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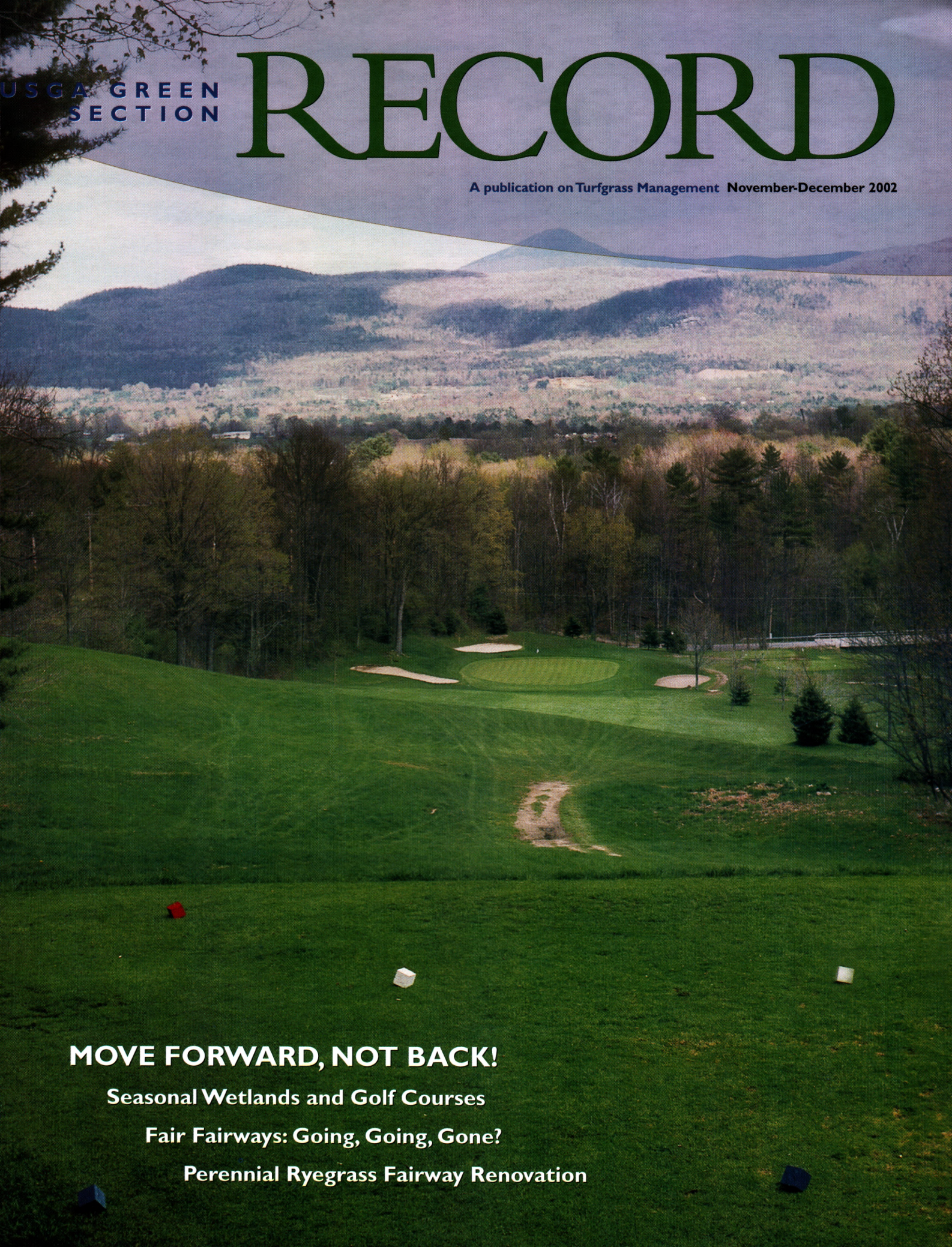

MOVE FORWARD, NOT BACK!

Seasonal Wetlands and Golf Courses

Fair Fairways: Going, Going, Gone?

Perennial Ryegrass Fairway Renovation

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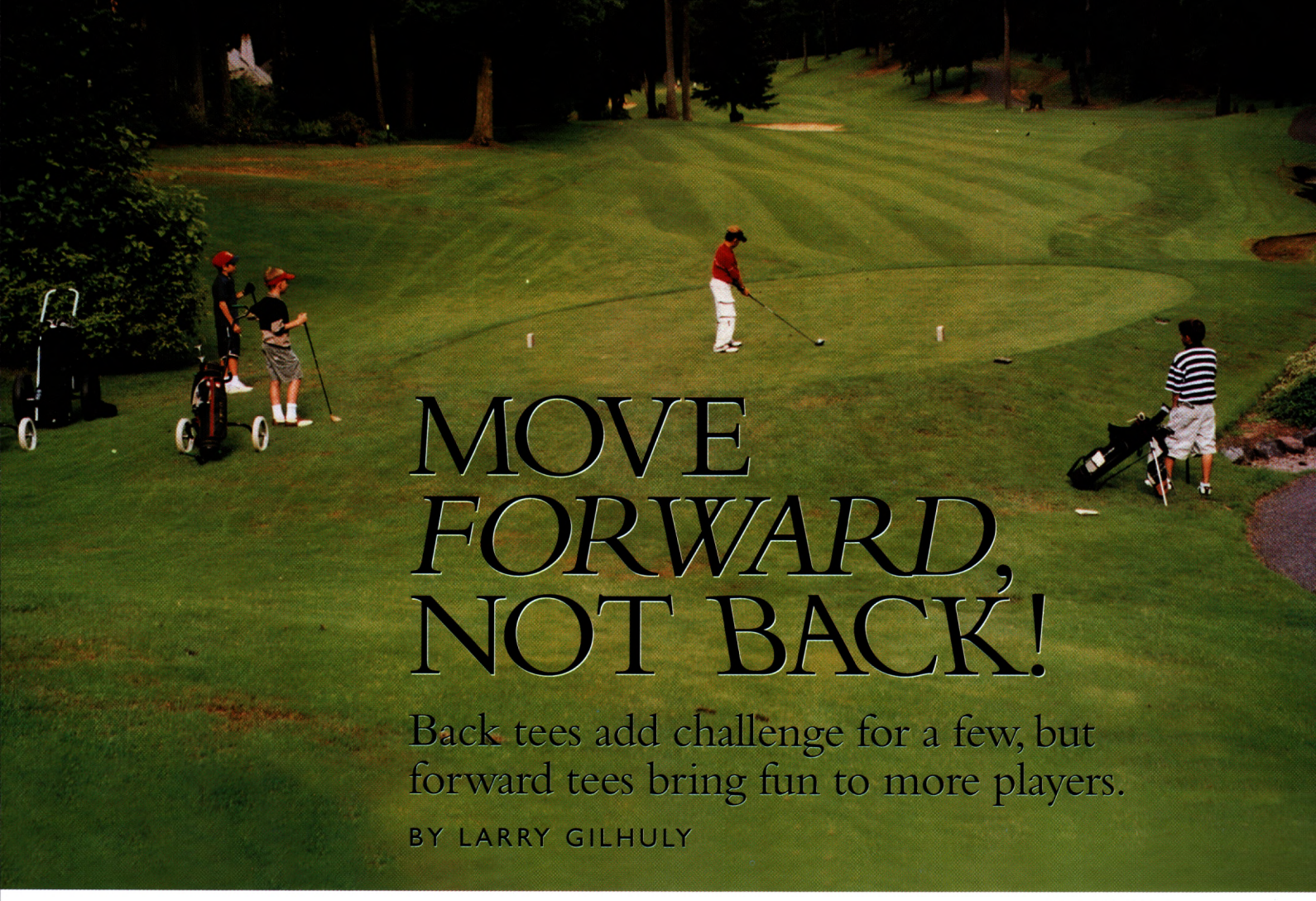
Cover Photo
Because there are golfers of different levels of ability, golf courses should provide a choice of tees to make the game enjoyable for everyone.



