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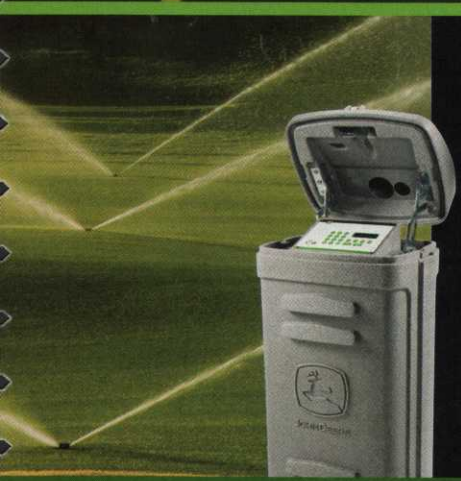

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Blue Grama Has Potential For Drought-Resistant Turf

Additional breeding will improve the cultivar's athletic turf qualities

By Leo Schleicher and Shane M. Andersen

Renewed interest in blue grama (*Bouteloua gracilis [H.B.K.] Lag. Ex Steud.*), particularly as a drought-tolerant species, has stimulated renewed research efforts in recent years.

Blue grama is valued for its ability to survive severe environmental stress, particularly drought. Although blue grama demonstrates potential as an acceptable turfgrass managed at intermediate intensity, little information is available and considerable genetic improvement is needed.

Blue grama is a perennial, warm-season grass species with excellent drought, heat, and cold tolerance. Native to the North American Great Plains and Southwest, blue grama has traditionally been used as a forage or range grass, particularly in the mixed and short grass prairies of the High Plains. Blue grama was planted during the severe drought of the 1930s to control erosion.

Although several blue grama varieties have been released, such as Bad River, Hachita and Lovington, no true turf-type cultivars are currently commercially available.

Blue grama is a sod-forming grass, spreading from basal tillers or short, scaly rhizomes. Its deep and extensive root system allows it to survive long periods of drought. It tolerates frequent, relatively short mowing and has low fertility requirements. Although blue grama has historically been used as a low- or reduced-input turfgrass, the genetic potential for improvement is high. The species is highly outcrossing with considerable ecotypic variation in morphology. Ecotypes within the Great Plains are tetraploid.

Desirable turfgrasses — in terms of growth habit and spread, density, mowing and traffic tolerance, genetic color and leaf texture — are those able to produce a perennial, sod-forming turf. Development of blue grama as a quality turfgrass will require improvement in several of these characteristics through selection, traditional breeding and genetic engineering.

Blue grama germplasm

At South Dakota State University, we have evaluated blue grama as a turfgrass for several years. Polymorphic molecular markers (SSRs) identified in related grass species were screened for amplification in blue grama, and selected markers are currently being screened on plants collected from wild South Dakota populations. These markers will be useful to blue grama breeding programs and future linkage and mapping studies. Additionally, native germplasm from northern Great Plains grasslands is being collected to increase diversity for research.

Preliminary data from our South Dakota collection have been gathered. For example, leaf width variability among 66 accessions was investigated using samples from greenhouse pots of 2-year-old blue grama stands mowed at 7.6 centimeters. Longitudinal sections of leaf blades were excised from second-oldest, fully developed leaves at 25.4 millimeters apical to the leaf collar. Leaf width values were derived from spatial-calibration software using scanner-generated imagery. Leaf widths ranged from 0.93 to 2.22 mm, with a mean of 1.65 ±0.31 mm.

The bluish-gray to grayish-green color of blue grama is often considered undesirable in quality turf compared to the darker green color of traditional cool-season turfgrasses. Data from our Highmore, S.D., location in 2006 indicated that the average

QUICK TIP

Nematodes can be beneficial or parasitic to plants. Parasitic species that feed on plants pose concern for turf managers. These microscopic worms attack all parts of the plant above and below the surface, but they are most detrimental to the plant when the root system is attacked. Once infected, plants are highly susceptible to other potential problems. Discussions about the prevention of nematode occurrence begin with the importance of having a healthy plant. Proper fertilization and the reduction of stress will result in healthier plants that can sustain some damage from these parasites. Conduct proper soil and tissue testing to monitor your turf's specific nutritional needs.

