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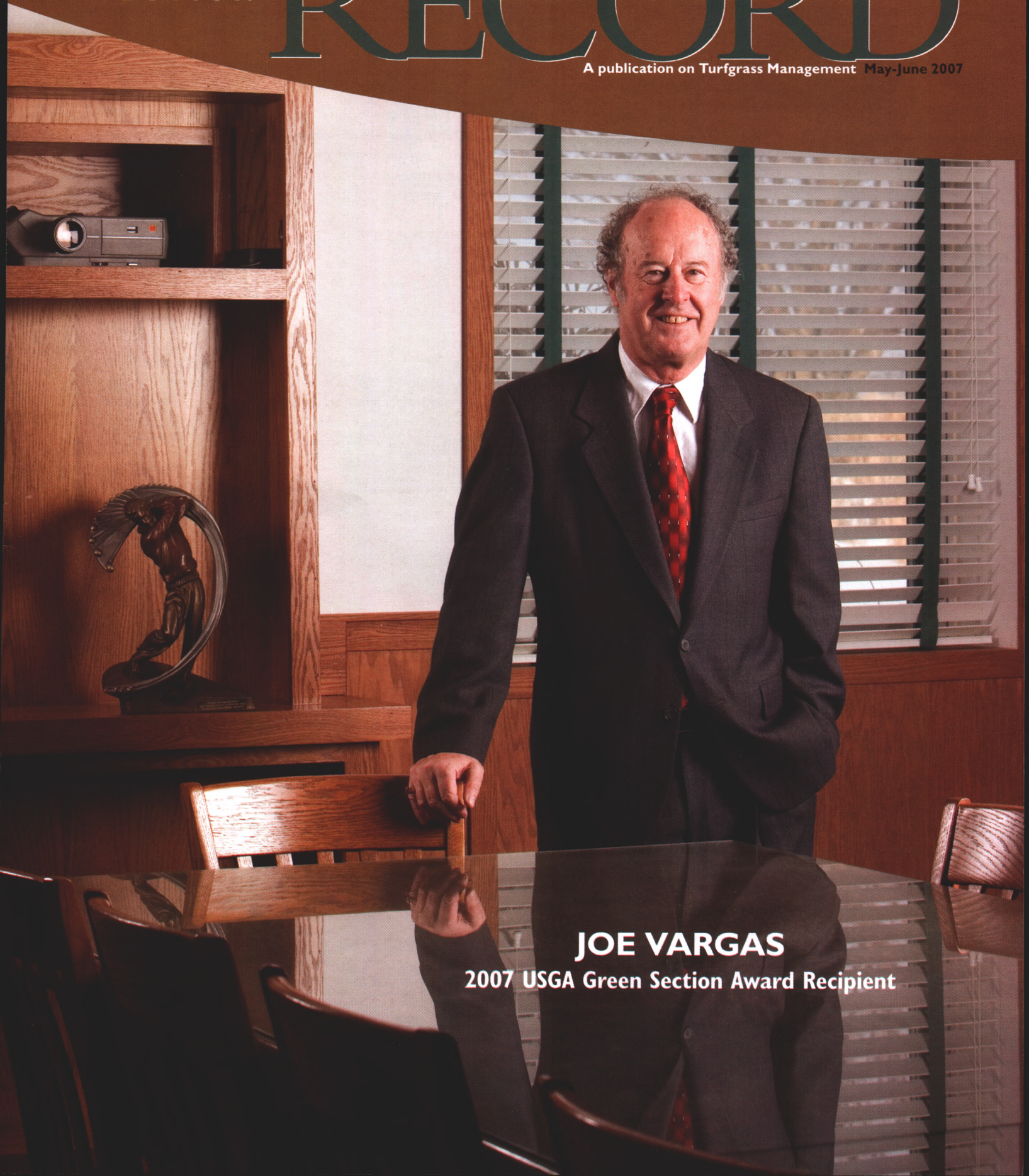

JOE VARGAS

2007 USGA Green Section Award Recipient

Contents

May-June 2007 Volume 45, Number 3

Cover Photo
The 2007 USGA Green Section Award was presented to Dr. Joseph M. Vargas for his contributions as a turfgrass extension specialist, teacher, and researcher who has touched the lives and careers of his students, golf course superintendents and other turfgrass practitioners, and colleagues in academia.

COVER PHOTO: © USGA/PHIL A. WEVER

2007 GREEN SECTION EDUCATION CONFERENCE

Myths, Fads & Fallacies: Their Impact on the Game

February 23, 2007 • Anaheim, California

For the 26th consecutive year the annual Green Section Education Conference was held in conjunction with the Golf Industry Show. This year, more than 1,000 people attended the Green Section's program on Friday, February 23, at the Anaheim Convention Center. Matt Nelson, Northwest Region senior agronomist, served as moderator for the morning's program of eight speakers who addressed this year's theme, "Myths, Fads & Fallacies: Their Impact on the Game."

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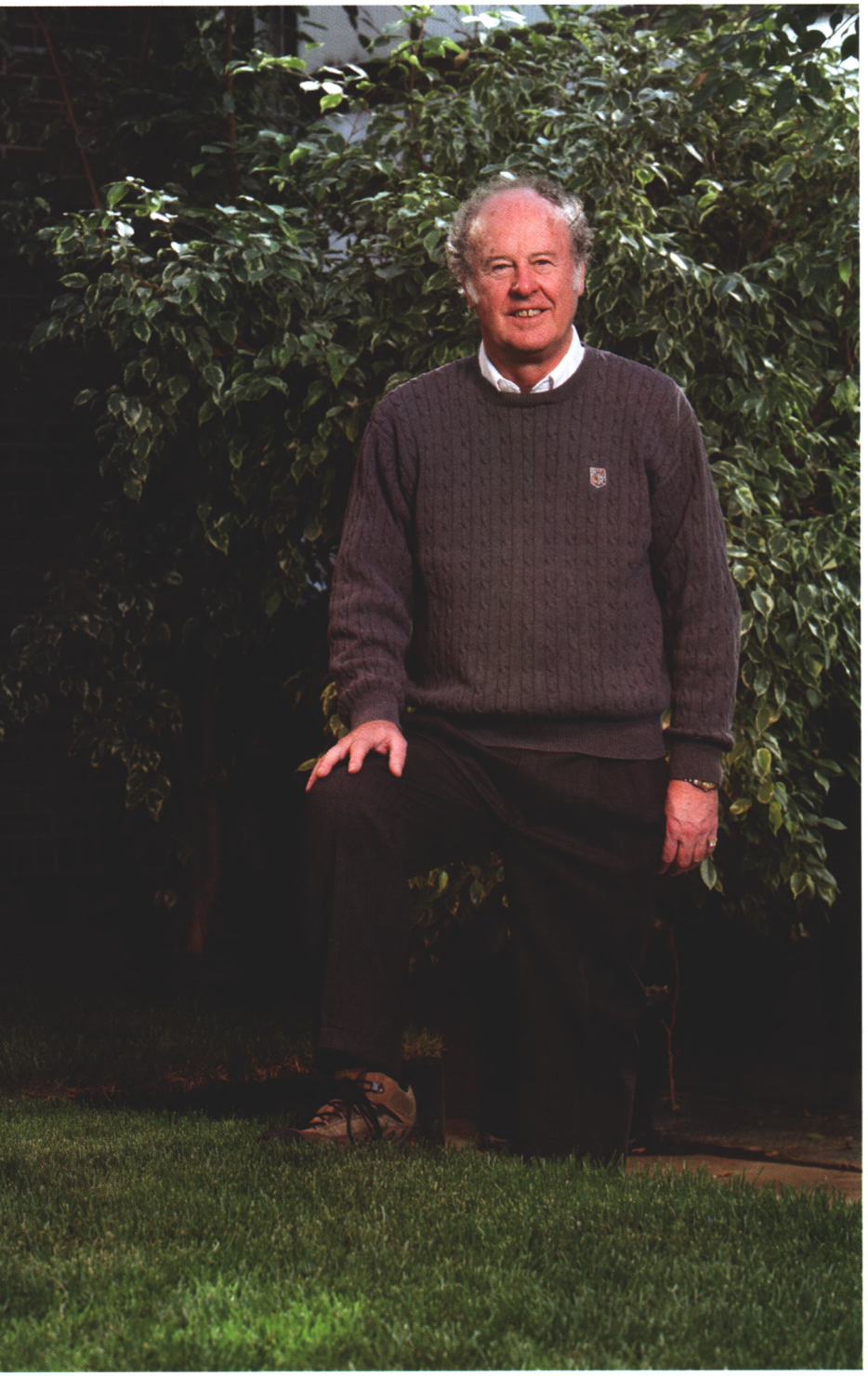
JOE VARGAS

Green Section Award — February 2007



There have been very few turfgrass experts who have made the world their laboratory, and Dr. Joseph M. Vargas is one of them. Starting his journey in Fall River, Massachusetts, as a worker on the maintenance staff at the Fall River C.C., and taking undergraduate and graduate degrees at the University of Rhode Island, Oklahoma State, and the University of Minnesota, Dr. Joe was just beginning a career that would take him around the world many times.

Vargas joined the faculty at Michigan State University in 1968 and for nearly 40 years has excelled as a turfgrass extension specialist, teacher, and researcher, touching the lives and careers of his students, golf course superintendents, and other turfgrass practitioners, and colleagues in academia. But it was his *accomplishments* that brought Dr. Joe the recognition he richly deserves and the invitations he receives to speak to audiences in every corner of the world. For the record, he has published three books, written more than 300 articles on turfgrass diseases, and has given more than 1,000 presentations in his career thus far. He has traveled to every corner of the globe, including Australia, Argentina, China, Europe, England, Mexico, New Zealand, Japan, South Africa, and other countries. In fact, Joe has been instrumental in establishing a joint turf educational program between Michigan State University and four universities in China.

Always searching for an overlooked path that can lead to a successful conclusion, Vargas has resolved problems that have stumped many other experts. In the mid-1970s, for example, he recognized that the decline of *Poa annua* fairways during the summer was caused not by heat stress, but rather by various disease organisms and other factors. This concept was greeted with skepticism from many academics and practitioners until Dr. Joe demonstrated that the regular use of fungicides could allow *Poa annua* fairways to

survive the dog days of summer in good condition. Proper management of *Poa annua* has been a theme of his throughout his career.

Another coup of Dr. Joe's was his discovery of the first known bacterial disease that at the time in the late 1970s was causing a severe decline in Toronto creeping bentgrass on many golf courses in the Midwest. Because of the difficulty and cost in controlling this disease with antibiotics, Toronto creeping bentgrass was ultimately replaced with other cultivars.

In the late 1970s, many courses across the country experienced what was referred to as *black layer* in their greens, a situation that could cause the turf to thin out or die. It was caused in part by poor drainage or overwatering, but why the profile turned black was not at all understood. Dr. Vargas investigated this phenomenon and discovered that high levels of sulfur caused the black color and exacerbated the decline in the turf. As it turned out, many courses were applying sulfur to their greens turf in hopes of suppressing *Poa annua* and encouraging bentgrass. When golf course superintendents reduced or eliminated sulfur from their maintenance programs, the black layer gradually disappeared.

In addition to his many accomplishments, Dr. Joe is a great speaker. With his deep voice, self-confident nature, and persuasive tell-it-like-it-is presentation, it's no wonder that audiences call him back many times over to speak. In fact, he has been known to perform as Elvis at turf conferences and meetings. It endeared him to his audiences, who clearly gave special attention to "The King." Other speakers on the program indeed had a very tough act to follow!

Over a period of four decades, Joe Vargas has distinguished himself as teacher, researcher, and advisor to the turfgrass industry, and you might think he's contemplating a well-deserved retirement. But not Joe! "Why would I ever retire? This is what I enjoy doing, and there's so much more to do. We have to find better ways of managing grasses!"

Steve Smyers, a member of the USGA Executive Committee and current chairman of the USGA Green Section Award Committee and the Turfgrass Environmental Research Committee, was on hand to present the 2007 Green Section Award to Dr. Joe Vargas.

