking for a local chapter in 1982.

Since I live at the Palm Aire Country Club in Sarasota, I was surprised to learn that the first Suncoast Scramble was held there. Checks were presented to Sarasota Jr. College and the FTGA. Jim Lerner was superintendent of Palm Aire and the tournament stayed here through 1988.

The Scramble moved to River Wilderness in 1989 with Mike Miles as host superintendent; then in 1990 to the River Club with George Cook superintendent and in 1991 to Bent Tree with Tom Biggy as host. The Venice G&CC and Troy Smith, GCS played host from 1992 to 1994. The past seven years (1995 - 2002), the event has been at the Misty Creek CC with Tom Crawford as the host superintendent.

Each year the Suncoast Scramble research tournament has grown till it now fills the playing field to capacity. The last few years they have had to turn away some entries. The format has stayed about the same with a golf superintendent, golf professional, general manager, or board member and a supplier making up each team.

In the mid-90s they decided to add some entertainment to the pre-lunch program. One year they perpetuated a giant hoax on the audience by announcing a speaker from the "Penn State Institute of Turfgrass Development" who proceeded to tell the audience they were releasing a new grass that only needed to be mowed once a week even on greens.

The new grass was immune to disease and completely resistant to all pests including mole crickets. The speaker then proceeded to tell the golf superintendents they should probably start to look for a new profession because even a high school student could take care of the golf course.

Jim Svabek told me he watched jaws drop open and eyes widen as the speaker continued. Jim said it was all he could do to not fall off his chair laughing. Of course by the end of the talk most people realized that they had been bamboozled. From 1996 until now, McCurdy's Comedy Club has provided the entertainment.

What a success story for the Suncoast Chapter. Twenty years of the membership working together to successfully have this tournament each year. Their original purpose has not changed. It is still to support research and the betterment of golf in Florida.

P.S. Congratulations to Greg Richardson (from Hibiscus Golf Club) for a hole in one on the 12th hole at Misty Creek in this year's event.

Editor's note: This column was written on March 30, before Tom Crawford's death in May. The column celebrates the success and history of the Suncoast Chapter of which Tom will forever be a part.