MOVE *FORWARD*, NOT BACK!

Back tees add challenge for a few, but forward tees bring fun to more players.

BY LARRY GILHULY

You have completely warmed up and are ready for a challenging round at the golf course. After hitting your longest drive and fairway wood on the opening par 4, you are faced with a mid to long iron for your third shot. Maybe a shot at par, but probably a bogey or double-bogey start. Tough opening hole! On to the second hole, a truly difficult par 5. After a career drive and two massive fairway woods, you still have a mid to short iron just to make the green in four. Looks like another bogey or worse! Oh well, it can't be this tough all day. On to the third hole, an uphill par 3 that is unreachable with a driver and has a bunker stretching across the front of the green. With a good chip, maybe a par, but a birdie putt is out of the question. This game is challenging, but isn't it also supposed to be fun?

As a typical male player, how would you like to be put in this position every time you play your home golf course? It would probably get pretty old, pretty quick. Well guess what? The above scenario is played out day in and day out at most older golf courses where the forward tees offer a golf course for the lady players that is far too long for their skill level and certainly not conducive to a *fun* round of golf. Think this is a new problem? In 1949, Miss Margaret Curtis (three-time Women's Amateur Champion and co-donor of the Curtis Cup) stated, "We women play our golf on courses laid out for men. Our games are thus under the decided handicap of being misfits." (*USGA Golf Journal*, Vol. 1, No. 7, Winter 1949, pp. 10-11.)

Forward tees are challenge enough for many players who would only be discouraged if they had to use back tees.

WHAT'S THE PROBLEM?

Several years ago, the NGF (National Golf Foundation) conducted some very interesting research that showed the following three facts:

- The best lady players hit a golf ball approximately 85% as far as men.
- The average lady player hits a golf ball only 75% as far as men.
- The average driving distance for the average lady player is 140 yards.

So what's the problem? The problem is simple. Many older golf courses force women golfers to play a golf course that is exceedingly long for their ability, and this takes much of the fun out of

Comparative Distance Chart

Women's Yardage	Comparative Men's Yardage
6,000 yards	6,000 ÷ 0.75 = 8,000 yards
5,750 yards	5,750 ÷ 0.75 = 7,667 yards
5,500 yards	5,500 ÷ 0.75 = 7,333 yards
5,250 yards	5,250 ÷ 0.75 = 7,000 yards
5,000 yards	5,000 ÷ 0.75 = 6,667 yards
4,750 yards	4,750 ÷ 0.75 = 6,333 yards

the game. This group has no choice; they play markers that are too long with no diversity in club selection and they have little chance to enjoy par, let alone birdies!

While many golf courses have this problem, it doesn't stop with the lady players. Consider the other groups that are affected if your golf course offers a forward set of markers that is too long:

- **Senior men players.** Let's face it. The ego of most male golfers will not allow them to play from the "ladies' " tees, despite the very same situation described in the opening paragraph of this article. Senior players naturally lose distance over time; thus, they should also move forward to enjoy a golf course that is more suited to their game. That length can be found at the current length of the forward markers, generally in the 5,600- to 6,000-yard range. Unless an additional *option* of forward tees is added to address the ladies, the men will not move forward. However, when these tees are added, the response at most golf courses has been positive.
- **Junior players.** If the goal of your golf course is to make the game grow, it is best to provide a golf course that is less intimidating for the younger golfer. As these players grow older and become stronger and more proficient, they can easily move back.
- **Beginning players.** Those of you who have fallen for this maddening addiction known as golf understand the difficulty of the game and the inner joy it can provide. Why not make it more popular and fun at your golf course by adding forward tees that make the game easier for beginning players? As the beginners become more advanced, the *option* is available to move back.
- **Nine-hole women.** The players in this ever-increasing group generally enjoy their time on the golf course, but they do not desire another nine holes of difficulty. Forward tees offer a great option for this group of players and may encourage some to go the full 18.

HERE COME THE OBJECTIONS!

The idea of adding forward tees to give *all players the option of different yardage markers* is very logical and reintroduces more fun into the game for a majority of your players. The cost of tee construction and maintenance is a consideration that may not make this possible for all golf courses. However, despite the preceding statistics and comments, it is amazing how fast and strong the objections arise when this concept is discussed at many courses. Surprisingly, the objections do not come from the male side. In most cases, the most vocal and adamant dissenting voices come from the very group that the tees will assist — the women! As stated by Miss Curtis, "In the main, men's golf committees have been very sympathetic to women's needs. The fault has been that the women usually haven't realized or asked for what would be good for women's golf." Let's look at the objections and offer answers to each concern:

- **"The new tees will make the course too short!"** Players who are at or near a single-digit handicap generally express this objection. Of course the golf course will play shorter, and those who hit the ball longer actually will hit mid-short irons to par 4s and have birdie putts on numerous holes. At the same time, the shorter hitter now will enjoy the thrill of a par or the occasional birdie.

While on the subject of course length, let's take a close look at the "comparative distance" chart for men and women. Using the "75% Rule" described earlier, a 6,000-yard golf course for women stretches to an unbelievable comparative distance of 8,000 yards for men (6,000 ÷ 0.75 = 8,000). Now who in their right mind would design a golf course to play 8,000 yards from the regular tees for men? More important, who would want to play such a creation? Only the best single-digit handicap players! For this reason alone, many golf course architects, with Alice Dye at the forefront, recommend the forward tees at 4,800-5,200 yards to give a comparative distance of 6,400-6,900 yards for women.

- **"Forcing the women to play a golf course that is much shorter will change our handicaps!"** This is simply not true. If this were the case, all male players have artificially low handicaps if they play the traditional 6,000- to 6,300-yard white markers instead of the back tees. The USGA Slope and Course Rating systems are designed to provide a lower slope and course rating from shorter tees, thus lower scores will not

change your handicap. They will, however, change your enjoyment of this difficult game!

- **"Playing the new forward tees will put us at a disadvantage when we play our intra-club match with XYZ Country Club!"** If your handicaps don't change, how can you be at a disadvantage?
- **"We have polled our women's group and there is overwhelming support to keep the current forward tees at 5,800 yards!"** Let's get this straight. Women who hit a golf ball on the average no more than 140 yards with a driver *prefer* to nearly always putt for bogey or worse and always play shots from the same area? We are expected to believe that there is a high level of excitement when hitting yet another fairway wood or when leaning over to make that 10-foot double-bogey putt? Why not give your players the option of a shorter course to add more interest in your golf course and its players? Do you honestly believe that the majority of women players at your 5,800-yard (national average) golf course prefer to play a course that is 7,733 yards when compared to the men's course? By educating your players with facts, why would anyone not want an additional set of forward tees to let players have the option of playing at their real skill level?

WHAT'S THE SOLUTION?

Does your golf course/club sound like the preceding description? Are those making decisions focused on improving the back tees or making the course "stronger"? Does your women's group strongly oppose this idea? If so, the following four steps can be taken to introduce this concept at your golf course.

- **Determine if the need exists.** This is the easiest part of the process. Take a look at the overall distance of your forward tees. If they are in excess of 5,300 yards (7,066 comparative yards), you are a candidate for improved forward tees. Above all, get the point across that the new forward tees are an addition and not a replacement for the existing forward tees.
- **Hire a qualified golf course architect to assist in the placement of the tees.** This point cannot be overemphasized! A qualified golf course architect will use professional experience in placing the tees in the proper position while taking distance, angle of play, and hazards into account. In some cases, the desired distance may place the tee directly in visual or playing conflict with the original tees; thus, an architect will be helpful in this regard. Also, using an outside authority removes individual preferences that can result in improper tee locations. Finally, as Miss Curtis stated in her 1949 article from *Golf Journal*, "The crux of this problem isn't the drive but the shot to the green and the trajectory (isn't it a grand word) of the ball — what club should be *used* and what club *is* used by the Good Women for that shot?"