HARVESTING A VALUABLE RESOURCE

Making the decision to undertake a large-scale tree management program is only half the battle. How to pay for it can be a daunting hurdle.

BY DAVID A. OATIS AND JIM SKORULSKI

In recent years, many golf courses have had to embark upon large-scale tree programs to correct problems created by overzealous tree-planting programs initiated years earlier. Planning and implementing a large-scale tree removal project can be challenging in many ways. The process can be lengthy and frequently requires ongoing education of golfers, appropriate committees, and boards on the necessity of the program. The prospect of tree removal programs often becomes an emotional and potentially divisive issue.

The analysis, planning, and educational processes alone can take months or perhaps even years to fully develop. Depending on state and local ordinances, local officials also may need to be convinced that the work is necessary. In some areas, permits may be required before any trees can be removed. Outside consultants often are employed for their specialized knowledge of golf course architecture, trees, and sun angles. These individuals can be invaluable in helping to evaluate the condition and relative value of the trees. They also can help identify exactly which trees need to be removed to maximize turfgrass and tree health and value. Eventually, tree contractors are interviewed and bids to carry out the work are obtained. Next come the budgeting and scheduling processes. Only when all of these steps are completed can the actual process of removing trees begin. Many will argue that getting to the point of actually removing trees is the most challenging aspect of the process.

Assuming all goes according to plan, the trees eventually are cut and carted away, the slash is chipped, the stumps are ground, and a very sizeable bill is paid. The result in most cases is quite remarkable. The formerly hidden topography comes alive and the aesthetic beauty of the course and its key features improve. The growth rate of any remaining trees usually increases dramatically as a result of the reduction in competition among trees, and a marked improvement in turf health and vigor can often be documented. However, it must be noted that turf accustomed to a very shaded environment often experiences some extra stress for the first season or so after its environment is radically altered. The grass species that are well adapted to a shaded environment frequently do not fare as well in full sun, and it may take a year or more for the turf to adjust and for better-adapted species to get a foothold.

Some courses do much of the work in-house, and costs are harder to compute; however, some grossly overplanted courses in the New York metropolitan area have spent as much as $500,000-$700,000 and more to have contractors remove the trees and stumps, clean up the debris, bring in topsoil, and restore the turf. With such a potentially large price tag, it makes sense to explore alternative means of tree removal in order to control costs. It is not practical everywhere, but trees can be worth plenty if you happen to have enough of the right types of mature tree species that are in good condition. Geographic location does enter into the equation. Distance from a potential buyer and the associated trucking costs greatly influence the financial outcome. Unfortunately, the relative quality of golf course trees generally is not high, often as a result of poor care and maintenance, undesirable varieties, or excessive competition among trees.

Mature hardwood and softwood trees that can provide timber and veneer offer the highest values. Smaller and lower-quality trees can sometimes be marketed for fuel wood and pulp. The idea of harvesting trees is not original. It is believed that the trees removed during the construction of Hackensack Golf Club (Oradell, New Jersey) were used to construct the clubhouse, and this is likely to have occurred at other early American golf courses.

This turf tip is not a new one, and it comes from the many courses that have utilized one or more different strategies in completing their tree work. Most notably, Oak Hill C.C. in Rochester, N.Y., and Beacon Hall Golf Club in Ontario, Canada, utilized portable sawmills to better utilize their tree resources and to reduce the costs associated with removals. The lumber generated was used to upgrade mainte-

nance and storage facilities and to build restrooms on the golf course. Many other courses elsewhere in New Jersey, New York, and Connecticut have utilized large-scale logging companies to remove trees quickly and efficiently. Riverton C.C., Sleepy Hollow C.C., Round Hill Club, Hop Meadow Club, Yale Golf Course, The Patterson Club, and Concord C.C. are just a few that have chosen this route.

Harvesting trees is not practical for all golf courses. Many factors need to be taken into consideration, such as the location of the golf course and its proximity to potential markets; the volume of mature, marketable timber available for harvest; and the availability of an adequate area to stockpile the logs, and mill and store the lumber generated. If the sawmill is too far away and the quality/volume of wood is not substantial, it may not be possible to attract much interest.

For many golf courses, the only practical approach is to pay to have the trees removed. However, a large number of golf courses are defraying the removal expense in various ways.

- Traditionally, courses have used local tree contractors who are skilled in tree care and pruning. Putting large-scale work out to bid can generate healthy competition and may lower costs substantially.
- A few courses have used land-clearing companies with large-scale logging equipment. This type of contractor can do the work very quickly and with less labor than traditional tree companies, ultimately generating considerable savings. However, they also may cause more damage to the course, so the benefits have to be weighed.
- Some courses have hired logging companies to remove and pay for the desirable timber. This money then can be used to pay for the removal of additional trees and restoration of the turf.
- Other courses have allowed loggers to harvest the desirable trees, and, as part of the agreement, the logger removes other undesirable trees in lieu of payment.
- A number of golf courses have made agreements with firewood contractors to remove hardwood trees in exchange for the wood harvested.
- In some cases, golfers and/or the public are allowed free access to firewood generated, eliminating the cost incurred in disposal.
- Some courses have given their wood chips to contractors who produce mulch and have received a lifetime supply of mulch in return.
- Oak Hill C.C. and Beacon Hall G. C. brought in portable sawmills to generate usable lumber on-site. The lumber was then used for various course projects.
- Eastern trees commonly harvested for saw timber include: pine spp., oak spp., sugar maple, ash, red maple, black cherry, hemlock, spruce, yellow/black birch, tulip poplar.

Tree work may sound easy, but the resulting debris can be substantial and likely will have a major impact on the budget. Tree projects can generate potentially valuable wood that can be sold and used to create lumber.

A forestry background, although helpful, is not a prerequisite to implementing a harvesting program. Information and guidance are available to help you get started, and a good place to begin is with your state extension service or state forestry department. Most have excellent Web sites devoted to forestry and woodlot management. There you should be able to locate the state or county extension service forester who can conduct a site visit and provide a preliminary assessment of the trees and the potential for harvest. The forester will offer advice for the best harvesting options and should have contacts to private foresters and contractors who work in the region.

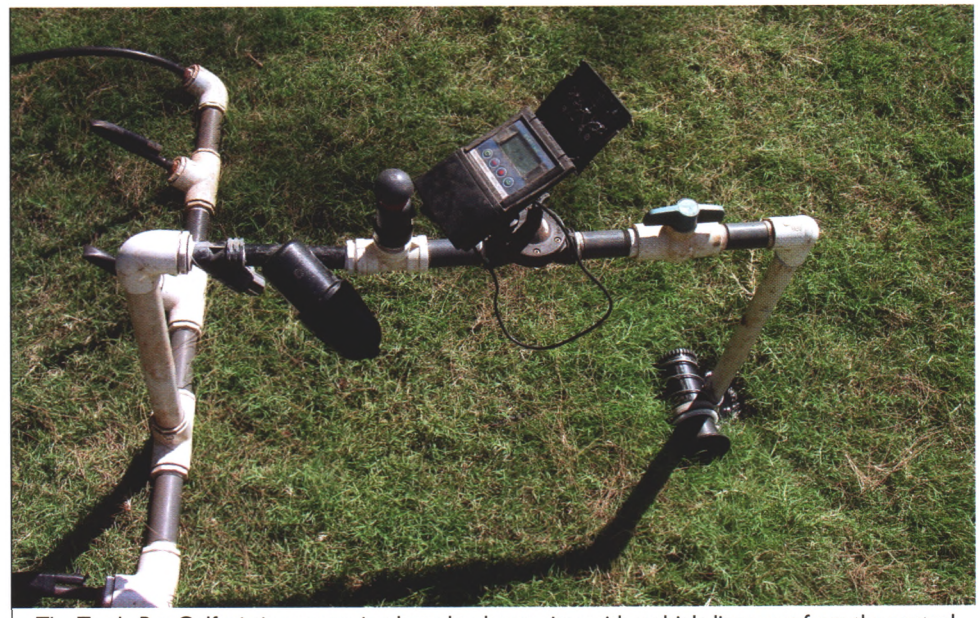
Clearly, many factors come into play in determining whether harvesting trees will be a viable approach for your course. However, when considering the potentially expensive prospect of large-scale tree work, it may be worth considering alternative methods to help control costs and better utilize a potentially valuable resource.

DAVID OATIS *has been the director of the Northeast Region of the USGA Green Section since 1990.* JIM SKORULSKI *is a senior agronomist in the USGA Green Section's Northeast Region based in Massachusetts.*

MISTER AND MISSES

The survival of seedlings and sprigs with adequate moisture can be assured with this simple technique.

BY LARRY GILHULY



The Turtle Bay Golf misting system is adapted to larger sites with multiple lines sent from the control system. The lines have been pressure reduced from the regular irrigation system.

The principles of grass seed/sprig establishment are well known. Adequate temperature, fertilizer, light, and air are all necessary to start and continue the growth process of every type of cool- and warm-season grass. However, the one variable that often determines the success or failure of initial establishment is adequate water. Over the years, the standard

The low throw angle and precipitation of this type of misting system is ideal for wind-swept sites when growing-in sprigs or seeds.

practice of using the existing irrigation system with multiple cycles has been used; however, the following problems can sometimes occur:

- Wind causes dry areas, which requires reseeding/sprigging.
- Excess water volume at the end of the large nozzle causes seed/sprigs to move slightly, requiring reseeding/sprigging of small areas.
- Too long between cycles, which causes drying of seed/sprigs.
- Excess water during establishment, which causes seedling disease.
- Disruption to nearby players.

The establishment of greens, tees, and other smaller areas (along with large acreage areas) has certainly been completed with success by using existing irrigation systems. Although irrigation is a necessity for the grow-in of a new golf course, the preceding points do not necessarily make them the best choice on an existing golf course where smaller areas must be established. With this challenge in mind, a simple idea observed in Hawaii at multiple sites during the past decade may be of interest if you want to eliminate the potential for seed/sprig failure. A supplemental form of irrigation that provides a "24/7" approach to irrigation coverage is highlighted in this turf tip as a sure-fire way to keep your sprigs or seed moist enough at all times to assure rapid germination and seeding/sprig establishment.

Mike Honma, superintendent at the Turtle Bay Resort on the Island of Oahu, has been the golf course superintendent at Turtle Bay since the time of original construction, and he has experienced both hybrid bermudagrass and seashore paspalum establishment on the same golf course. This extremely windy site posed the problem associated with a regular irrigation system where the water from high-throwing heads is simply displaced by the wind, resulting in inconsistent coverage during establishment. He also wanted to find a way to avoid disturbing golfers when tee and cart path renovation work was being done. His answer was a simple misting system that he has used on seashore paspalum sprigs on greens, green surrounds, tees, and other small areas with very positive results. The system covers approximately 9,000 sq. ft. at a cost of approximately $0.15/sq. ft., and its components can be found in the accompanying sidebar table. According to Mr. Honma, this method of sprig establishment has been more effective and faster than relying on his regular irrigation system. For more information, contact Mike Honma at Turtle Bay Resort at 808-293-8574.

Milton Nakagawa, superintendent at the Mauna Kea/Hapuna Resort, has had similar success with hybrid bermudagrass sprigs on tees and other small areas at both golf courses on the Big Island of Hawaii. He also wanted to find a way to apply water in nearly constant wind while not bothering golfers. The components of Mauna Kea's misting system cost an estimated $0.15/sq. ft., and it covers approximately 1,200 sq. ft. Mr. Nakagawa also reports a preference for this type of small area misting system, as it keeps the sprigs moist at all times without overwatering and is less affected by the persistent wind. Both superintendents report no disruption for golfers, other than a few cooled-off ankles! For more information concerning this system, contact Mr. Nakagawa at 808-880-3131.