TABLE 1

Phytotoxicity of postemergence herbicides applied to blue grama seedling turf in 2005 and 2006.

Herbicide Treatment	Formulation	Rate (kg of a.i. per hectare)*	Labeled for blue grama turf†	Visual injury‡ Early	Visual injury‡ Late	Coverage reduction§
MSMA	1.6SC	2.43	No	Yes	No	No
quinclorac	75DF	0.84	No	Yes	Yes	No
imazapic	2L	0.07	Yes	Yes	Yes	Yes
mesotrione	4L	0.27	No	Yes	Yes	Yes
fluroxypyr	1.5L	0.28	No	No	No	No
carfentrazone-ethyl	1.9L	0.03	No	Yes	No	No
2,4-D amine	3.8L	1.12	No	No	No	slight
triclopyr	4L	1.12	No	No	No	No
clopyralid	3L	0.55	No	No	No	No
dicamba	4L	1.12	No	Yes	Yes	Yes
fenoxaprop-ethyl	0.57L	0.10	No	No	No	No
simazine	4FL	1.12	No	No	No	No
2,4-D+mecoprop+dicamba	0.73L	1.12	No	Slight	Slight	Slight
metsulfuron-methyl	60D	0.04	No	No	No	No
halosulfuron-methyl	75D	0.07	No	No	No	No
carfentrazone-ethyl + quinclorac	1.9 L + 75DF	0.02+0.84	No	Yes	Yes	No
isoxaflutole	4L	0.16	No	Yes	Yes	Yes

† *Source: www.state.sd.us/doa/* ‡ *Early, 3 to 10 DAT; Late, 14 to 28 DAT* § *3 DAT to 28 DAT;* **Kilograms of active ingredient per hectare.*

genetic color in our collection was unacceptable, but highly variable. Mean genetic color was 3.4 ± 1.0 on a 1 to 9 scale, where 9 is excellent. Fewer than 8 percent of rated accessions had acceptable color (equal to or better than 5.0).

Blue grama establishment

Recommendations regarding blue grama establishment for erosion control and range sites are available; however, additional research is needed to establish blue grama as turf. Recommended seeding rates for non-turf sites can range from 1.3 kilograms per hectare to 56 kilograms per hectare depending on the source. Seeding rates are highly dependent on method of seeding (such as broadcast or drill) and whether the seed is cleaned or processed.

Available water near the soil surface is critical for an extended period between germination and adventitious root development due to an elongated subcoleoptile internode that pushes the crown near the soil surface.

Acceptable turf stands are possible in a relatively short period when seeding at 146 kilograms per hectare PLS (Pure Live Seed — the percent by weight of desirable turfgrass seed in a bag that can be expected to germinate), particularly with favorable soil temperatures and light, frequent watering. For example, Bad River ecotype emerged from soil within 48 hours after planting at our Brookings, S.D., site in mid-July for three consecutive years. Soil temperatures at 5-cm depth during planting were 22.4, 19.6, and 21.3 degrees Centigrade in 2005, 2006 and 2007, respectively.

Germination of summer annual weeds seriously interferes with late spring and summer establishment. Light watering that is required for early blue grama survival also enhances weed germination and growth. Although mowing is effective in controlling taller growing weed species, weeds with a prostrate or decumbent growth habit can create problems.

No pre-emergence herbicides are labeled for weed control in blue grama turf, and imazapic is the only labeled post-emergence herbicide.

Herbicide screening studies for phytotoxicity in blue grama seedling turf were recently conducted over a two-

Continued on page 44

TABLE 2

Phytotoxicity of pre-emergence herbicides applied at blue grama seeding in 2006 and 2007.