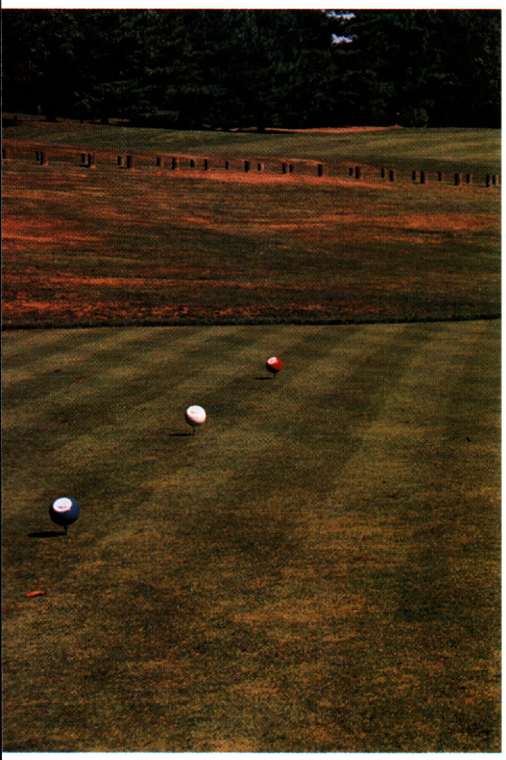
The construction of the forward tees should be part of a long-range plan created by a golf course architect and built with care.

In regard to the lengths of individual holes, Alice Dye recommends the following:

- **Par 3s: 60-150 yards.** According to Ms. Dye, par-3 holes with a fairway and an entrance to the green may run up to 150 yards. Although not reachable with a driver by the average player, this would leave only a short pitch from a fairway lie. Most golf course architects try to design the par 3s with one long, one short, and two medium-length holes to provide players with a diversity of challenges. Unfortunately, many older golf courses provide three or four long holes from the forward tees.
- **Par 4s: 240-340 yards.** Based on the average drive of 140 yards and a second shot of 120 yards, any hole over 260 yards is unreachable in two for the average woman player. A hole measured at 340 yards will leave the player with an iron approach for the third shot and a chance for a one-putt par. Holes longer than 340 yards will generally require three woods and little chance for success or fun.
- **Par 5s: 401-420 yards.** Par-5 holes are generally unreachable in three by all but a very small minority. For example, the average woman would hit a 140-yard drive followed by two 120-yard fairway woods, leaving another 60 yards to a 440-yard par 5. If the hole is uphill, less than 401 yards can be utilized, but this should be determined by your golf course architect.

In addition to the preceding recommendations by Ms. Dye, she offers another compelling reason why many of the older courses have such long

holes from the forward tees. Most of the older courses were designed in an era when irrigation was added only for the greens and tees. Fairway irrigation was unheard of; thus, golf courses were designed with *ball roll* in mind. Today's demands for verdant green fields has resulted in far less ball roll and much longer golf courses. Adding forward tees will actually return most of the older golf courses back to the architect's original intent.



Many older golf courses force women golfers to play a golf course that is exceedingly long. This can take much of the fun out of the game.

- **Create a long-range program, rather than adding tees in a "piecemeal" manner.** Based on the experience of numerous golf courses, the best way to approach this concept is through a complete long-range plan completed by a qualified golf course architect. This can be a portion of a complete course master plan or a separate issue. Regardless, completing one hole at a time to "test the waters" is a sure way to drown!
- **Be careful when selecting the color for the tee markers.** Golfers are creatures of habit and nowhere is this seen more than in the colors used for tee markers. For better or worse, red designates the "ladies'" tees, white is for the regular "men's" tees, blue generally marks the "tournament" tees, and black is for the "championship" markers. During the past decade attempts have been made to eliminate these names with limited success. Many courses have added "gold" markers to nudge senior men forward with equally limited success. If you should add a complete set of forward tees, keep the red markers forward, followed by white, blue, gold, and black. In this sequence, the average ladies have the choice of red or white, while senior players are far less reluctant to play the new white tees.

BUILD 'EM RIGHT!

Now that you have gone through the entire process of possibly adding a set of forward tees to add more fun into the game for shorter hitters, the actual construction of the tees must occur. Let's face it. We have all played or seen golf courses where the forward tees are little more than an afterthought. The size of the forward tees does not need to be large (1,000-2,000 sq. ft.), since the majority of players using these tees do not cause nearly the amount of damage compared to their male counterparts. Also, the amount of play on these tees does not warrant large surfaces that will do little more than use valuable labor for mowing and other operations. However, as with any tee on a golf course, the same amount of care should be given during construction. Specifically, the tees need to be well drained with good sand-based mix and internal drainage. Without internal drainage, seepage usually occurs on the tee perimeters, causing wet areas for mowers or, worse yet, in the entry and exit points for players. The surface should be as level as possible, and it should be seeded or sodded with turf that is grown on the same type of sand to avoid layers. Finally, your golf course architect should design contours that blend into the surrounding area. Hopefully the days of small "push-up" tees that send the wrong message are over!

SUMMARY

During the boom phase of golf in the '90s, golf courses were being built at a rate for the expected growth of the game. This growth has flattened off recently, leading many golf courses into an unexpected competitive situation with other nearby public, private, and resort courses. At a time when the game (and your course) should be welcoming new players, shouldn't we focus on making the game less difficult for these players rather than "stiff-arming" them out of the game? The addition of shorter forward tees is noted at virtually every new golf course built during the past decade. Why shouldn't it be when NGF reports that 25% of all golfers and 41% of new golfers are women! While forward tees are found at nearly all of the newer golf courses, a definite trend has also been noted at older golf courses that have seen the positives that a shorter course represents. In addition to the previous points, the addition of a set of forward markers speeds play and reduces overall fairway acreage, as fairway mowing can start further away from the existing forward tees. It also has the added agronomic advantage of spreading play over more teeing area. Despite initial misgivings voiced by some, forward tees have proven popular to most average players, with many couples reporting that they are finally playing the same course. Whether this leads to more marital bliss or strife remains to be seen!

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

Seasonal wetlands generally hold water for only part of the year. In the Southeast, these wetlands usually fill with rains in late autumn and early winter, and often remain filled through early summer.

Seasonal Wetlands and Golf Courses

Innovative research demonstrates increasing golf course biodiversity.

BY DAVID E. SCOTT, BRIAN S. METTS, and J. WHITFIELD GIBBONS

The golf course landscape may provide an ideal opportunity to combine golf course design objectives with conservation goals such as habitat protection and biodiversity enhancement. From a design standpoint, the incorporation of seasonal wetlands (areas that temporarily hold water) into a course layout has the potential to make a course more varied, aesthetically pleasing, and challenging. From a conservation standpoint, numerous isolated seasonal wetlands scattered across a habitat mosaic of forested and open areas on a course may create a biodiversity boon for amphibians and some reptiles.

Seasonal wetlands represent ideal habitats for many species due to the absence of predatory fish. In conjunction with permanent water hazards, seasonal wetlands of varied types create features with a variety of water-holding periods across the landscape that will be used by a diverse array of species.

THE VALUE OF SEASONAL WETLANDS

Seasonally flooded wetlands have an ecological value that is disproportionately large relative to the space they require and the time that water is present. In some coastal regions, they maintain water quality by controlling the seasonal movement and storage of rainfall. Seasonal wetlands provide essential habitat for a rich diversity of plant and aquatic invertebrate species.

Additionally, many species of semi-aquatic reptiles and amphibians use small wetlands and surrounding uplands as linked habitats, both portions of which are vital to the organisms' survival. These isolated, *seasonal wetlands*, also known as ephemeral wetlands, are an important refuge for wildlife species, particularly in agricultural landscapes where the wetlands are the last remaining unexploited habitat. If a goal of conservation efforts is to maintain or restore the ecological value of small wetlands, then greater knowledge of seasonal wetlands and their contribution to regional biodiversity is critical.

HISTORIC WETLAND LOSS AND THE POSSIBILITIES FOR GOLF COURSES

Wetland loss in the southeastern U.S. has been of concern for many years.