The use of this unique form of misting system for growing-in sprigs or seed offers a simple way to consistently provide needed moisture during the critical portion of early establishment. It also is the perfect answer if you are concerned about bothering golfers who may come in close proximity to the renovated location. Whether you are a "Mr." or "Mrs." growing-in new turf areas, this is one "mister" that will greatly reduce the "misses" that can occur with a regular irrigation system when dealing with small area establishment of sprigs or seed.

LARRY GILHULY *is director of the Green Section's Northwest Region.*

TURTLE BAY MISTING SYSTEM

1	DC Propagation Controller with 1" valve
120	SuperNet Brown Nozzle X Purple LR Swivel, 30" Tube & Stake
1	0.5" x 1,000' blank RAM tubing, .57 inside diameter x .66 outside diameter (17 mm)
1	0.5" x 250' blank RAM tubing, .57 ID x .66 OD (17 mm)
1	1" mipt, Air/Vacuum Relief Valve
1	0.75" x 80 mesh disc filter
1	0.75" x 43 psi. pressure regulator
	Multiple bushings, elbows, tees, nipples between tubing and water connection point
	Manifold assembly — outside source

MAUNA KEA MISTING SYSTEM

1	DIG Controller 1" Single DC
125'	Poly tubing 0.75" Roberts
28	EFCO Mini Compact Brown 42 gph / 29' diameter
28	EFCO 36" tube with Cantal assembly
28	EFCO stake 13" press fit
1	Senninger PRV 30 psi 1" 2-20 gpm
	Minor fittings

Research*You Can Use*

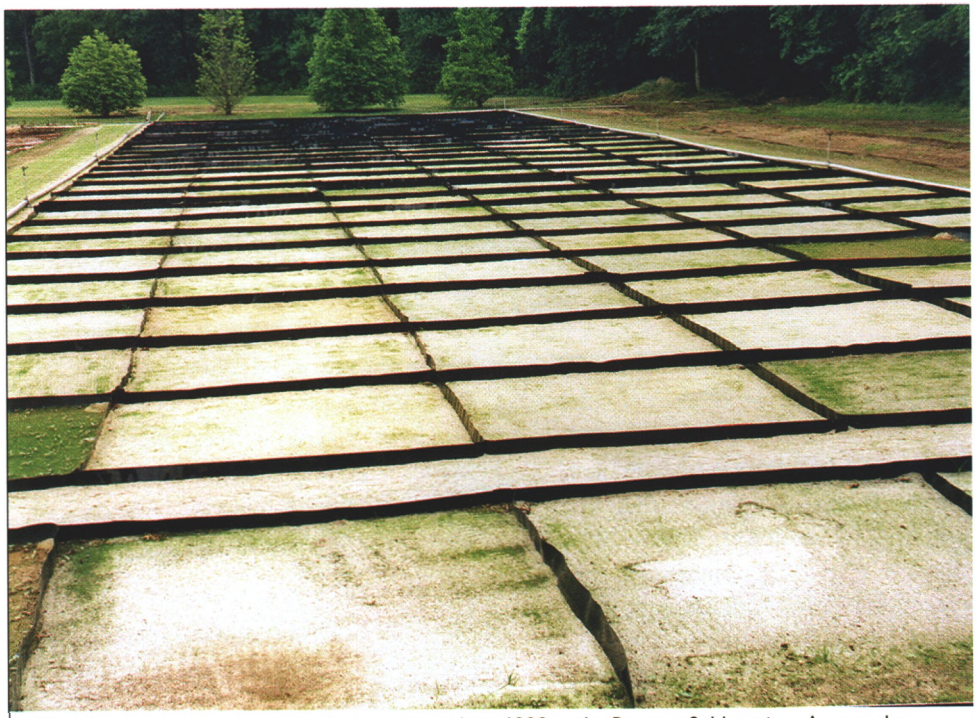
Rootzone Amendments for Putting Green Construction

So many greens, so many soils, so many soil amendments. Making sense of it all.

BY JAMES A. MURPHY

Sandy, infertile soils have long been recognized as highly suitable for golf courses since the earliest days of golf course development on the links land bordering the sea in Scotland (Alister Mackenzie, 1995). Such land provides good drainage and low to moderate turf growth, both conducive to playing the game of golf. As interest in the game expanded, golf courses were built in locations lacking sandy, infertile soil. Thus, the need arose for specifications to guide the construction of rootzones (soil), particularly for putting greens, that were suitable for the game. The USGA Green Section first published guidelines on rootzone construction in 1960, with the most recent update being completed in 2004. These guidelines primarily describe the physical parameters for constructing a rootzone that will create a well-drained playing surface. Research has demonstrated that the range of properties described in the guidelines is large enough to provide a notable range in the behavior of the rootzone (that is, requirements for water and nutrient management). Thus, particular combinations of sand and amendment(s) can be selected to produce a specific influence on the vigor of the turf, which, as previously mentioned, is often intended to be low to moderate for good playing conditions.

The selection of amendment(s) for a sand mix varies throughout the United States and other parts of the world, and it is often based on the biases of individuals involved in the design, construction, and future management of new or rebuilt putting greens. Regardless of personal biases, it is important to understand that sand and amendments should be selected based on climatic and other environmental and management conditions that can limit putting green performance. Peat continues to be the most widely used amendment for sand-based rootzone construction; however, a number of materials have been proposed and used over the years as a replacement for peat in sand-based rootzones. Many involved in the design and construction of putting greens do not realize that considerable insight has been gained from recent research on putting green rootzone materials. This article summarizes major findings from a nine-year field study of rootzone amendments conducted by the Rutgers Center for Turfgrass Science and draws from the findings of others as well.



This photo shows one grow-in plot location in June 1998 at the Rutgers field station. Among the objectives of this study were to evaluate the effects of 1) sand size distribution, 2) plot locations (poor vs. excellent air circulation), 3) rootzone amendments, 4) rootzone depth, 5) options to reduce water and nutrient inputs for managing putting greens, and 6) rootzone physical and chemical changes over a nine-year period.

Image 1. Profile samples of nine-year-old rootzone plots visually indicate that very little organic matter has accumulated within the original rootzone (note yellow sand color of 100% sand profile on left) compared to the large amount of organic matter above the rootzone (note brown colored thatch-mat layer of both profile samples). Profile on right is from an 80:20 (v/v) sand-peat rootzone mix, which has a similar accumulation pattern.

100% SAND CONSTRUCTION (NO AMENDING)

Constructing putting greens with 100% sand (non-amended) is popular with some architects, builders, and superintendents. The cost savings in construction associated with not blending an amendment into the sand is typically the primary justification used by advocates for straight-sand construction. However, often overlooked are the increased long-term costs associated with maintenance of these putting greens, discussed later. Construction with 100% sand is also rationalized with the misconception that problems associated with the accumulation or organic matter (thatch) will be reduced by this type of rootzone. Advocates argue that accumulating organic matter "amends" the sand rootzone over time, therefore eliminating the need to amend the sand at the time of construction (Hurdzan, 2004). Research has proven that this concept is flawed. Measurements of organic matter accumulation in field studies clearly indicate that the vast majority of organic matter addition is not in the rootzone (Table A and Image 1). Rather, the majority of organic matter accumulates above the rootzone in the form of thatch or mat, which is thatch plus topdressing. It is the thatch-mat layer above the rootzone that reduces water infiltration and increases water retention at the surface of putting greens, not the underlying rootzone. A rootzone of 100% sand does not become "amended" over time and will continue to have very low (too low) water and nutrient retention. The end result is putting green turf that requires frequent, intensive management inputs to avoid drought stress and maintain adequate plant nutrition.

On the other hand, experience demonstrates that the dry, infertile condition of 100% sand construction does gradually alleviate over time as the developing thatch-mat layer becomes thick enough to improve water and nutrient availability. Never-

Table A

Concentration of organic matter and saturated hydraulic conductivity of surface layers of putting green rootzones after nine years of growth of L-93 creeping bentgrass maintained as putting green turf in North Brunswick, N.J.

	Organic Matter Concentration[1]		Saturated Water Conductivity[2]	
Profile Layer	100% Sand	90:10 Sand-Peat[3]	100% Sand	90:10 Sand-Peat
	% by Weight		Inches per Hour	
Thatch-Mat layer above the rootzone (1.3 inches thick for sand) (1.4 inches thick for 90:10 sand-peat)	4.52	5.38	7.8	8.3
0- to 3-inch depth of the rootzone	0.22	0.40	32.1	28.5

[1]Organic matter concentration determined by combustion (360° C) of 3-inch-diameter cores taken from the respective layer of the rootzone plots in 2006.

[2]Saturated water conductivity determined from undisturbed 3-inch-diameter cores taken from the respective layer of the rootzone plots in 2006.

[3]Type of peat is sphagnum.

theless, our field trial experience indicates that there are meaningful differences between a rootzone of 100% sand and a sand-peat rootzone even after nine years (Figure 1). Turf performance on 100% sand plots frequently was poorer than turf grown on sand-peat rootzones. Also, hand-watering needs were sometimes greater (more frequent) on 100% sand rootzones than sand-peat rootzones (Figure 2). The author and numerous USGA agronomists have worked with many superintendents in every region of the country who struggle with water management on 100% sand putting greens during dry weather, even during late winter months when evapotranspiration is low. Thus, it is unreasonable to expect thatch-mat layer development on 100% sand rootzones to match the performance of putting greens constructed of a sand-peat mix without an increase in maintenance costs. Moreover, there will be opportunity costs incurred by the superintendent and staff; that is, the additional time managing 100% sand putting greens will take time away from other management needs on the golf course. Eventually, the unending need to assess and tweak the management program of 100% sand putting greens can shift from an intriguing mental challenge for the superintendent to a seemingly infinite frustration.

INORGANIC AMENDMENTS

Various mineral sources — including clay, diatomaceous earth, clinoptilolite (zeolite), and volcanic rock — are used to produce inorganic amendments (IAs), which are comprised of hard, porous (lightweight) sand-sized particles. The internal pores of IAs increase effective surface area within the rootzone and are small enough to retain water against the pull of gravity (capillary) as well as increasing cation exchange capacity (surface chemistry). The amount of CEC depends on the mineral source of the IA; generally, zeolites have the greatest CEC.

The improved nutrient retention of a sand-IA mix can improve turf vigor and quality, especially during establishment of new turfs when ample amounts of water and fertilizers are being applied (Murphy et al., 2004). However, the longer-term effects of sand-IA mixes on turf vigor and quality are not as consistent as those observed during establishment (Figure 1). The differences in turf performance between establishment and maintenance programs on sand-IA rootzones are often attributed to water availability. Despite greater water retention for sand-IA mixes, we only observed sand mixes with Axis™ and Isolite™ to reduce the need for hand watering compared to 100% sand rootzones (Figure 2). Sand-IA mixes with Profile,™ Greenschoice,™ and ZeoPro™ typically required similar hand-watering as 100% sand rootzones. At various times during the trial, localized dry spot developed in some plots of 100% sand, 90:10 sand-IA mixes of Profile™ and Greenschoice,™ and 95:5 and 80:20 sand mixes with loam. Putting greens on golf courses constructed of sand-IA mixes have also been observed to suffer droughty conditions and localized dry spot. Reasons for these observations continue to be studied, but it is likely that changes in the structure of macropores (air-filled porosity) versus micropores (capillary porosity) within the rootzone profile contribute to performance issues related to water. Thus, our experience indicates that medium sand mixed with IAs will be very well drained and aerated, but some sand-IA mixes can suffer from droughty conditions.

The fact that IAs do not decompose is another purported benefit. Since organic matter can undergo decomposition, it is argued that organic amendments in a rootzone will degrade into

finer particles and contribute to the challenges of managing organic matter in a rootzone. Focus on the rootzone profile is one important flaw in this rationalization. Our research and others clearly show that it is the accumulation of organic matter above the rootzone that is the site of declining physical conditions, not the rootzone mix itself (Table 1). The physical changes in the rootzone of a sand-peat or sand-compost mix are relatively small and of little consequence compared to the changes occurring above the rootzone mix. This observation, combined with the fact that turf performance on sand-IA mixes most typically does not exceed that of sand-peat or sand-compost mixes, indicates that the agronomic value of a non-decomposing amendment in the rootzone profile is very limited. Moreover, high-quality peat amendments are typically humified; that is, the organic matter has been microbially altered into relatively stable organic matter.