Herbicide treatment	Formulation	Rate (kg of a.i. per hectare)*	Labeled for blue grama turf†	Visual injury	Coverage reduction‡
siduron	50WP	6.72	No	Slight	Slight
mesotrione	4L	0.27	No	Yes	Yes
pendimethalin	3.8ECL	1.68	No	Yes	Yes
isoxaflutole	4L	0.16	No	Yes	Yes
quinclorac	75DF	0.84	No	Slight	Slight
dithiopyr	40WSP	0.28	No	Yes	Yes
imazapic	2L	0.03	No	Slight	Slight
simazine	4FL	1.12	No	Yes	Yes
metsulfuron-methyl	60D	0.04	No	Slight	Slight

*† Source: www.state.sd.us/doa/ ‡ 3 DAT to 28 DAT *Kilograms of active ingredient per hectare.*

Continued from page 43

year period at Brookings, S.D., (Tables 1 and 2 for post-emergent and pre-emergent herbicides).

Results indicated that several post herbicides were safe at listed rates on blue grama seedling turf. However, all pre-emergent herbicides applied at seeding caused slight to severe injury.

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REFERENCES

Andersen, Shane M. and Leo Schleicher. 2006. Blue grama seedling tolerance to postemergence herbicides. In 2006 Annual Meeting Abstracts. ASA-CSSA-SSSA, Madison, WI.

Beard, J.B. 1973. Turfgrass: Science and culture. Prentice-Hall, Inc., Englewood Cliffs, NJ.

Falkenberg, D.A. 1982. Buffalograss, blue grama, and fairway wheatgrass for dryland turf. M.S. thesis. Colorado State Univ., Fort Collins.

Kahler, Jonathan and Leo Schleicher. 2006. Genetic diversity of blue grama grass as revealed by simple sequence repeats. In 2006 Annual Meeting Abstracts. ASA-CSSA-SSSA, Madison, WI.

Riegel, A. 1941. Life history and habits of blue grama. Trans. Kans. Acad. Sci. 44:76-83.

Smith, S.E., M.R. Haferkamp, and P.W. Voigt. 2004. Gramas. p. 975-1002. In L.E. Moser et al. (ed.) Warm-Season (C4) Grasses. Agron. Monogr. 45. ASA/CSSA/SSSA, Madison, WI.

Snyder, L.A. and J.R. Harlan. 1953. A cytological study of Bouteloua gracilis from western Texas and eastern New Mexico. Amer. J. Bot. 40(9):702-707

Wilson, A.M. and D.D. Briske. 1979. Seminal and adventitious root growth of blue grama seedlings on the central plains. J. Range Manage. 32(3):209-213.

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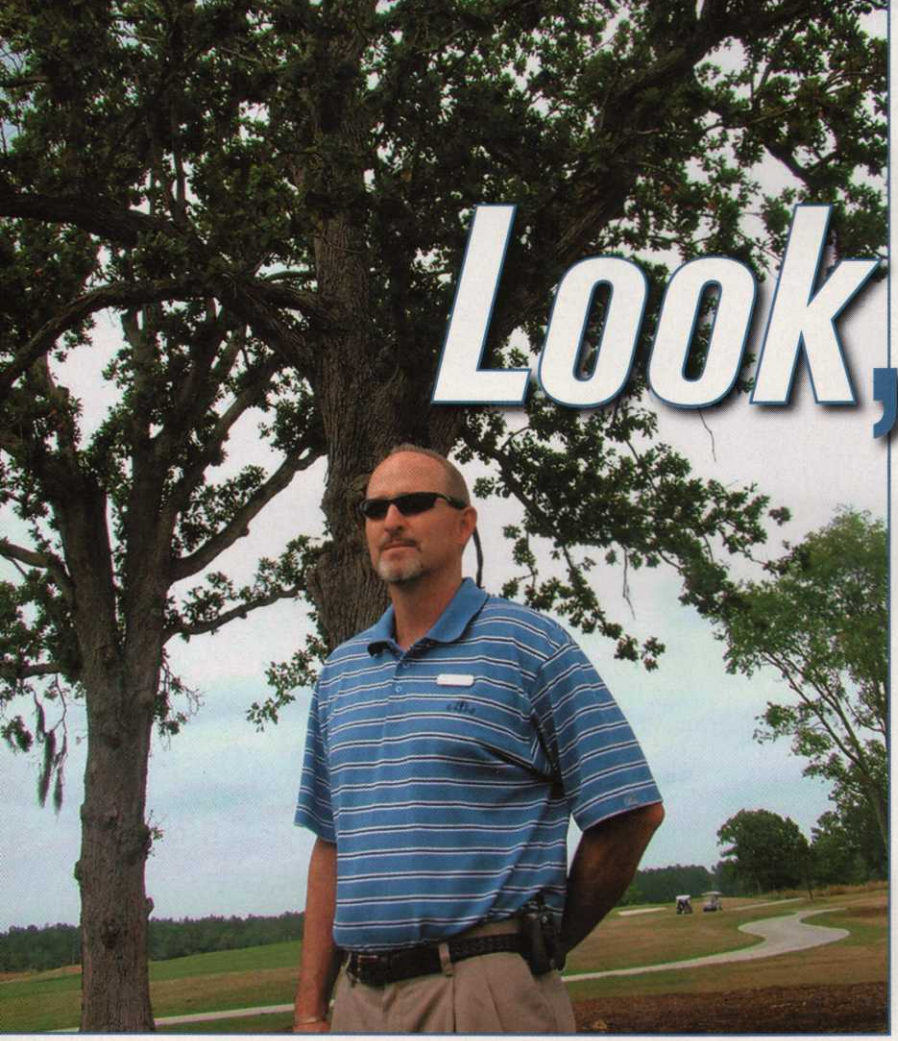