Research at Frostburg State University (Maryland) investigated the viability of constructing seasonal wetlands on the golf course. The work identified amphibian species that inhabited seasonal and permanent wetlands on the golf course.

From the 1950s to the 1970s the loss of wetlands in the Southeast was greater than any other region of the country, with a net annual loss of 386,000 acres (6). On the Coastal Plain of North Carolina, 51% of all wetland acreage had been lost by 1980 (11).

In South Carolina, isolated freshwater wetlands account for more than 22% of the total wetland acreage, yet alteration and destruction of these types of wetlands also have been severe. A recent survey of the status of Carolina bays on the Coastal Plain of South Carolina found that approximately 97% have been altered or severely impacted, and fewer than 200 bays of the original thousands remain relatively unimpacted.

Seasonal wetlands are important from an ecological perspective because they retain surface water for only a portion of a year. The length of time that a wetland holds water, the hydroperiod, has an overriding influence on the range of species that can live and reproduce in or near the wetland, especially with regard to amphibians and other semi-aquatic taxa.

Permanent lakes and ponds are at one end of a hydroperiod continuum because most water hazards on golf courses can be categorized as *permanent*. Lakes and ponds are usually inhabited by a few common non-native fish species (e.g., largemouth bass, bluegill), and, as a result, a limited number of amphibian species except bullfrogs. In general, most amphibian species are preyed upon heavily by fish and bullfrogs, and they do not fare well in permanent waters. Most *pond-breeding* amphibian species actually require seasonal wetlands for breeding and for completing the larval stage of their life cycles.

The historic availability of seasonal wetlands probably accounts, at least in part, for the exceptionally high amphibian and reptile biodiversity of the southeastern U.S. Throughout the region, seasonal wetlands are used by large numbers of amphibian species: 16 species in a 0.40-acre Florida pond (3), more than 20 species in each of numerous wetlands in South Carolina (14,17), 19 species in each of two Tennessee ponds (13), and more than 15 species of just frogs and toads in a single Texas pond (22).

Thus, while increasingly recognized as the most valuable wetland habitat type for maintaining amphibian diversity in the Southeast, seasonal wetlands continue to disappear rapidly and remain unprotected by most wetlands regula-

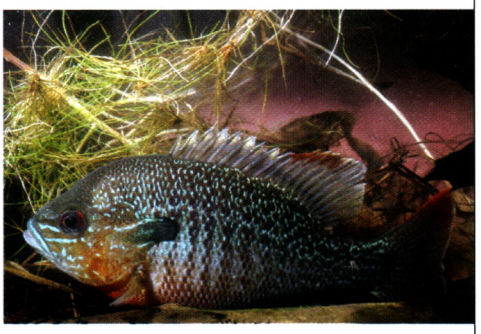
tions. A concerted effort by golf courses to preserve and even create new seasonal wetlands has the potential for great conservation value.

THE GOALS OF OUR STUDY

In general, the goal of this research was to examine how amphibians use the variety of wetlands found on golf course landscapes, and compare them to amphibian use of off-course seasonal wetlands. This was accomplished through a combination of sampling on five courses and in ten off-course wetlands, surveying the literature, and analyzing prior data on seasonal wetlands. Based on the results, recommendations were developed for enhancing biodiversity on golf courses by increasing the distribution and abundance of seasonal wetlands as part of a golf course landscape.

THE MAIN PLAYERS . . . FROGS, TOADS, AND SALAMANDERS

Approximately 40 species of amphibians occur in the Central Savannah River Area (CSRA), and many of them use seasonal wetlands for breeding and larval development. Individual species vary in the times of year they breed.



Some species, particularly some salamanders, breed in the autumn, followed by other species that breed in winter, spring, and summer. We sampled wetlands on and off golf courses throughout the year to account for species differences in breeding chronology. Wetlands were sampled approximately every two months. Each sample period consisted of four days/three nights of trapping with small-meshed minnow traps, supplemented by dip-netting, hoop-net trapping, hand collecting, and visual observations.

Sampling in off-course seasonal wetlands began in April 1999. Golf course wetland sampling at five courses was added in late summer of 1999. We compared the diversity and abundance of amphibians in permanent aquatic habitats to those of seasonal wetlands,

both among courses and between courses, and the off-course wetlands.

Sampling confirmed a well-known trend in amphibian ecology — wetlands that harbor fish populations are generally not suitable for a diversity of amphibian species. In the permanent lakes and ponds on CSRA golf courses we have found three primary amphibian species: bullfrog (*Rana catesbeiana*), green frog (*Rana clamitans*), and southern toad (*Bufo terrestris*). All lakes and ponds contain numerous predatory fish species, including species of sunfish (*Lepomis* spp.), largemouth bass (*Micropterus salmoides*), redfin pickerel (*Esox americanus*), mosquitofish (*Gambusia affinis*), and lake chub (*Couesius plumbeus*). Additional amphibian species were found in stream and marsh areas on some courses, including the lesser siren (*Siren intermedia*), dwarf waterdog (*Necturus punctatus*), southern leopard frog (*Rana utricularia*), and mud salamander (*Pseudotriton montanus*).

The seasonal wetlands sampled off golf courses had greater numbers of amphibian species than permanent golf course wetlands. Off-course seasonal wetlands generally had 2-3 additional salamander species and 2-5 additional frog and toad species. On the two courses that have seasonal wetlands (Edgefield, S.C., and North Augusta, S.C.), we found some of this region's pond-breeding species in our sampling of the on-course seasonal wetlands, but we did not find these species in the on-course permanent lakes. Species at the permanent golf course wetlands were the expected species, i.e., those known to be tolerant of fish and to inhabit long hydroperiod wetlands, such as bullfrogs and southern toads. At the on-course seasonal wetlands we picked up several species generally associated with shorter hydroperiod wetlands and a lack of fish, including marbled salamanders, spotted salamanders, and narrowmouth toads. At the comparison sites we found many species not captured on any golf course, including mole salamanders, ornate chorus frogs, spadefoot toads, and gopher frogs.

IMPLICATIONS OF THE RESULTS

Most golf course water hazards had a lower diversity of amphibians than

comparison seasonal wetlands (i.e., similarly sized, natural wetlands with variable hydroperiods). Consequently, we predict that incorporating more seasonal wetlands into the golf course design will increase the biodiversity of amphibians and other semi-aquatic animals. This idea cannot be tested until seasonal wetland habitats are implemented in golf course designs and the amphibian populations are monitored. However, our extensive sampling of seasonal wetlands indicates that if the wetland itself is intact, and if there is suitable adjacent terrestrial habitat, then it is likely that amphibians and other wetland species will thrive. One unknown, of course, is whether effects from chemical use on golf courses will be any different in a variable hydro-

Summary Points and Management Recommendations

- Seasonal wetlands enhance amphibian diversity on golf courses.
- Increased landscape diversity of wetlands equals higher diversity of amphibians.
- Education of the golf community on the value of seasonal wetlands is vital.
- Seasonal wetlands should be incorporated into golf courses, either in out-of-play areas or as course hazards.
- Some permanent wetlands can be converted successfully to seasonal wetlands.
- Upland habitats of amphibian species also must be conserved.

period habitat, as compared to permanent waters.

The creation of true seasonal wetlands from scratch is largely an unknown art/science. Although there is abundant information on techniques for restoring previously degraded wetlands, if the goal is to create a wetland with a variable hydroperiod that mimics a natural seasonal wetland, then little research has been conducted. Given the need for and benefit of such wetlands on a golf course landscape, studies that determine the best methods for constructing these habitats are essential.

ACKNOWLEDGMENTS

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Research *You Can Use*

Biological Control of White Grubs by Parasitic Wasps

Parasitic wasps help control white grub populations.

BY MICHAEL E. ROGERS AND DANIEL A. POTTER

White grubs, the root-feeding larvae of various native and introduced scarab beetles, are the most widespread and destructive insect pests of lawns and golf courses in the United States. Collectively they account for hundreds of millions of dollars in damage and control costs every year (1).