Thus, other benefits may be needed to justify the greater cost of constructing putting green rootzones with IAs. There are some advantages to IAs that may be important. The better IA products are very uniform and therefore make quality control easier, unlike peat and compost, which can vary considerably in water content, other physical attributes, and chemical properties during the blending operation. Inorganic amendments are very dry and flowable, making blending much easier and more consistent. Inorganic amendments will displace a significant volume within a mix with sand, whereas peat does not. For example, blending 7,000 cubic yards of a 90:10 sand-IA rootzone mix will require approximately 10% less sand than a 90:10 sand-peat mix. This 10% reduction in sand (700 cubic yards) will significantly reduce shipping costs. If peat were to be used, you will still need to haul all 7,000 cubic yards. Nelson (2003) discussed this in a cost analysis of materials for constructing 140,000 sq. ft. (3.2 acres) of putting green rootzones using either peat or IAs. This analysis demonstrated that use of a

Table 1
Data pertaining to Figure 1 (Quality)

Treatment	1999	2000	2001	2002	2003	2004	2005
Sand 100%	6.8	6.5	7.0	5.6	4.1	5.3	5.2
Sphagnum 10%	7.4	6.5	6.8	5.9	6.0	6.8	6.0
Reed Sedge 10%	7.3	7.6	7.4	6.4	7.1	7.9	6.5
AllGro 10%	7.3	8.0	7.6	8.2	7.9	8.5	8.0
Profile 10%	5.6	6.6	6.4	5.7	4.6	5.8	6.7
ZeoPro 10%	6.2	7.1	7.2	6.2	4.7	6.8	6.9
LSD	0.3	0.7	0.4	0.6	0.8	0.7	0.5

Figure 1. Average annual turf quality ratings for L-93 creeping bentgrass grown on rootzone plots in North Brunswick, N.J., from 1999 to 2005. All amendments were mixed at 10% by volume with medium sand that conformed to USGA guidelines. Error bars represent the least significant difference among means ($P < 0.05$); that is, mean differences greater than the error bar are statistically different.

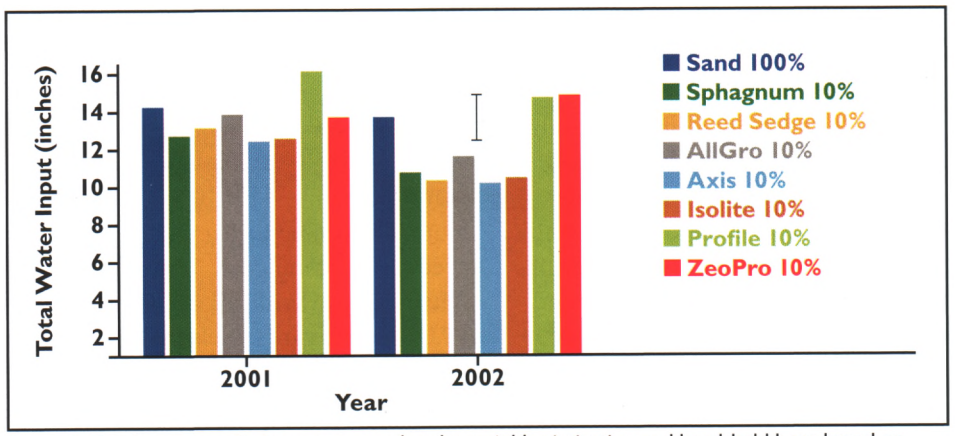


Figure 2. Total water applied to rootzone plots by sprinkler irrigation and hand-held hose based on visual wilt stress and low soil water content measurements from April to October of 2001 and 2002. Hand watering was done to avoid overwatering plots that were able to retain a greater amount of plant-available water and reduce the frequency of watering. Sprinkler irrigation applied 8.7 inches of water in 2001 and 8.8 inches in 2002. Error bar for 2002 represents the least significant difference among means ($P < 0.05$); that is, mean differences greater than the error bar are statistically different. No differences were observed among root zones in 2001.

Table 2
Data pertaining to Figure 2 (Water input, inches)

	2001	2002
Sand 100%	14.34	13.78
Sphagnum 10%	12.87	10.69
Reed Sedge 10%	13.22	10.44
AllGro 10%	13.98	11.66
Axis 10%	12.52	10.34
Isolite 10%	12.64	10.51
Profile 10%	16.24	14.72
ZeoPro 10%	13.74	14.83
LSD	NS	2.4

sand-IA (90:10 by volume) mix would increase material cost by $86,000 on average compared to a sand-peat (90:10) mix. The analysis used modest values for shipping cost compared to today's costs, and thus would be a significant underestimate. A savings in shipping cost may be a substantial factor for some regions in the United States where high-quality sands and/or organic amendments are not readily available, particularly considering the recent increase in fuel costs.

COMPOST

Compost is a very popular organic amendment among those interested in "organic" or "natural organic" methods to manage turf and other plants. Unfortunately, the quality and consistency of composts can vary widely, presenting a significant challenge when selecting composts. The physical, chemical, and biological qualities of compost will vary depending on the source material (feedstock) as well as the composting process itself. Unlike fertilizer products, there are limited government regulations or certification standards in place that provide a guaranteed analysis for compost. Thus, the onus of documenting compost quality and consistency (quality control) often falls to the buyer.

High-quality composts for amending sand rootzones are produced by aerobic decomposition of organic matter and should be mature, stable, and weed free. Examples of organic matter sources for compost (feedstock) include agricultural, food or industrial residuals, class A biosolids, yard trimmings, or source-separated municipal solid waste. Composted biosolids should meet all applicable USEPA CFR, Title 40, Part 503 Standards for Class A biosolids. Compost should be free of objectionable odors. Nutrient content can vary, but compost used to amend sand should be slightly acidic (pH 6.2-6.8), relatively low in salts (EC<10dS/m, preferably <5dS/m), and low in chemical (arsenic, cadmium, lead, zinc, etc.) and biological (pathogens, weed seed) contaminants. Composts should not contain visible refuse or other physical contaminants, substances toxic to plants, or sufficient fine particles such that the specifications for particle size distribution and other physical properties of a sand-compost mix cannot be met. Blending operations will proceed more easily and be more uniform if the compost is moist but not excessively wet (not clumpy) and capable of passing through a screen. Certainly, there should be no visible water or dust produced when handling compost. More information on compost specifications can be viewed at the U.S. Composting Council Web page: http://compostingcouncil.org/pdf/fgcu_4-Characteristics-Parameters.pdf.

The composts evaluated in our trials have generally improved soil fertility, particularly phosphorus and micronutrient content. Turf performance on a 90:10 sand-compost mix was as good as or better than sand-peat mixes (Figure 1), and hand-watering needs were similar to 90:10 sand-peat mixes (Figure 2).

These research findings, along with an ample supply of consistent and high-quality composts within the NY/NJ/PA region, have encouraged more blenders and suppliers of sand mixes to offer compost as a component of construction mix products. It cannot be overemphasized that the quality of compost is essential for success. There are unfortunate examples where use of an improperly composted material had disastrous results. Thus, buyers should confirm (test) the quality and consistency of composts or sand-compost mixes available in your region before using.

FINER-TEXTURED SOIL

Sand can also be amended with a finer-textured soil to subtly increase the organic matter and fine particle size content (silt and clay) of a mix, which is intended to improve nutrient and water retention. We observed that sand-loam mixes were effective at improving nutrient retention and turf quality in our trials; however, we could not demonstrate improvements in water availability by amending sand with loam. Moreover, we found that amending sand with excessive amounts of loam (too much silt and clay) resulted in a more compacted rootzone and turf that was very sensitive to drought stress.

Putting green construction using finer-textured soil native to the site was very common during the early years of golf course construction; this type of construction is often referred to as "push-up" greens. These native soils were often mixed with small amounts (relative to today's standards) of sand and/or an organic matter source such as manure, compost, or peat. Additionally, many "push-up" greens have been aerated and topdressed for numerous years, developing as much as 6 inches of an improved rootzone over the original soil profile. This improved rootzone in the uppermost profile is generally much closer to current USGA construction mix guidelines than the original underlying soil base.

Many older golf courses in cooler temperate climates have outstanding putting greens originally constructed and managed in this way. However, repositioning, expansion, or recontouring of putting greens is sometimes necessary to update older golf courses and accommodate modern playing standards. Use of sand-based construction in these cases can produce significant inconsistencies in playability and turf management that are undesirable. As a result, there is interest in mimicking push-up construction on older golf courses.

Our research corroborates field observations of excellent putting greens maintained on sand-topdressed push-up greens. However, mimicking push-up construction has two major challenges: developing a successful profile design and identifying a builder experienced in construction means and methods compatible with manipulating and layering of finer-textured soil. Detailed specifications for this type of construction are not available due to the wide variation in soil textures and layering used to construct and manage putting greens on older golf courses. Thus, it is essential to work with a qualified agronomist who can assist in rootzone design and the interpretation of physical property tests of potential construction materials (soils).

Dr. Jim Murphy describes results of the comprehensive root zone mix project at the Rutgers Field Day in August 2005. The USGA, GCSAA, and other state and regional associations helped fund this landmark nine-year study.

Inclusion of an improved sand-based layer in the uppermost part of the profile is an essential design element in this type of construction. Care must be taken to avoid working the native finer-textured soil when it is too wet or too dry. It is essential that the builder have an understanding of how to till and firm the soil so that excessive settling is avoided, yet prevent excessive compaction during the construction process. Lightweight equipment with low p.s.i. tracks or turf tires must be used to avoid excessive compaction of the soil. These can be difficult challenges for inexperienced builders, so diligence in selection is critical.

SUMMARY

Research clearly documents the benefits of properly amending sand for construction of putting green rootzones. Justifications for not amending sand are clearly based on short-term cost savings and not improvements in long-term management or costs. While IAs can improve some characteristics of a sand mix, a cost-benefit analysis should be considered since IAs are not typically cost effective in a sand mix where high-quality sand and organic amendments are readily available at moderate shipping costs. Compost can also be a highly effective amendment in a sand mix; however, it is critical that a high-quality and consistent supply of compost be identified before selecting. Push-up putting green construction may be appropriate in situations requiring expansion, recontouring, or movement of greens on older golf courses. Push-up construction requires a thorough understanding of finer-textured soil and layering (i.e. a skilled agronomist) as well as an experienced builder to be successful.

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Dredging Up A New Idea

Using remote dredging technology for golf course ponds.

BY PATRICK J. GROSS

The hydraulically powered suction-head dredge vacuums sediment from the bottom of the lake and pumps the slurry to the processing area one-half mile away.

From the time a lake is built, it slowly becomes contaminated with debris. Over a number of years, the layer of sediment builds, the lake becomes more shallow, and increasing problems are experienced with algae and water weeds. At this point, many courses face the daunting task of dredging the lake; however, such a project is often very costly, disruptive, and time consuming.

The Canyon Lake Golf Community in Canyon Lake, California, was facing this situation on their 400-acre recreational lake. An analysis of the lake indicated that more than 225,000 cubic yards of sediment needed to be removed to restore the lake. Draining the water and removing the sediment with large earthmoving equipment was not a desirable option due to the expense, disruption, and the extended time period that such an operation would entail. The general manager of the Canyon Lake Homeowners Association, Paul Johnson, did an internet search to investigate various options for dredging. He came across several references to a remote dredging technique that uses a suction head dredge that would allow them to remove sediment without having to drain the lake, while processing the sediment and debris in a remote location.