Look, Up in the Sky ...

... it's a live oak tree! Daniel Island Club goes to great lengths to preserve wondrous trees

BY LARRY AYLWARD, EDITOR IN CHIEF

Nobody marvels more at Daniel Island's trees than Mike Fabrizio, director of grounds and golf maintenance at the club.

They are as majestic as one of Bubba Watson's towering tee shots. But while Watson, the PGA Tour's driving distance leader, carries a big stick, he has nothing on these bigger and bolder billets — the magnificent live oak trees that dot the Daniel Island Club's two private golf courses in Charleston, S.C.

The live oaks at Daniel Island have been revered since the courses were built earlier this decade. Some trees stand 50-feet tall with canopies stretching 70 feet or longer and are a significant part of the golfing experience.

"There are few things that describe the essence of the low-country experience better than a Spanish moss-draped live oak tree," says Matt Sloan, president of the Daniel Island Co., who developed the property where the club is located.

It's not an accident that the live oak trees stand out like royalty on the two courses, known as Beresford Creek and Ralston Creek. Much thought went into preserving them and other trees during design and building of the courses. In fact, Rees Jones, architect of the Ralston Course, which opened in 2006, started working two years before construction began to plan a course routing to impact as few trees as possible.

Many trees were also transplanted — and with the utmost care. On the Ralston Course alone, 42 oak trees and 100 pine trees were relocated. Some of the oaks were at least 60 years old and had trunks as large as 31 inches in diameter.