White grubs traditionally have been controlled with soil insecticides. However, pesticide usage in suburban areas is increasingly restricted due to perceived hazards and environmental concerns such as groundwater contamination. These issues, and the 1996 Food Quality

White grubs, the root-feeding larvae of scarab beetles, account for millions of dollars in damage and control costs to golf courses and other turf areas. Oftentimes, skunks and raccoons cause considerable damage as they scavenge for grubs as a food source.

Protection Act, have led to cancellation of nearly all of the organophosphate and carbamate insecticides that previously were mainstays for curative grub control. While the older chemistry has given way to more selective, preventive products such as imidacloprid (Merit®) and halofenozide (Mach 2®), many superintendents still seek ways to reduce their reliance on insecticides, treating only as necessary and integrating pesticides with non-chemical controls.

Natural enemies can be important in buffering turf habitats against pest outbreaks (2), yet beneficial insects received little attention in the past decades of reliance on chemical controls. The research summarized here focused on wasps in the genus *Tiphia*, which are the predominant parasitic insects that attack white grubs in the soil. Little was known about these beneficial wasps before our studies revealed details of their life history, behavior, and some ways that their benefits on golf courses can be conserved.

We found two species of *Tiphia* to be abundant on Kentucky golf courses, taking a surprisingly heavy toll on the grub population at some sites. *Tiphia pygidialis* is a native species that attacks grubs of northern and southern masked chafers. *Tiphia vernalis*, a native of Japan, was introduced into the eastern United States during the 1920s for biological control of the Japanese beetle. We studied their life history, time of year that they are active, how wasps locate and parasitize their victims, and the extent of natural grub control that they provide. We also investigated ways that superintendents might conserve their populations on golf courses.

TIPHIA WASP BIOLOGY

Tiphia are dark-colored solitary wasps, typically less than ½ inch long, that spend most of their lives below ground. They are inconspicuous and pose no threat to humans. The females fly over turf, land, and burrow into the soil where grubs are present. Unlike the much larger cicada killer wasps, *Tiphia* burrowing does not cause mounding or other turf damage.

Once a suitable host is located, the wasp stings the grub in its ventral nerve cord to temporarily paralyze it. Then she lays a single egg on the immobilized grub in a species-specific location. Eggs of *Tiphia vernalis* are attached to the underside of Japanese beetle grubs, whereas *Tiphia pygidialis* glues its eggs on the back of masked chafers. The paralyzed grub soon recovers from the sting, but when the *Tiphia* egg hatches in about three days, the tiny wasp larva bites through the grub's skin and begins feeding on its body fluids.

The larval *Tiphia* feeds, vampire-like, slowly draining juices from the still-living victim. It molts several times over the next 14-21 days, increasing in size. By the time the parasite reaches the fifth (final) instar, the host grub has become flaccid and deflated. The *Tiphia* larva then devours all the remaining soft body tissue of its host and spins a small, fuzzy, brown football-shaped cocoon. The *Tiphia* pupates and overwinters within this cocoon, emerging as an adult wasp the following year.

FLIGHT PERIOD AND PARASITISM RATES

We monitored the seasonal flight periods of both species of *Tiphia* wasps

Tiphia pygidialis wasps are a natural enemy of the masked chafer grub and may be a part of future biological control strategies. They attack the host grub in the soil and apply a paralyzing sting.

The masked chafer grub bears a newly laid *Tiphia* egg on its back.

on central Kentucky golf courses. Two sampling methods were used. Pan traps, yellow plastic bowls filled with soapy water, were placed in roughs, one day per week, to monitor the spring-active *Tiphia vernalis*. We also sprayed dilute (10%) sugar water on foliage of adjacent trees and noted activity of wasps that came to the residues to feed.

Deploying these methods for three consecutive years, we determined that *T. vernalis* wasps are active in Kentucky from late April through the first week of June. They seek out and parasitize third-instar Japanese beetle grubs that have resumed feeding in the rootzone after overwintering. The wasp flight is largely over by the time non-parasitized grubs are pupating, two weeks or so before adult Japanese beetles begin to emerge.

Our pan traps failed to attract the fall-active *T. pygidialis* wasps. Sugar sprays applied to tree foliage also were ineffective for monitoring the flight of that species. Instead, we found that sugar water sprayed directly on the turf readily attracted large numbers of *T. pygidialis*. The difference in the two species' response to sugar sprays is likely due to a difference in their mating behavior. *Tiphia vernalis* mate on the foliage of trees and low-growing plants surrounding turf sites, whereas *T. pygidialis* mate directly on the turf. Monitoring also determined that *T. pygidialis* wasps are active from mid-August through the end of September, parasitizing third-instar masked chafer grubs.

The extent of natural control provided by each *Tiphia* species was estimated near the end of the wasps' flight period by sampling the grub population in the rough along the edge of fairways at several golf courses. We sampled Japanese beetle grubs in early June and masked chafers in September. Ten one-square-foot sections of turf about a foot deep were sampled at each site. Based on the number of non-parasitized grubs, parasitized grubs, and *Tiphia* cocoons found in each sample, grub parasitism rates ranged from 15% to 50% at our study sites. Parasitism rates tended to be highest in patches of turf where grubs were abundant, suggesting that *Tiphia* wasps focus on such areas.

HOW DO WASPS LOCATE GRUBS BELOW GROUND?

Each *Tiphia* species parasitizes only one or a few closely related grub species. Given that several unrelated grub species (e.g., Japanese beetles and masked chafers) often occur in the same turf, how do these wasps locate the "right" grubs and avoid those that are non-hosts?

We used a soil-filled glass observation chamber to observe and videotape the wasps' underground behavior, including their response to cues from host and non-host grubs. In the observation chamber, a Y-shaped trail was made in the soil. Each arm of the Y-trail was prepared with cues that included grub body odor trails, grub frass (feces), or combinations thereof to entice the *Tiphia*. A female wasp was introduced at the base of the Y and allowed to choose between the two trails containing different cues. Each comparison was repeated 30 times with different wasps, and responses to cues from both host and non-host grubs were tested.

We determined that each species of *Tiphia* wasp can discriminate between

The newly emerged wasp larva uses the grub as a food source.

The final instar wasp larva devours the deflated remains of its host grub.

body odor trails and frass from host and non-host grubs (3). Like a bloodhound, they follow these trails to locate their hosts in the soil. Females of *Tiphia vernalis* followed trails containing body odor and frass from Japanese beetle grubs, their normal prey, whereas *Tiphia pygidialis* followed similar cues from masked chafers. Neither wasp responded to cues from non-host grubs.

PARASITISM AFFECTS GRUB BEHAVIOR

Grub damage usually is diagnosed by pulling back patches of damaged turf, which exposes grubs at the soil surface. We tried to survey for parasitized grubs by this method, but surprisingly few were found. Excavating such patches with a shovel revealed that the parasitized grubs and *Tiphia* cocoons were deeper down than grubs normally feed. These observations suggest that parasitism causes grubs to cease feeding and move deeper in the soil.

We tested this hypothesis by placing newly parasitized or normal grubs into observation chambers resembling an "ant farm" through which we could observe their movements in the soil. Observations confirmed that parasitized grubs cease feeding and move deeper in the soil. This burrowing response is induced by venom injected by the adult wasp and sustained feeding of the developing *Tiphia* larva. Field tests with grubs implanted into turf plots showed the same response — white grubs bearing a *Tiphia* larva moved downward over 2-3 weeks until they were 8-10 inches deep in the soil. Likewise, *Tiphia* cocoons will be found relatively deep in the soil. This phenomenon likely is why the impact of *Tiphia* wasps on grub populations was underestimated, or even overlooked, in the past.

CONSERVING *TIPHIA* WASP POPULATIONS

Since *Tiphia* wasps occur naturally on many golf courses, we investigated tactics that superintendents might use to encourage or conserve their populations. One approach might be to provide supplemental food such as plantings of nectar-producing perennial wildflowers to attract or sustain the wasps in particular areas, resulting in increased parasitism rates.