The process involves placing a small floating dredge in the lake. A flexible pipe with a hydraulically controlled suction head device is operated across the bottom of the lake to vacuum the sediment and pump it up to three miles away to a processing area on the shore. Processing the sediment involves the following steps:

- Rocks and larger debris are separated through a processing screen.
- Polymers and flocculants are injected into the slurry.
- The treated slurry is pumped into a dewatering bin, which is essentially a large dumpster with a special filter fabric liner in the bottom of the container. For smaller operations, a belt press can be used to remove the water from the sediment.
- Clean drainage water flows out the bottom of the bin and is collected in a storage area and then is pumped back into the lake.
- Once the sediment has dried, it is hauled to a nearby construction site to be used as fill material for a new housing development.

The scope of the Canyon Lake dredging operation was quite large compared to most golf course situations.

The equipment used is capable of processing 200 to 250 cubic yards of sediment per day. This same type of equipment is available in smaller sizes and can be hauled with a pickup truck and small trailer for use in golf course ponds. The equipment can be rented (as was the case at Canyon Lake), or contractors are available to provide this service. The overall cost of processing the material ranges from $4 to $7 per cubic yard and does not include hauling or disposing of the sediment, which is the largest expense of the operation.

There are several benefits associated with remote dredging technology, including:

- Less damage to the golf course and areas immediately surrounding the lake.
- The material can be pumped and processed up to three miles away from the dredging site, making it less intrusive to the golf operation.
- The lake remains full at all times.
- A significant increase in overall water storage capacity.

A simple internet search of "pond dredging equipment" will provide several references to this type of equipment and various contractors who can perform the job. In the case of the Canyon Lake Golf Community, state and federal grants were available to help offset the cost of renting the equipment and implementing the project.

In the past, pond dredging was a messy, time-consuming, and disruptive process. This new remote dredging technology is ideally suited for golf courses and is capable of removing the sediment and processing the material offsite without disrupting the golf course.

PAT GROSS *is the director of the USGA Green Section Southwest Region, where he dredges up new and old ideas to assist golf courses in California, Arizona, Nevada, and Mexico.*

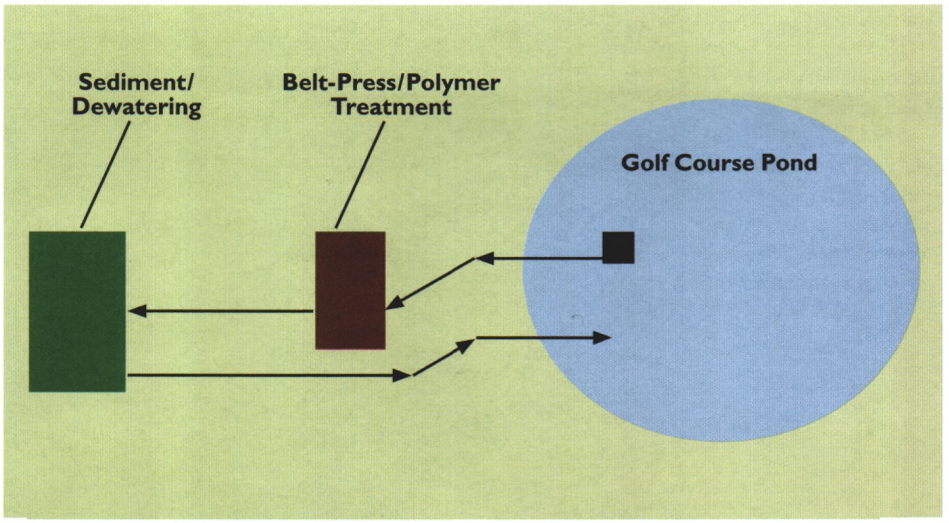


Diagram of the remote dredging process. The sediment from the lake can be pumped up to three miles away to the treatment and dewatering area and the clean water returned to the lake.

After mixing the slurry with a polymer and flocculant, it is pumped to a dewatering bin to separate the sediment from the clean water. From there the clean water drains from the bottom of the dewatering bins and is pumped back to the lake.

The overall philosophy of a U.S. Open setup has not changed significantly over the last half century. Prior to the event, the golf course is carefully studied to ultimately provide conditions that test a player's accuracy, distance control, ability to recover from trouble, and overall shot-making skills.

Preparing for Golf at the Championship Level

The facts about U.S. Open site selection and golf course setup.

BY MIKE DAVIS

The U.S. Open Championship was first played in 1895 at Newport Golf Club, but, unlike today, preparation for the early Opens was minimal. In fact, the inaugural National Open Championship was postponed by a month when the USGA decided it was best not to compete over the America's Cup yacht race dates. Agronomic conditions of the courses were substantially different then — consistent and near-perfect playing conditions were not available. Furthermore, the USGA had little to do with the golf course setup; that was left to the host club.

Now let's fast-forward 112 years and see what happens in preparation for a U.S. Open.

Before a venue is selected to host a U.S. Open, it is carefully examined by the USGA to ensure it meets key criteria. First and foremost, the golf course must be of excellent quality and design. Can it be set up to adequately test the world's best players? If the answer is "yes," the USGA staff then thoroughly study the operational aspects of the site and local community. There must be enough land surrounding the golf course for tents, operational compounds, admission entrances, and spectator transportation. The golf course must have enough space between and around golf holes for grandstands, TV towers, concession areas, and for the relatively unimpeded movement of thousands of spectators. Outside the golf course, we examine the potential space for parking upwards of 14,000 to 20,000 vehicles, the likely traffic conditions to shuttle spectators via bus between parking and the golf course, the availability of thousands of hotel rooms and a convenient airport, and the anticipated cooperation from the state and local governments, as well as the local business community.

The USGA Championship Committee generally awards U.S. Open sites six to eight years in advance. In addition to having the quality of the golf course and logistics analyzed, the Committee also takes geography into consideration. The national Open should and does move around to different parts of the country. A few of these golf courses have required rather substantial makeovers, both architecturally and agronomically, in order to obtain an Open bid.

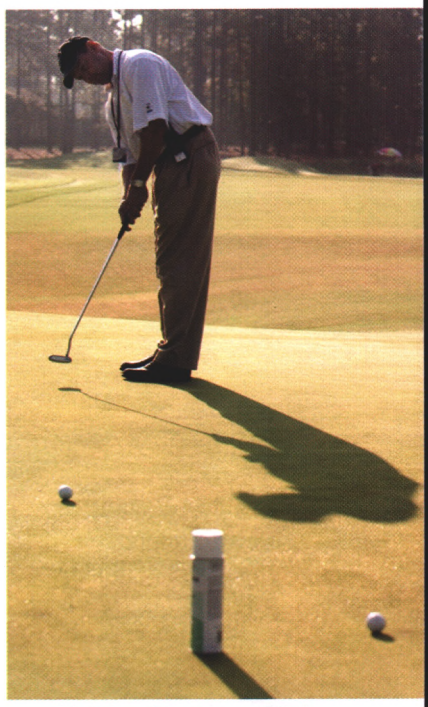
For instance, Bethpage Black, site of the 2002 and 2009 Opens, had a complete facelift in the late 1990s, as did Torrey Pines, host of the 2008 Open.

These two venues aside, the USGA generally prefers not to suggest or dictate architectural changes at Open venues other than when new championship teeing grounds or modifications to fairway widths and contours are needed. In fact, the USGA recommends widening fairways post-Open. Permanent course changes are decided and made by the host venue, with guidance from its architect of choice. Most of the USGA involvement with the Open setup revolves around agronomic preparation (e.g., determining various mowing heights, how much water should be applied to the course, etc.) and the selection of hole locations and teeing grounds.

So what is involved with a U.S. Open setup? What actually is the USGA trying to accomplish with this somewhat legendary brutal test of golf? The overall philosophy of a U.S. Open setup has not changed significantly over the last half century. Prior to the 1950s, the Open setup varied from year to year and seemed to be based on each host club's desires rather than a USGA mandate. Then in the 1950s, Richard Tufts, then USGA president and owner of the Pinehurst Resort, introduced what to this day is still the blueprint of a U.S. Open setup and test of golf. This plan called for firm and fast conditions, relatively narrow fairways, penal rough, and fast putting greens. The idea was to test all aspects of player shot-making abilities under difficult setup conditions. A by-product of this tough test was that players' mental and course management skills also were rigorously tested.

While the overall U.S. Open setup philosophy has not changed over the years, the actual setup specifications have evolved as the game has changed. As clubs have gone from wood to steel to titanium, and balls have evolved from gutta-percha to balata to the modern urethane-covered golf ball, the game and how it is played by the world's best have changed rather substantially. Additionally, the science, technology, education, and resources behind golf course maintenance also have changed how the game is played. With all these changes over the years, the USGA has attempted to evolve the U.S. Open golf course setup while staying true to Tuft's vision of a stern test of golf.

The first part of an Open golf course setup happens a couple of years in advance and involves analyzing how each hole should play ideally. What was the architect's intent for the hole? Where is the intended drive zone? Is the architect's original intent still valid, given the modern changes in golf equipment and agronomic preparation? If not, this change may support the cause for a new teeing ground. Was the approach shot designed for a long, medium, or short iron? Is the putting green open in front to allow for a run-in approach, or is it fronted by a hazard or some other obstacle? What are the ideal hole locations, and how do they relate to the overall strategy for a hole?



Hole locations are a critical aspect of the U.S. Open setup.

In an ideal championship setup, there must be a good balance — balance in long, medium, and short-length par 3s, 4s, and 5s; balance in a mix of holes where some are hard and others are relatively easy — par ought to be a good score on some holes, but the golf course most definitely ought to offer some birdie, perhaps even eagle, opportunities. Most golfers love risk-reward holes and, ideally, a championship test would have several holes that tempt the player. A par 5 reachable in two shots, and, if the course allows, perhaps even a drivable par 4, can provide interesting options. Winged Foot's sixth hole was a dramatic and drivable par 4 at the 2006 Open. In the final round, when there was a particularly inviting hole location, the majority of the players tried to drive the putting green. The result: many birdies, several eagles, and quite a few double bogies. Oakmont, the site of the 2007 Open, will have three risk-reward par 4s that can be driven under certain conditions. There should be balance in an Open so that both power and accuracy are rewarded, but neither overly so. Doglegs and different angles of play are tremendously underrated in today's game at the highest level. Offering incentive to players who can accurately curve their ball in either direction is a wonderful aspect of championship golf. Gradually bending doglegs mandate that shots either be curved or played at a certain angle and a certain distance. These types of doglegs challenge even Tour-level players. In fact, this may be one of the very few areas where modern equipment likely has had a negative

impact on the players' ability to score — the modern driver and ball make both distance control and the ability to "work the ball" somewhat more difficult.

Once the hole-by-hole analysis is done, the USGA then formulates a golf course preparation letter that is sent to the golf course superintendent. This letter outlines the mowing heights for fairways, rough, collars, teeing grounds, and putting greens. The letter also addresses putting green speeds, changes to fairway widths and contours, bunker preparation, daily maintenance schedules, water management, and a myriad of other particulars relevant to U.S. Open golf course preparation.

U.S. Open rough always is a topic of discussion each June. The underlying principle is that a player should be penalized for an errant shot, but not overly so. In 2006, a step-cut graduated rough was introduced to more equitably penalize inaccurate shots.

The trademark of a U.S. Open course setup is difficult playing conditions. Perhaps more than any other tournament in the world, the Open rigorously tests a player's accuracy, distance control, and ability to recover from trouble. This is accomplished by providing relatively narrow fairways, penal rough, and firm and fast conditions. In other words, the margin of error for shot-making is lessened. Depending upon the length of the hole, the slope and contour of a drive zone, fairway widths for an Open will range from 22 to 34 yards. On a relatively flat and straightaway hole of medium length, 26 yards of width would be the norm. In the days of persimmon and balata, that norm would have been around 32 yards. The advances in modern equipment have not only allowed for increased distance, but the players also are able to hit the ball straighter; thus the reason for the gradual narrowing of U.S. Open fairway widths over the past 15 years.