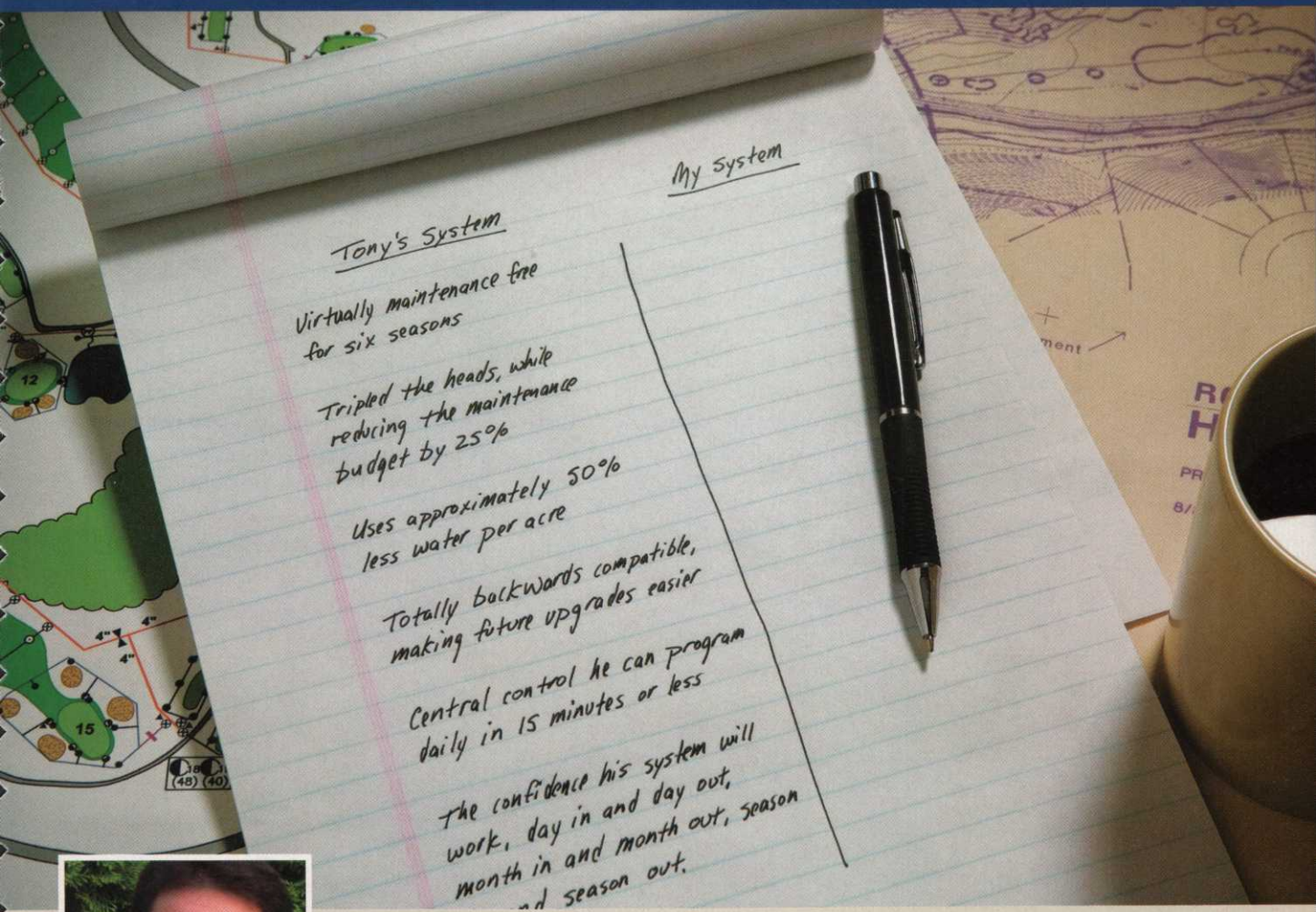
"There was a lot of consideration given to preserving trees and doing what had to be done whether it was changing the design of a golf hole or the position of a cart path," says arborist Ken Knox, who was hired as a consultant for the Daniel Island project.

Daniel Island's commitment to protect the trees has not gone unnoticed by the National Arbor Day Foundation. The environmental organization, whose mission is to celebrate trees, awarded both courses its Building With Trees Award. The Tom Fazio-designed Beresford Creek received the award in 2003, and Ralston Creek received it earlier this year.

Continued on page 48

PHOTOS BY: LARRY AYLWARD

Doing your homework still pays off.



Tony Girardi, *Certified Golf Course Superintendent (CGCS), Rockrimmon Country Club, Stamford, CT*

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While there are trees on the sides of the corridors, the corridors are wide enough to allow ample sunlight to reach the turf.

Continued from page 46

Driving in a golf car across Beresford Creek, Mike Fabrizio takes in the view, a tree-laden vista at which he never gets tired of looking. Fabrizio, a certified superintendent and director of grounds and golf maintenance at the Daniel Island Club, came to Daniel Island in March 1999 about three months before construction began on Beresford Creek.

Fabrizio knows what the trees, specifically the live oaks, mean to the property.

"If a 325- or 350-year-old live oak tree dies, you don't find something to replace it very quickly that has the same impact," he says.

Fabrizio says Charleston has one of the strictest tree ordinances in the country. But the planning meetings for the golf courses turned out to be a breeze. Sloan explained to the committee the steps Daniel Island planned to take to preserve the trees and relocate them, and the committee was impressed, Fabrizio says.

"They are the only public hearings I've ever been to where there was not one negative comment from anybody in the room about the designs," Fabrizio says. "The plans passed unanimously."