To test this idea, we established gardens with several dozen species of spring- or fall-blooming perennial wildflowers and monitored them to determine which flowers *Tiphia* wasps might use as a food source. While the gardens attracted many other species of parasitic wasps, as well as pollinators, almost no *Tiphia* wasps visited the wildflower gardens. Instead, we mainly found them feeding on the sugary excrement, or honeydew, left by aphids and scale insects on leaves of nearby trees. We did, however, find that the wasps, especially *T. pygidialis*, could be attracted to patches of turf by spraying the grass with sugar water. Further work is needed to determine if this approach results in any real practical benefit.

We also examined the compatibility of spring insecticide application with the natural control provided by *Tiphia* wasps. Lawn care companies and homeowners sometimes apply preventive insecticides, typically imidacloprid (Merit®) or halofenozide (Mach 2®) as early as late April or May, counting on their relatively long-lived residues to last until egg hatch of annual grub species in July or August. Golf course superintendents may make such applications in May when multiple-targeting black turfgrass ataenius and annual grub species. Such treatments coincide with the period when *T. vernalis* wasps are actively parasitizing Japanese beetle grubs.

Field and lab studies were done to examine the effects of imidacloprid (Merit®) on the health of *Tiphia* wasps and their ability to parasitize grubs in treated soil. Turf plots on a golf course where *T. vernalis* are abundant were treated with the label rate for grub control at the beginning of May, while others were untreated. Thirty third-instar Japanese beetle grubs were implanted into each plot. After three weeks, the plots were excavated to compare parasitism rates. The difference was striking: less than 10% of the grubs were parasitized in the treated plots, as compared to 45% in the controls. A similar experiment in pots of turf showed an even greater reduction in parasitism. We determined that exposure to the freshly treated soil did not kill the *Tiphia* wasps, nor did they avoid treated turf areas. Rather, the exposed wasps became intoxicated to the extent that their ability to locate and parasitize grubs was impaired.

These results show that even with modern insecticides, proper timing is important to conserve natural enemies. Unless the superintendent is simultaneously targeting the earlier-hatching black turfgrass ataenius, the optimal window for preventive control of Japanese beetles, masked chafers, and other major grub pests on golf courses is mid-June to mid-July. That timing ensures that fresh residues are in the soil during egg hatch, while conserving the spring *Tiphia* wasp populations that help to suppress Japanese beetle grubs in non-treated areas. While no one natural enemy alone is likely to bring about complete control of white grubs, conserving natural enemies, when possible, makes good agronomic sense.

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FAIR FAIRWAYS: GOING, GOING, GONE?

Maintenance technology may produce conditions too good for golfers.

BY PATRICK O'BRIEN

Mowing technology has improved significantly since the horse-drawn cutting units of the earlier part of the 20th century.

Turfgrass managers and course officials are being pummeled by cries of "there's no grass on the fairways." In this era of alleged global warming and massive maintenance budgets, is turfgrass disappearing from fairways? Not likely. Instead, these cries are the results of golfers receiving precisely what they have demanded for years: either "the best conditions possible" or "championship conditions every day." Championship conditions may sound desirable in the 19th hole, but hitting a golf shot off the tight lies associated with these conditions leaves little margin for error and a large margin for frustration.

How have improvements in technology and maintenance techniques allowed turfgrass managers to prepare the best fairway conditions ever? And what is the best strategy for creating the fairest fairway conditions for as many golfers as possible at a given course?

TODAY'S FAIRWAY CONDITIONS

The most typical fairway height of cut today is ½ inch. An appropriate management program combined with a mowing height of ½ inch produces a lie with a minimal amount of grass to be trapped between the ball and the clubface on a well-struck golf shot.

Mowing heights and management strategies at the other ends of the spectrum produce different types of lies and different levels of playability. For U.S. Open conditions, "We do not desire any grass between the clubface and the ball," reports USGA Director of Championship Agronomy Tim Moraghan. The absence of grass between the clubface and the ball offers the skilled player the best opportunity to control the spin and trajectory of the ball.

As fairway height increases above ½ inch, there is a greater likelihood that grass will be trapped between the ball and the clubface. The chance for "flier" lies is greater at taller mowing heights.

THE EFFECTS OF TIGHT FAIRWAY LIES ON GOLFERS

Many higher-handicap golfers believe a low height of cut on fairways or the use of plant growth regulators can cause them not to play well. This is not a turfgrass problem, but a golfer problem. High handicappers have a tendency to scoop or sweep the ball. The less cushion that exists underneath the ball, the less margin there is for error. Low-handicap players prefer tighter lies because they have greater control of ball flight.

WHY ARE FAIRWAYS MAINTAINED SHORTER TODAY?

There has been a desire to mow fairways lower and improve conditions for many years. As technology has developed and budgets have increased, turfgrass managers have the ability to maintain fairways shorter and tighter than ever before.

MOWING TECHNOLOGY

Mowing technology has improved significantly over the past 40 years. Old tractor-drawn 5- and 7-gang pull units of the 1960s and '70s were capable of mowing fairway turfgrass at just below ¾ inch. Lower mowing heights were not possible with these machines because the bedknife would drag along the ground.

The next mowing advancement was the 9-gang self-contained unit, with 9-bladed reels that rotated based on the ground speed of the machine. The cutting units were ahead of the tractor for the first time ever. These machines cut the grass without bending the blades with the tractor tires. This produced a higher quality clip, but the mowing height still was limited to just below ¾ of an inch.

In the early 1980s, another major advancement occurred with the development of the first hydraulically driven reels with either 5- or 7-gang reels drawn by a tractor. These mowers could cut the fairways at ½ inch, but the tractor was ahead of the reels, causing some bending of the grass blades due to the tires.

In the late 1980s, the first self-contained 5-plex units were developed. These mowers have cutting units ahead of the tractor, similar to the green triplex mowers. Today, these units are made with more durable materials to improve longevity. A grooved front roller has replaced the solid front roller, further reducing the bending of the turfgrass prior to mowing. Articulation of the cutting units also is highly advanced to reduce scalping injury to the turfgrass. Most 18-hole golf courses today have two 5-plex self-contained mowers that easily stay ahead of play with their speed. Mowing at ½ inch or even ⅜ inch is easily done with these 5-plex machines, and their cost is now more justifiable to practically all types of courses with either lease or purchase plans.

GROWTH REGULATORS

Growth regulators have significantly improved fairway quality since the early 1990s. These products impact the plant by reducing vertical growth without affecting lateral growth. The result is a turfgrass with better density, improved turfgrass health, and reduced water use.

Growth regulators reduce clipping production, which improves the quality of cut and reduces difficulties associated with mowing damp fairways. Scalping is reduced due to less vertical growth. This is a key feature when rain cancels one or more scheduled fairway mowings. Slower top growth now provides better weekend play when fairways are not mowed.

CULTIVATION EQUIPMENT

Superintendents have better cultivation equipment to battle soil compaction, drainage, and thatch problems. Fairway turf is healthier, smoother, firmer, and more dense. At most courses, full turf coverage exists without minimal bare areas due to modern cultivation strategies. In the Pacific Northwest, fairway topdressing has reduced fairway wetness and earthworm castings.

TURFGRASS SPECIES

The most popular turfgrass species used on golf courses today are hybrid bermudagrass, zoysiagrass, seashore paspalum, creeping bentgrass, *Poa annua*, perennial ryegrass, and Kentucky bluegrass. All these species except Kentucky bluegrass and zoysiagrass can be mowed well below ½ inch and can provide incredibly smooth and tight surfaces.

FINDING A HAPPY MEDIUM

There are several steps that should be followed to establish reasonable fairway conditions.

STEP 1: Be careful what you ask for.

For years, golfers have been clamoring for the best conditions possible on a daily basis. Some-

The development of new mower cutting units helps produce some of the finest fairway playing conditions on today's golf courses.

times this statement sounds better than the results it produces. The best daily fairway conditions just might be too difficult for many golfers to handle.

STEP 2: Remember "The Law of Unintended Consequences."