In the last couple years, the USGA has given considerable thought on how best to prepare the rough grass. Ideally and under Tufts' method, the rough should be at a height where players are penalized for errant shots, but not overly so. The USGA wants to test shot-making and reward recovery skills; thus "pitch out" rough really is not desirable unless the player misses the fairway by a significant margin. Jack Nicklaus, winner of four Open Championships, was a master at recovery from U.S. Open rough. At Winged Foot last year, the USGA slightly altered its long-standing tradition of one stand of long, penal rough; graduated rough was introduced. This stepped-cut rough was adopted with a goal of better rewarding accuracy and more equitably penalizing inaccuracy. Two, rather than just one, heights of cut were used for the primary rough. The first cut closest to the fairway was approximately seven paces in width and was mown on a daily basis at 3.5 inches. At this height, the grass was low enough so players could play to the putting green, but high enough so their ability to control distance was lessened. The first cut was and is supposed to be a bit less penal than past U.S. Open rough. Outside the first cut of primary rough was a higher second cut. This rough, at 6-plus inches in height, more severely penalized the truly errant shots. In addition to the graduated roughs, the spectator rope lines were moved further away from the fairways so players who really hit an errant shot would less often get a fortuitous lie in grass trampled by spectators.

The putting green speed for each U.S. Open is determined by carefully studying the slope and contour of each of the 18 greens. This speed changes from year to year because the design of putting greens varies so greatly from course to course. Inevitably, one or two of the greens are more severely sloped or contoured than the others. Those greens ultimately end up dictating overall putting green speeds for all 18 greens. Flatter, less-undulating greens are prepped for faster speeds. U.S. Open putting green speeds vary from 10.5 to 14-plus feet on the Stimpmeter, depending upon the design of the greens. The USGA wants greens fast, but not so much so that good hole locations cannot be used. Fast greens require a deft putting touch and a great imagination when trying to recover from around the greens. The USGA also considers how wind might affect playability of putting green speeds. Pebble Beach, for example, is typically prepped a bit slower than the slopes would otherwise allow due to the likelihood of strong winds.

How are hole locations chosen? As anyone who has ever picked hole locations knows, setting 71 out of 72 good ones is not good enough. Fast speeds coupled with undulating and sloping putting greens can sometimes, as the USGA unfortunately has seen a few times, be the recipe for the dreaded bad hole location. The

Measuring the percentage slope six or so feet out from a prospective hole location can better ensure a fair setup.

prospective area for a hole location must be carefully studied. Knowing the amount of slope around a prospective hole, say within a 6- to 7-foot radius, is critical. In the last couple of years, the USGA has used a digital level to calculate the percentage slope. On the higher end of U.S. Open green speeds (13 to 14-plus on the Stimpmeter), we begin to be very cautious with a percentage slope greater than 2.4% or 2.5% within a 6- to 7-foot radius of the hole. When green speeds are on the lower end (10.5 to 11.5 on the Stimpmeter), percentage slopes up to 2.8% or 2.9% seem to be the cutoff mark. We also look for ample "roll-out" — the ability to stop a golf ball within 6 or 7 feet on the low side of the hole. More roll-out is given if winds are forecasted in the downhill direction.The other tricky part in avoiding a bad location lies in anticipating possible scenarios where green speeds might increase as the day goes on. Will conditions dry out? Could it get windy? Is there dew on the green in the early morning when the holes are being picked that might fool you into a dicey location? Was a chemical growth retardant used on the green?

Assuming four good hole locations can be found per hole, the USGA tries to balance these locations for each stipulated round. We are very cognizant of balancing the lefts and rights, as well as fronts and backs, so as not to advantage or disadvantage a certain playing style. There is no attempt to make the final round any more difficult than the first round; however, there might be times when a dramatic (i.e., more risk-reward) location is saved until the final round. We also consider the approach shot being played. Will it be a long iron or a wedge? Firmness of the putting greens also must be strongly considered. Tucking a hole location right behind a front greenside bunker on a long, downwind hole may be too difficult, but placing a hole near the edge of the green may be fine when mostly wedges are being played for approach shots. Placing a hole location in the very back of a soft green on a short hole may be a great test of shot-making — can a player take enough spin off his golf ball to get it close, or will he risk going over the green by flying the ball the whole way to the back? We also believe it is okay to have one or two so-called "sucker" hole locations over the course of a championship as long as it doesn't cross over into being unfair or downright goofy. These occasional "sucker" hole locations can test a player's course management skills when it might be best to play an approach away from the flagstick.

Water management is one of the most crucial aspects of championship setup. Firm and fast conditions are ideal. It brings out a wonderful aspect of the game — what will happen when the golf ball lands. A player must plan for the bounce and roll. Firm conditions require a greater ability to control ball flight and spin. This is one reason the British Open is such a fascinating championship. In an ideal world, every U.S. Open would be played on a course built on a sandy-loam terrain like Pinehurst, Shinnecock Hills, Olympic, and Bethpage. These sites allow us to better control firmness even when Mother Nature is providing unwelcome rain. Most U.S. Open sites, however, are built on heavier soils that retain moisture much longer. That unfortunately means Mother Nature sometimes dictates softer playing conditions than wanted. The key with firmness is trying to provide fair conditions for the players. Ideally, the firmness of putting greens and their approaches ought to be consistent. The USGA works hard with the superintendent to provide firm approaches to the putting greens. Typically, every time greens are aerated or topdressed, the USGA recommends the same procedure for the approaches. It is downright unfair to provide greens that are too firm and won't adequately hold well-struck shots. This can be a tremendously fine line, especially when dew points are dropping or it gets windy.

The USGA's philosophy on bunker preparation for national championships differs somewhat from the norm. We still believe in the concept that bunkers are hazards. A penalty should be paid. Adapting to the look and feel of the sand ought to be part of the challenge. Bunkers should not always be perfectly prepared with firm, consistent sand. In fact, in the last few years we have purposely had the grounds staff soften up the bunker bottoms by vigorously and deeply raking. Softer sand translates into less ability to spin and control the ball. Could the players get the occasional "fried egg"? Yes, and the USGA believes recovering from a buried lie is still a skill required for playing the game.

Consistency of the overall golf course from day to day is part of the setup plan. For years the difficulty of the U.S. Open setup seemingly increased as the week progressed. Sunday's final round has many times played more difficultly, sometimes significantly so, than during practice rounds and early championship rounds. The greens were faster, the rough was taller, and sometimes the course was firmer. The USGA has changed its philosophy a bit of late. We now strive for relatively consistent setup conditions for the whole event, including practice rounds. That is not to say we want the course to play exactly the same every day; adapting to changing conditions is part of the game. The real influence on change ought to come from Mother Nature, not from the USGA purposefully giving the players a golf course they have not seen before. It is the job of the USGA and the course superintendent to react to changing weather conditions and modify course setup accordingly. This sounds easy in concept, but it can be very difficult in execution. Sometimes the USGA has done an admirable job in this regard; a few times we have not. And when a course is set up to be as difficult as an Open, the margin for error can be razor thin. A wrong weather forecast or poor reaction to a good one can potentially push an otherwise fair but tough setup into an unfair setup where good shots are not rewarded.

There is one final question that often comes up about the Open test of golf — Is the USGA really after a winning score of even par? The simple answer is no. Windy and dry versus soft and calm conditions can make for a 15- to 20-shot swing in the winning score. The USGA obviously cannot control wind or rain. So, while an even-par winning total is not a goal, the USGA is genuinely focused on testing the players' shot-making and course management skills under the most rigorous and challenging setup conditions. Some years that test is more rigorous than others.

Moving the national open around to different courses provides a wonderfully interesting variety. It is apropos to say there are different courses for different horses. Some are long — Torrey Pines next year will be more than 7,500 yards; some are short — Merion in 2013 will play to around 6,900 yards. Some have large, relatively flat greens, while others are small and undulating. Some are open and subjected to strong winds, and others dogleg their way through towering trees. But they all end up one way or another doing one thing — identifying the national champion of golf in the United States.

MIKE DAVIS *is senior director of USGA Rules and Competitions.*

Accommodating People with Disabilities

Staying out of court and making money in the process.

BY MARTIN S. EBEL

Bob Wilson (right) and Marty Ebel get ready to tee it up at Bethpage Black (New York) in 2006.

Everyone knows that the number of rounds of golf per year is stagnant, or even falling. There is a big push from industry groups to grow the game. The industry is interested in building the number of rounds at almost every facility. Each year, more and more new courses are coming on-line, and almost everyone is getting a smaller slice of the pie.

So why is it that with these declining numbers, the industry is not making concerted efforts to reach the 54 million people in this country with disabilities? Why isn't the industry aggressively seeking ways to keep baby boomers (now that they are entering their retirement years) in the game longer? I suspect the answer has lots of facets, but part of it must be that the industry doesn't realize how much revenue it's turning its back on.

According to one research group, the biggest reason why people leave the game is that it's too hard to get around — that there's too much walking. These are most likely people who have some sort of mobility impairment — people with disabilities. Often, these are core golfers — golfers with both the free time and the money to play the game regularly. Once they reach the point where it is too hard, they quit playing. If golf courses can keep even one core golfer in the game for an additional year, they can generate tremendous amounts of additional revenue. So let's look at a great way to keep these people in the game longer — the single-rider golf car.

There are at least three reasons to reach out to people with disabilities and offer them accommodations like a single-rider golf car: (1) It's the right thing to do, (2) it will make you money,

and (3) it's required by law (and fighting it will cost you money). The biggest debate seems to turn on whether courses must provide single-rider cars. It seems clear from a legal perspective that courses *must* supply single-rider golf cars to comply with the law.

You know accommodation is the right thing to do, and you don't need anyone to tell you this. Just as it was the right thing to do to open courses and clubs to people of color and to women, it is right (and fair and just) to offer accommodations and welcome people with disabilities. It is also not that daunting. And all the rhetoric about people with disabilities is wrong. For example, there are a number of incorrect positions about single-rider golf cars in the industry:

(1) The law doesn't require them.
(2) They damage turf.
(3) It's too costly to provide them.
(4) There is no demand.

All are dead wrong. Let's take a look.

Federal law requires accommodation of people with disabilities. The Americans with Disabilities Act explicitly applies to golf courses. Accordingly, the ADA requires golf courses to provide access to their facilities (clubhouse, pro shop, course, and practice facilities) and their programs (playing golf, renting a golf car). There are only a few things that will relieve the requirement — if there is an undue burden (meaning hugely expensive), if the accommodation fundamentally changes the program, or if the accommodation poses a danger. If an accommodation does not pose an undue burden, alter the fundamental nature of the facility, or pose a safety hazard, *the golf course is required to supply the accommodation!*

This means that the first rumor is dispelled — golf facilities are required to provide accommodations by the plain language of the ADA. Furthermore, the U.S. Supreme Court in *Casey Martin v. PGA Tour, Inc.*, explicitly said that riding in a golf car does not change the nature of golf and was a reasonable accommodation. Furthermore, the U.S. Access Board, the group charged with regulating the design of facilities to ensure access for people with disabilities, makes clear that using a golf car is reasonable.

The Access Board Guidelines for Recreational Facilities *requires* new course construction to include one or more tee boxes that a golf car can enter on each hole. It *requires* a "path of travel" from tee to green that a golf car can negotiate. It *requires* that every green have a point of entry and exit for a golf car. The Access Board's requirement of construction, allowing a golf car to drive on the tees and greens, demonstrates that it's reasonable to drive golf cars over them. Couple this with the Department of Justice's requirement that rental car companies *must* supply adapted automobiles to people with disabilities, and it becomes clear that providing a single-rider car *is* required. Anecdotally, no golf course has successfully defended against a lawsuit seeking a single-rider golf car as an accommodation.

Second, single-rider golf cars don't damage turf, at least if they are operated responsibly. Like any other vehicle, reckless operation can cause damage. But the standard under the ADA is no fundamental alteration (i.e., permanent damage) to a facility. And there is no permanent turf damage associated with single-rider golf cars. They exert less pressure per square inch than an adult male at heel-strike. And really, do you suppose that Pebble Beach, Hazeltine National, Bethpage Black, and every single TPC (just to name 28 courses) would have single-rider cars in their fleets if they caused damage to *their* hallowed grounds?