From his golf car, Fabrizio points to a corridor constituting one of the holes on Beresford Creek. The average corridor, or total width of a golf hole, is 300 feet to 350 feet, Fabrizio says. But most of the corridors at Daniel Island are 350 feet to 400 feet. While there are trees on the sides of the corridors, the corridors are wide enough to allow ample sunlight to reach the turf, which is vital because bermudagrass needs almost 100 percent sunlight to grow and be healthy, Fabrizio points out.

Large mulch beds are used around the live oaks because it's not easy growing turf around them.

Fabrizio, who has an associate's degree in turf management from North Carolina State University, has worked around magnificent-looking trees before. He helped build the two golf courses at Wild Dunes Resort in Charleston, where he worked for 10 years. But the fairway corridors were too narrow at Wild Dunes and the live oaks there caused turf problems. "We had tees and greens where you couldn't keep the grass alive," Fabrizio says.

But that hasn't turned Fabrizio into a tree hater. "Even though they can cause us problems with turf, I can appreciate the value of a tree," he says.

Fabrizio played a key role in the club's tree preservation program. It was his idea to bring in Knox, who has gained a name in the golf course industry for his tree expertise. Fabrizio and Knox worked together twice before, once when Fabrizio was superintendent at Wild Dunes. After Hurricane Hugo struck Charleston in 1989, Fabrizio summoned Knox to help preserve some of the damaged trees at Wild Dunes.

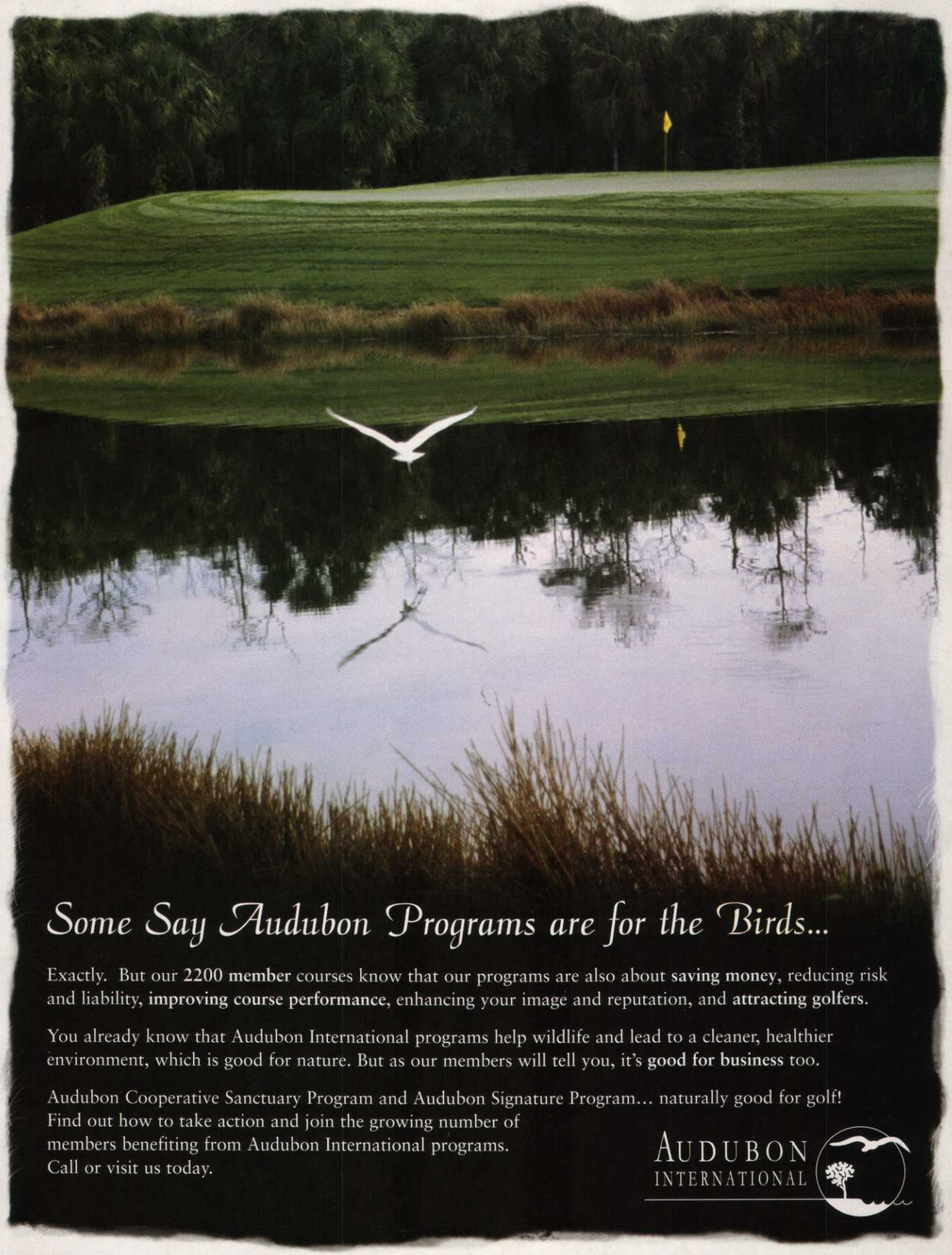
At the Daniel Island Club, Knox worked closely with Fabrizio and others. Knox, who calls his consulting business The Tree Doctor, tapped into his 40 years of experience as an arborist to assist in the project.