A decision to raise the fairway mowing height may improve the ease at which a high handicapper can hit a shot from a fairway, but it may have other unintended consequences. For example, taller grass on fairways reduces ball roll. This impacts the player who is accurate, but does not hit the ball far. Distance control will be more difficult at higher heights, as more grass becomes trapped between the clubface and the ball. The cushion beneath the ball offers higher handicappers more margin for error, but they, too, will hit more "fliers" than on fairways with shorter grass. The private club business is becoming increasingly competitive. Fairways with grass taller than the average ½ inch cut may make the course unattractive to some prospective members.

STEP 3: Create a standard at the course.

In today's era of political correctness, it is often the group that screams the loudest that gets the most attention. If a golf course has not established a maintenance standard for fairways that takes into account the desires of all groups, they are vulnerable to the vocal minority and may be pressured into making a decision that does not reflect the interests of the majority.

STEP 4: Stay with the standards.

You cannot please all of the people all of the time. Keep in mind that the comment "There's no grass on our fairways" is a golfer issue, not a turfgrass issue. A better solution may be instruction, not changing maintenance practices to suit a certain group's skill level.

CONCLUSION

Technology and the skill of today's turfgrass professionals have made a lasting impact on course conditioning. Have we reached a point where conditions have become too good for most of the players? Only time will tell as we examine the standards implemented by golf courses throughout the country.

PATRICK O'BRIEN *is the director of the USGA Green Section Southeast Region and just hopes he plays on the fairways.*


THE
COMMANDMEN
of GOLF

The Lost Commandments

The wisdom of the ages is preserved for posterity.

BY DAVID A. OATIS

In the course of conducting a Turf Advisory Visit at a very old golf course, I was shown an ancient cemetery in an unused portion of the course. Its existence was previously unknown to the superintendent and golfers, and it had been uncovered in the process of carrying out some much-needed tree and brush removal work.

With the idea that this might be a good place to collect grasses for turfgrass breeding purposes, we decided to examine the cemetery. In the course of our search, we stumbled upon an unusual stone monument located in the exact center of the cemetery. It was taller than the others and was ornately adorned with golf balls, trophies, and cherubs brandishing golf clubs. The writing was difficult to decipher because the stone was quite weathered and the inscription was written in Old English, so the spelling and grammar were peculiar. Close scrutiny revealed an interesting inscription, perhaps just as appropriate today as the day it was chiseled into the stone long ago.

THE 10 COMMANDMENTS OF GOFFE

I. Thou shalt not complaine that the links are not well suited to thy game.

II. Thou shalt accept responsibility for thine own actions and not blame hapless folke for thine own mistakes.

III. Thou shalt not take the name of thy greenkeeper in vain.

IV. Thou shalt not covet thy neighbor's greens.

V. Thou shalt not force, nor pressure in any mannour, thy greenkeeper to imperil thy greens by means of using weighty rollers or clipping/grazing too closely.

VI. Thou shalt not place at risk the plants or little creatures in an unholy pursuit of deepening the colour of thine turves.

VII. Thou shalt not place any woody plants or artificial or contrived moundes on the links, for if they were intended to be there, the Lord would have seen to it long before they were envisioned by thee.

VIII. Do not place thy game of goffe before the true gods of man and nature, and remembre that goffe is a grande and wonderful game and a chance to speake with nature, but it is not a religion unto itselfe.

IX. Lest thy families and worke be ignored, thou shalte playe in a most expediente mannour.

X. The single most important commandment, find thy featherie/guttie and smite it until it is lost from the eyes of man or until it is directed into the hole. Thou shalte not improve thy lie.

At the end of the list of "Golf's Ten Commandments," there was clearly placed an "XI," and a blank space was provided after it as if to say, "Here are the ten commandments but I'll leave space for another one should it ever become necessary." Considering all that has changed in the game of golf over the years, one must believe that there is need for a few more commandments. I will be happy to entertain all suggestions, but until such time as they are received, the following are my proposals:

XI. Thou shalt not confuse the blasphemy thee hears on television with commandments I through X.

XII. Abel bodied men shalte not use goffe carts. Theye are for the infirme.

XIII. Thou shalte let thy links rest on the seventhe daye.

XIV. Thou shalte not seeke to immitate or copy the links of they neighbore.

Author's note: Honoring the request of the course official, the exact location of the cemetery and monument is considered privileged and shall not be disclosed.

DAVID OATIS *is director of the Green Section Northeast Region.*

ILLUSTRATION BY JOHN FRETZ

Fairy Ring: Fantasy or Nightmare?

"At night, fairies come out of their hiding places, join hands, and dance in a circle. By morning, mushrooms have sprouted in the circular path where the fairies danced."

BY JAMES J. FARRAR

One or a combination of fairy ring symptoms may appear at any one time. Dark green rings are primarily an aesthetic problem.

That pre-golf-era tale was the original explanation for roughly circular patterns of mushrooms growing in forests, grasslands and, later, golf courses and lawns. Fairy ring of turfgrass is actually caused by mushroom-forming fungi growing and reproducing in the soil. Although at least 60 species of fungi have been reported to form fairy rings, fairy ring in any one particular location is caused by only one species of fungus. The most common are species in the genera *Marasmius* and *Lepiota*.

Fairy ring is an odd turf disease since the fungus does not directly attack the grass plant. The fungus grows on the dead organic matter in the soil and only indirectly causes symptoms. While it may be pleasant to fantasize about fairies dancing in a circle, fairy ring actually is a serious problem of golf greens and fairways.

SYMPTOMS

Fairy ring fungi produce three kinds of symptoms: mushrooms, dark green rings, and rings of dying turf. One or any combination of symptoms may appear at any particular time. On golf courses, fairy rings generally occur in two- to five-year-old greens. The classic fairy ring symptom is a ring or partial ring of mushrooms. Rings vary in

diameter from a few inches to 30 feet or more. Larger rings are often arcs or partial rings, and there may be large gaps in the ring. Fairy ring symptoms can occur without the mushroom stage, and on golf courses the appearance of mushrooms is the least common of the three symptoms.

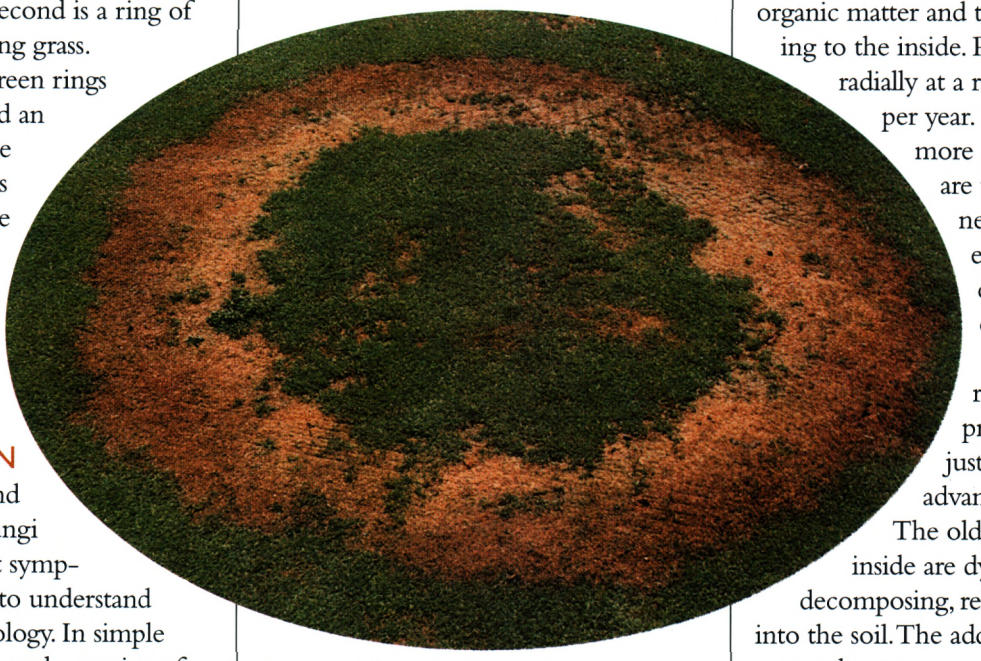
There are two non-mushroom symptoms. One is a ring of darker green grass and the second is a ring of water-stressed or dying grass. Although the dark green rings are usually considered an aesthetic problem, the mushrooms and rings of dead grass interfere with play of the game.