Turning to cost, it's a myth that single-rider golf cars' expense is a defense against purchasing them. First, to obviate the need for an accommodation, the cost must be extreme in comparison to the total assets of the facility, taking into account its parents, subsidiaries, and other related financial sources. Second, single-rider golf cars, just as standard cars, can be in the

regular rotation and generate revenue for the course. You don't need to restrict their use to people with disabilities.

Additionally, a significant tax credit awaits businesses purchasing adaptive equipment. A business with either fewer than 30 full-time employees or under $1 million in annual revenue is entitled to a 50% credit on the first $10,000 it spends each year on adaptations. For most, this credit brings the cost of a single-rider car in line with a standard car. Those not eligible for the tax credit almost certainly fail the financial means test and can afford the car(s).

The last refrain heard from those opposing single-rider cars is that there is no demand for them. This is simply not recognized by the law as a reason for non-compliance. The reason that Congress enacted the ADA was that it found there was systemic, long-term exclusion of people with disabilities from all sorts of activities in this country. The reason there is no demand is because until very recently, most people with disabilities were unwelcome at golf courses.

The golf course industry should take a page from the snow ski industry's playbook. About 20 years ago (pre-ADA!), they decided to embrace people with disabilities. These facilities spent some money on equipment, training, and marketing. And they found that every person with a disability who came brought at least one, and sometimes many more, able-bodied people with them. They made money from these people and more money from their friends. In the lean years, this population helped some of the ski operators survive. Today, adaptive programs are one of the features that ski resorts compete with each other on. It is a money-making proposition. There is money — perhaps lots of money — to be made catering to this segment.

In February at the Golf Industry Show, I spoke on this topic. The next day, the NGCOA published in the show's daily paper the following "clarification": "A GIS session yesterday has sparked questions concerning the legalities surrounding single-rider golf cart[s]. Although the U.S. Department of Justice is currently reviewing the matter, there is no requirement that courses provide the cars."

Yes, the DOJ is looking at the issue of single-rider golf cars, but their issue is not whether to require single-rider cars — instead it is how many single-rider cars will be required at every course (one or two)! More importantly, these regulations will merely codify the existing law — law that *currently* requires reasonable accommodations, including single-rider cars, for people with disabilities.

You know it's the right thing to do. You can make money doing it. It'll cost you money if you don't. Add single-rider cars to your fleet now. If you do so and are ever sued for failing to accommodate someone, the fact that you put a car in your fleet will be presumptive evidence that you don't discriminate! Look for a car that has passed the same safety tests as the rest of your fleet. It's the right thing to do.

MARTIN (MARTY) EBEL *is a commissioner (and formerly the general counsel) of the Massachusetts Commission Against Discrimination. Prior to joining the MCAD, he practiced discrimination law for more than ten years. Ebel's private practice included employment law and public accommodation for management clients, including a number of golf facilities. He is a trustee of the National Amputee Golf Association and a longtime instructor in that organization's First Swing/Learn to Golf programs.*

Two for the Money

Combining fairway mowing and clipping dispersal in one job saves time and labor, and lessens interference with golfers.

BY CHRIS HARTWIGER

Labor is the largest expense in golf course maintenance budgets, and in an era of slow growth in the game, every golf course is either reducing staff or looking for ways to increase productivity. Jason Sanderson and his staff at Cherokee Country Club in Knoxville, Tennessee, are on a mission to maximize worker productivity without compromising on quality. Another key tenet of their maintenance program is to get as much work done on the golf course as possible before play each day. This turf tip will explore the unique idea of mowing fairways and dispersing clippings at the same time.

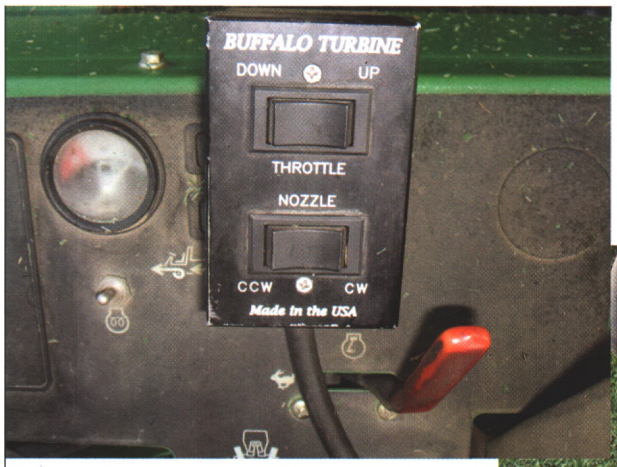
ORIGIN OF THE IDEA

Fairway mowing and clipping dispersal are two important jobs during the growing season, and the concept of mowing and dispersing clippings at the same time is not new. Over the years, superintendents have equipped fairway mowers with nets, hoses, or ropes to break up clippings while mowing. Although these concepts are effective to a point, the staff at Cherokee Country Club felt they could improve on this idea and further enhance worker productivity. The staff found that using a Buffalo Turbine blower

Combining mowing and clipping dispersal allows the staff to get one more job done before play. Best of all, both of these jobs are done with one operator.

was the most effective way to disperse clippings. Dragging nets or hoses did not produce the desired result.

Several years ago while Chris Sykes was the golf course superintendent and Jason Sanderson was the assistant superintendent, they hypothesized that it might be possible to connect the Buffalo Turbine Cyclone KB3 blower to the back of their John Deere 3235B fairway mower. The connection was easy to make, but they were left with several hurdles to overcome before this idea could be put into use with the quality they expected.



The mower operator has easy access to the blower controls.

The blower and fairway mower unit are attached via a simple hitch.

CHALLENGES TO OVERCOME

The first matter to address was the connection of the blower to the fairway mower. Fortunately, the talented mechanic at Cherokee fabricated a hitch similar to those found on many popular utility vehicles. The Buffalo Turbine blower can be quickly hitched to the fairway mower with a pin.

The next stop was a trial run on the fairways. The staff learned that pointing the nozzle directly behind the blower caused the fairway bermudagrass to tuft up and did not provide a wide enough swath of wind to disperse the clippings. However, when the nozzle of the blower was angled to the previous pass mowed, the grass did not tuft and the swath was wide enough to disperse the clippings. At this point, it looked like the idea was a success.

Unfortunately, the staff realized that the fairway mower's exhaust pipe discharged directly behind the Buffalo Turbine blower. This led to clogging of the blower's air filter after only six to eight mowings. With the help of the mechanic, the exhaust pipe was modified to discharge out the side. Today, Deere fairway mowers have a side discharge, so this is no longer an issue.

STANDARD OPERATING PROCEDURE

Mr. Sanderson felt confident enough in the results of this experiment to make this a part of the regular maintenance program, and he reports that operator training is straightforward. At Cherokee Country Club, the fairways employ a split or 50:50 mowing pattern. The mower operator has easy access to the controls of the Buffalo blower. The operator begins with two mower passes up and down the middle of the fairway. On successive mowing passes, the blower nozzle is pointed to the previous pass in that direction and the clippings are dispersed.

The final two mower passes require another pass using the blower only. Mr. Sanderson reports that the learning curve of his operators has been quick and the process is not much different from mowing fairways only. Mr. Sanderson mentioned that with the mower and blower configuration, the operator cannot make as sharp a turn as with the fairway mower only. This is beneficial, actually, as it protects the turf against injury caused by sharp turns.

If the growth rate of the grass is unusually fast or if the mowing schedule has been interrupted by bad weather, Mr. Sanderson advises the operator to watch and make sure all the clippings are dispersed. If any remain, the operator makes additional passes to clean off the fairways.

AND THE WINNERS ARE?

Both the maintenance staff and the golfers are big winners with this program. The maintenance staff benefits through reductions in fuel, labor, equipment, and improvements in productivity. An added benefit is that a separate utility vehicle is not needed to tow the blower.

The golfer is the real winner with this idea, too. The blower is one of the loudest pieces of equipment on the golf course. When the staff gets the fairways mowed and clippings dispersed, golfers enjoy well-groomed surfaces and less disruption from noisy, but necessary, golf course jobs.

Labor issues and productivity will continue to play an important role in golf course maintenance for many years to come. Implementing this turf tip just might be the bargain you have been searching for.

CHRIS HARTWIGER, *senior agronomist in the Southeast Region, is fond of multitasking from his home base in Birmingham, Alabama.*

You Take the Hard Road . . . and I'll Take the Soft Road

Paved paths near greens are simply a fact of life at some heavily played courses. Cover asphalt with strips of PVC matting to soften paved cart paths located adjacent to greens.

BY BOB VAVREK

Love 'em or hate 'em, motorized carts are an integral part of American golf. Unlike golfers overseas, many Americans won't play unless they can ride. In fact, a fair number of relatively new resort courses were designed to be played from a cart and are practically impossible to walk. In many ways, carts can be both an asset and a detriment to the course.

The need for paved cart paths is obvious at heavily played golf courses that have a limited ability to accommodate walkers.

Cart rentals provide a significant percentage of the cash flow necessary to maintain courses at a level that meets the ever-increasing expectations of today's golfers. Green fees and dues at most courses would need to be increased significantly without cart revenues.

However, the wear and compaction of turf caused by concentrated cart traffic will always have a negative effect on playing conditions. All golf shots are directed toward the greens, so the turf adjacent to greens and approaches suffers the most from cart traffic damage. Consequently, cart paths are often employed near green complexes to keep traffic away from these prime areas of play.

Place the path too far away from the putting surface and golfers will be tempted to drive across the turf between the path and green. Place the path too close to the green and the path will affect a considerable amount of play. A slightly errant shot to the green that bounces off the path and onto an adjacent hole, or worse, bounces out of bounds or into a hazard, will generally be accompanied by a strongly worded complaint to the grounds staff.

The green complexes of most old classic courses were not designed to accommodate cart paths. Multiple green and tee complexes are often found in close proximity to each other. It may be necessary to place the path very close to a green at old courses that exist on limited acreage or courses that have become landlocked by adjacent development. This turf tip discusses a way for paved cart paths and greens to coexist in close proximity.

An option employed at some courses is to construct the cart path near greens from a material that can absorb the energy of a shot better than asphalt or concrete. Paths made from gravel or wood chips are more yielding than a hard surface. However, these materials are susceptible to displacement or rutting from erosion or traffic. Gravel and wood chip paths need to be repaired frequently to maintain a level surface.

Mike Jones, CGCS, superintendent of the Lochmoor Club (Grosse Pointe Woods, Mich.) softens the cart paths near greens by covering the pavement with poly extruded matting. The green PVC mat absorbs the impact of a golf ball and blends in well with the surrounding turf. The matting is available from Eagle One products (http://eagleonegolf.com) or directly from the manufacturer (http://www.pemsurface.com) in 6-foot by 25-foot rolls.

Golf cart operators tend to stop abruptly, and the process of locking up the tires on a moving cart can quickly detach a poorly applied cover from the path. The key to success is the installation process that firmly binds the mat to the asphalt.

Asphalt is, by far, the most common material used for cart path pavement in the North. Fresh asphalt contains petroleum-based oils that need to volatilize before it can be sealed or treated with the adhesives used to attach a mat to the path. A new path should age for a year before attempting this procedure.

The 6-ft.-wide mat is cut into 8-ft.-long pieces and installed perpendicularly to the direction of the path. Unfortunately, there will be a seam across the path every 6 feet. A seam sealer is available from the supplier, and taking the time to join the seams is well worth the effort, especially where carts are most likely to stop and start. On the other hand, the smaller pieces of mat are easier to handle and attach to the pavement compared to a single long strip of material installed parallel to the direction of the path. Furthermore, a 6-foot-wide strip of matting would not entirely cover the 8-foot-wide paths that are commonly seen on golf courses.