Knox was impressed with the Daniel Island staff and the dedication its members showed to preserve the trees. Nobody balked at spending money to preserve the trees, Knox says. Incidentally, Daniel Island spent more than $1 million to preserve them.

"In the long run, what they spent to save those trees will reward them many times over by making their property so much more valuable," says Knox, who advised the golf course construction crew at Daniel Island to place barricades around certain trees to keep bulldozers away from them.

So often, people go into a project similar to that of Daniel Island with no guidance or knowledge of how to protect trees, Knox says. "They end up compacting the soil under the trees and crushing their roots," he adds. "And they change the oil in their bulldozers under a tree's canopy and contaminate the soil and kill the roots."

Continued on page 50



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Continued from page 48

Daniel Island contracted with Environmental Design, a Houston-based tree transplanting company to relocate about 45 trees in the fairway corridors using the company's massive 114-inch spade. Most of the relocated trees were 16 inches to 24 inches in diameter. Moving the trees was a slow process. First, the trees' roots were pruned by hand with axes. Then the trees were allowed to grow through the fall, winter and early spring before being removed by the spade. While some good-sized roots were trimmed, they were replaced with young and growing fibrous roots to take up nutrients and water.

It wasn't just live oaks that were relocated. So were pine trees. While pines aren't as prominent as live oaks, they are important because they provide diversity to the property, Knox says.

How long it took to move a tree depended on its size. With a larger tree, it took about one hour to dig it out and up to four hours to move it. Then it took about another hour to replant it.

Although great care was taken to protect the trees, a few were lost during construction. Some were also taken down because they needed to be, Knox says. For instance, if a tree was decaying and posed a possible danger to golfers, it was removed. "It's not all about tree preservation; it's also about knowing which trees to cut down and why, and getting rid of the junk," Knox explains. "Everything needs to be thinned out, including a forest."

Knox understands why golf courses sometimes have to take out hundreds or even thousands of trees. "Because when the golf course was built ... it wasn't taken into account that there would be too much shade to grow healthy turf because of too many encroaching trees on both sides of the fairways," he says." You can't play a decent round of golf without quality turf."

The tree preservation program at Daniel Island is ongoing. Because the trees receive supplemental nutrients from golf course fertilization and more water from golf course irrigation, they grow faster and must be maintained more often, particularly live oaks. "They will get so heavy with growth that they are prone to damage from winds," Fabrizio says, noting that deadwood and excess foliage must be removed.

Preserving the trees has also allowed Daniel Island to be more competitive in a golf course-heavy region.

"This part of the world has some of the finest golf facilities in the country, and we're going head to head with some formidable competition," Sloan says. "We felt that preserving and enhancing the natural landscape in this manner was something that would help us stand out. Clearly it has."

The live oaks, with their prolific trunks and long-limbed branches, make sure of that. ■