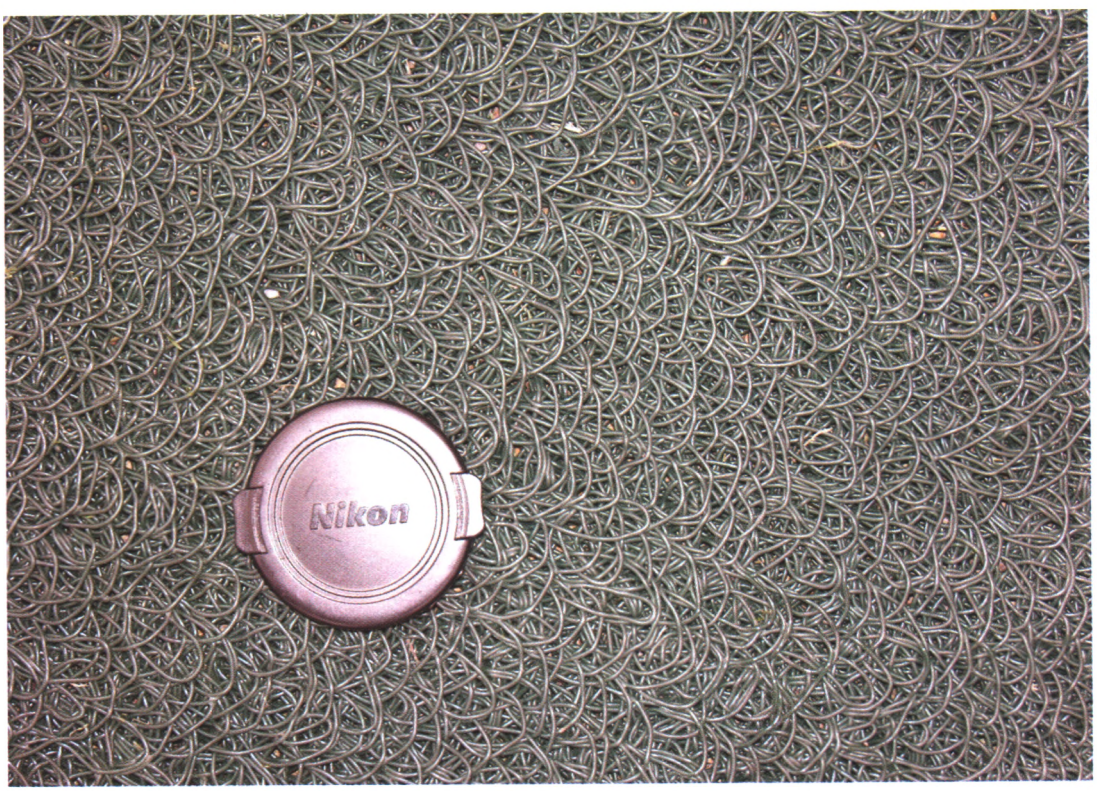
You must begin with a clean, dry surface. A pressure washer is ideal to prepare the surface for the adhesive. Allow time for the path to dry. The best success is realized using a combination of the GE 1800 silicon adhesive recommended by the manufacturer of the matting and Roberts Premium Indoor/Outdoor Carpet Adhesive 6700 (http://www.robertsconsolidated.com).

The Roberts mastic is spread on the asphalt using a notched trowel adjacent to a bead of the silicone adhesive. The process is repeated alternating mastic (8 inches to 10 inches wide) and silicone adhesive (6-inch squiggle) across the path. A strip of the mat is placed over the adhesive. A sheet of plywood is placed over the mat and a vibratory plate compactor is operated over the plywood to firmly press the matting into the adhesive. Allow at least one day for the adhesive to cure and the path is ready for traffic.

It's difficult to predict the life span of the PVC mat because it has been available for only 10 years. Obviously, the mat will last longer if the paths accommodate nothing heavier than cart traffic. Operating large trucks or other heavy equipment will certainly damage the mat as well as the pavement.

If the intent is to minimize the bounce of a golf ball, then the matting does its job very well. Golfers are never quiet about the annoyance of seeing a cart path in play, particularly a path located very close to a green. The green color of the mat blends in with the adjacent turf and may reduce or eliminate the need to hide the path from view using berms or landscaping.

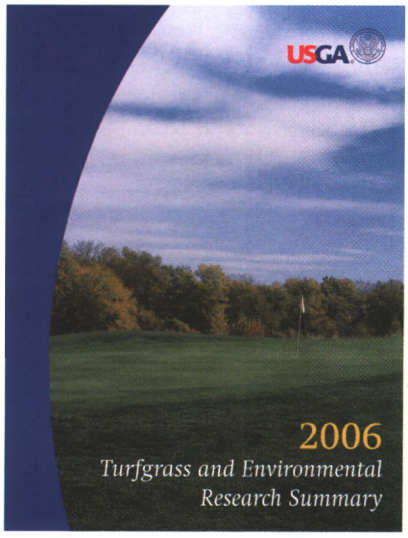
On a final note, the same process can be useful for covering a paved path located along a steep slope. The matting improves traction across wet pavement for golfers who walk or ride. PVC mats on a cart path, however, should never be considered a substitute for using common sense when operating carts across the course during wet weather.



Unrestricted cart traffic can cause considerable injury to turf during wet weather. A well-designed paved surface can accommodate carts when the soils are saturated from rain, flood, springs/seeps, and poor drainage.

BOB VAVREK's *path takes him to golf courses in Michigan, Wisconsin, and Minnesota for Turf Advisory Service visits throughout the season.*

NEW PUBLICATION AVAILABLE



The *2006 Turfgrass and Environmental Research Summary* is now available free of charge through the USGA Order Department (800-336-4446). The research summary provides a one-page summary of each research project currently being funded by the USGA's Turfgrass and Environmental Research Program. This publication is appropriate for researchers, university extension personnel, and golf course superintendents who are interested in learning about the latest results from the program. Request publication NS 1645.

GREEN SECTION INTERNSHIPS AWARDED FOR 2007

For the tenth year, the USGA Green Section has awarded internships to outstanding turfgrass management students. During 2007, the Green Section will provide the opportunity for 15 students to travel with the Green Section staff on Turf Advisory Service visits. Each intern will travel for one week with an agronomist in his region between the months of May and August. The goal of the internship program is to provide students with a broader view of the golf course industry and the opportunity to learn about golf course maintenance through the perspective of the Green Section agronomists. More information about the internship program can be found on the USGA Green Section Web site at http://www.usga.org/turf/internship/2007_internship.html.

Intern Name	Year	University	Advisor
Christian Baldwin	Ph.D. Program	Clemson University	Haibo Liu
Jason Frank	M.S. Program	University of Florida	J. Bryan Unruh
Anthony Garzia, Jr.	Junior	Delaware Valley College	Doug Linde
Matt Gourlay	Senior	Kansas State University	Jack Fry
Nicholas Hanson	Senior	California State Polytechnic University	Sowmya Mitra
Lindsey Hoffman	M.S. Program	University of Massachusetts	J. Scott Ebdon
John Inguagiato	Ph.D. Program	Rutgers University	James Murphy
Shaun Knutzen	Junior	Washington State University	Bill Johnston
William Kreuser	Sophomore	University of Wisconsin	John Stier
Megan Marcovecchio	Senior	Colorado State University	James Carey
Brian Schwartz	Ph.D. Program	University of Florida	Kevin Kenworthy
Michael Vysocka	Senior	North Carolina State University	Daniel Bowman
John Willis	Ph.D. Program	Virginia Tech	Shawn Askew
Joey Young	M.S. Program	Mississippi State University	Gregg Munshaw

PHYSICAL SOIL TESTING LABORATORIES

The following laboratories are accredited by the American Association for Laboratory Accreditation (A2LA), having demonstrated ongoing competency in testing materials specified in the USGA's Recommendations for Putting Green Construction. The USGA recommends that only A2LA-accredited laboratories be used for testing and analyzing materials for building greens according to our guidelines.

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308 Main Street, New Knoxville, OH 45871
Attn: Mark Flock
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FAX: (419) 753-2949
E-Mail: mflock@BLINC.COM

Dakota Analytical, Inc.
1503 11th Ave. NE, E. Grand Forks, MN 56721
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Voice phone: (701) 746-4300 or (800) 424-3443
FAX: (218) 773-3151
E-Mail: lab@dakotapeat.com

European Turfgrass Laboratories Ltd.
Unit 58, Stirling Enterprise Park
Stirling FK7 7RP Scotland
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Hummel & Co.
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Trumansburg, NY 14886
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ISTRC New Mix Lab LLC
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Tifton Physical Soil Testing Laboratory, Inc.
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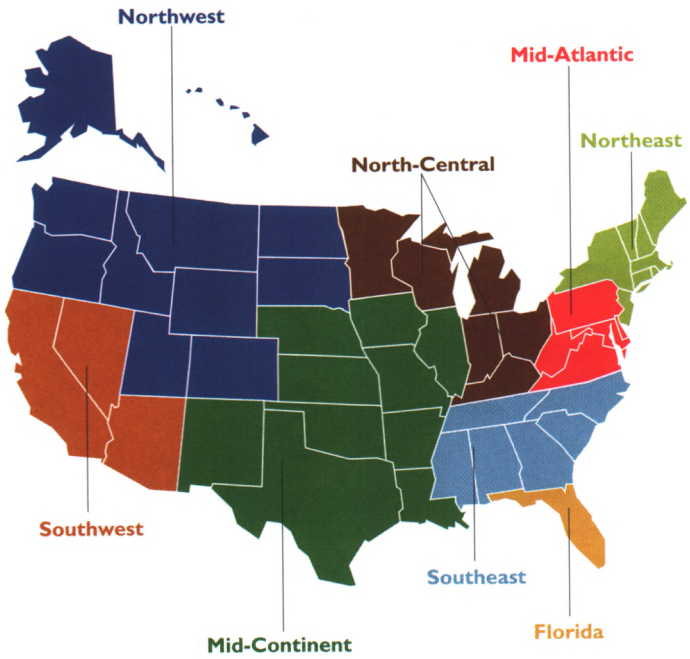

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Turf *Twisters*

Q: In 1990, our greens were completely rebuilt to USGA guidelines and have performed satisfactorily. However, the base Tifdwarf bermudagrass contains a high percentage of "off-type" surface contamination, and it has become progressively more difficult to provide consistent and acceptable playing conditions and aesthetic character. We are in the initial planning stage of renovating the greens and converting to an ultradwarf bermudagrass cultivar. Our obvious question is whether or not resurfacing is a viable option, or is total reconstruction necessary? (Florida)

A: With proper construction and subsequent management, USGA greens can easily have an effective life expectancy of 25 to 30 years or longer. Thus, resurfacing is a viable option. Review the article "Rebuild or Resurface" (by Bud White, *USGA Green Section Record*, January/February 2006, 44(1):1-6). It is available on the Turfgrass Information File at: http://turf.lib.msu.edu/2000s/2006/060101.pdf.

Q: The USGA says "bunker" and I say "trap." What real difference does this make to golf course maintenance? (Indiana)

A: Perhaps none, and yet there could be significant impact. There are activities a player cannot do in bunkers that are acceptable on other areas of the course. This means that a defined edge is important to properly apply the rules. The use of incorrect terms suggests ignorance of the rules, which suggests the maintenance program may not be accommodating proper application of the rules. Terms and definitions provide the foundation for the rules, the game of golf, and course maintenance.

Q: We recently sent disease samples off to a diagnostic lab. In their response, the lab stated that the sample that we sent was not in good enough condition to provide a reliable diagnosis. How should samples be sent to a diagnostic lab? (Delaware)

A: Proper sampling is critical to proper diagnosis. First, a cup-cutter-size plug, 2 to 3 inches deep, should be taken at the edge of each area to be sampled so that a combination of damaged and healthy turf is provided. The plug should be wrapped in a moist paper towel and then wrapped in foil to preserve the plug. It is critical to prevent the underlying soil from mixing in the turf canopy. Pack the plugs securely in a box as if they are fragile so that they will not be damaged during shipping. Finally, use an overnight shipping method so that the plugs reach the lab quickly. Shipping after Wednesday could lead to samples sitting in a box over the weekend because most labs are not open on weekends.

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