FUNGI GROWTH AND REPRODUCTION

In order to understand how the fairy ring fungi produce the different symptoms, it is important to understand some basic fungal biology. In simple terms, the fungus life cycle consists of three parts — mushrooms, spores, and vegetative filaments called hyphae. Mushrooms are the sexual reproduction stage, and they produce millions of microscopic, airborne spores. The spores are passively transported by air currents and then settle to the ground. If the spores land in a suitable environment, they germinate to produce hyphae.

Hyphae are very fine, threadlike structures. Hyphae produced from spores of opposite mating types must fuse together in order to continue the life cycle. Hyphae grow by elongating at the tip and branch, so that starting from one point the vegetative body expands radially. This means the fungus expands as an enlarging circle. The expansion rate is generally a few inches per year.

Hyphae in the leading or outside edge of the circle grow and digest the organic matter in the top few inches of soil. Hyphae toward the inside of the circle die from lack of food since all the available organic matter has been consumed. Then the mass of hyphae changes from a solid circle to a ring shape. When the fungus has gathered enough energy from digesting organic matter in the soil, it forms a mushroom and reproduces by making spores.



Fairy ring exhibits itself as dying, water-stressed grass, and eventually dead turf. The rings of dead grass interfere with play of the game.

DEVELOPMENT OF FAIRY RINGS IN GOLF COURSES

With that understanding of fungal biology and reproduction, it is easier to understand the symptoms. Fairy ring fungi thrive on organic matter that contains high amounts of lignin, such as thatch, peat moss, sawdust, wood chips, and bark. If thatch is not properly managed by regular core aerification, vertical mowing, and sand topdressing, then a high-lignin habitat for fairy ring is created. The airborne spores of the fungus will settle on the thatchy turf and begin growing. Regular thatch maintenance helps prevent fairy ring by not allowing a favorable habitat to develop. Recently constructed greens also are a good habitat for fairy ring since they are typically constructed of a combination of sand and peat moss. Symptoms may occur two to five years after construction of a new green, since that is enough time for the spores to land, grow, and cause symptoms.

The ring pattern for all three symptoms (mushrooms, dark green grass, and water-stressed to dead grass) is due to the hyphae growing outward into new organic matter and the old hyphae dying to the inside. Rings expand radially at a rate of a few inches per year. Figure eights and more complex patterns are the result of neighboring rings expanding and contacting each other.

The dark green ring of grass is produced in the area just behind the advancing new hyphae. The old hyphae to the inside are dying and decomposing, releasing nitrogen into the soil. The additional nitrogen causes the grass, especially grass that is slightly nitrogen deficient, to become a darker green.

The water-stressed and dying rings of turf are somewhat more difficult to understand and much more difficult to control. If the hyphae are growing closely packed together because of an abundance of organic matter, they form a tight mat-like layer in the upper one to two inches of soil. Hyphae are water-repellent (hydrophobic), and when they are packed tightly together, they form an impervious layer that irrigation water does not penetrate. The soil dries out below the water-repellent layer of hyphae. Therefore, grass roots will not have water to absorb and send to the grass blades. The grass wilts and, in severe cases, dies from a very localized lack of water. The mat of white hyphae and the localized area of dry soil below are easily visible if one cuts into the ring with a soil probe or shovel. The

soil just a few inches away from the localized dry spot has plenty of moisture.

MANAGEMENT OF FAIRY RING

Using the knowledge of the biology and causes of fairy ring makes it easier to understand the remedies to the problem. Mushrooms interfere with play, but they can be easily dealt with by mowing off the tops, vertical mowing to remove the mushroom stumps, and sand topdressing. These treatments just remove the existing mushrooms and more may spring up the next day or next week. Hyphae are still growing in the soil and will continue to produce mushrooms for up to several years.

Applying additional fertilizer to the surrounding turf to make all the grass the same color can mask the dark green ring symptoms. Foliar applications of iron are especially good for masking symptoms. Fertilizer applications are cosmetic fixes and do not affect the fairy ring hyphae in the soil.

The most difficult symptom to control is the ring of water-stressed and dying grass. Several different controls can be applied alone or in combination. These include vertical mowing, core aerifying, and sand topdressing to break up the hydrophobic layer of fungal filaments, surfactants (soap-like chemicals) to break down the hydrophobic properties of the fungal filaments, and specific fungicides to kill the fungus. All of these control treatments help promote healthy turf, but none of them provides perfect control. Core aerifying and surfactant treatments break up the hydrophobic layer and allow water to penetrate the soil but do not kill the fungus. Fungicide treatments kill or debilitate much of the hyphae. The older fungicides were not always effective at controlling fairy ring, but the new strobulurin fungicides (e.g., ProStar and Heritage) work well. Despite the best control efforts, fairy ring may reappear as a slightly larger ring in the same location year after year.

CONCLUSIONS

Fairy rings are caused by certain species of mushroom-forming fungi growing on the organic matter in the soil. Rings expand as the fungus continues to grow outward. Management of fairy ring consists primarily of prevention and judicious use of strobulurin fungicides when symptoms appear. Although the name fairy ring evokes fantastic images of fairies dancing on the turf, the disease is much more like a nightmare for golf course superintendents.

JAMES FARRAR, PH.D., *is assistant professor in plant pathology at California State University in Fresno.*

The classic fairy ring symptom is a ring or partial ring of mushrooms. The mushroom mycelia feed on organic matter found in the turfgrass root zone.

Perennial Ryegrass Fairway Renovation

Effective renovation to seeded bermudagrass.

BY D. W. WILLIAMS AND P. B. BURRUS

Perennial ryegrass (*Lolium perenne*) is a popular choice for golf course fairways in the transition zone. There are many perennial ryegrass cultivars that exhibit excellent turf quality: dark green color, high shoot density, acceptable heat and drought tolerance, and adaption to low mowing heights.

Disease resistance is another story, and fungal diseases may cause major problems. Perennial ryegrass is highly susceptible to brown patch (*Rhizoctonia solani*), pythium (*Pythium spp.*), and gray leaf spot (*Pyricularia grisea*). Each of these diseases can cause significant damage to perennial ryegrass fairways and may require regular fungicide treatments.

Bermudagrass (*Cynodon dactylon*) is also a desirable species for low-maintenance fairways in the transition zone due to its relative lack of pest problems, and it is at the peak of its growth during the peak of the golf season. It also allows cost-efficient and effective weed control strategies during its winter dormancy.

Much progress has been made in improving turf quality and cold-temperature hardiness of seeded bermudagrass, and using seeded bermudagrass has become a viable option for transition zone turf managers who wish to renovate perennial ryegrass fairways. However, the best methods of renovating existing perennial ryegrass fairways with seeded bermudagrass have not been investigated.

Turf renovation often requires herbicide applications to reduce or remove competition, thereby allowing new seedlings to become established. Glyphosate (Roundup) is often used in renovation and is very desirable for two reasons. The effects of glyphosate generally are not visible until five to seven days after application, allowing time for overseeded seed to germinate before the effects of glyphosate become apparent. Secondly, glyphosate applications have little effect on germination or establishment, even when seeded soon after application.

Pronamide (Kerb) is often used to selectively remove perennial ryegrass from existing stands of bermudagrass

Seeding in the research plots was accomplished by aeration, vertical mowing, application of chemicals, and broadcast seeding. Plots were aerated to ensure good seed-to-soil contact during the seeding process.

The best methods of renovating existing perennial ryegrass fairways with seeded bermudagrass have not been investigated.

An important aspect of successfully renovating perennial ryegrass fairways to seeded bermudagrass is winter survivability of the bermudagrass. This plot shows the excellent survival of "Yukon" bermudagrass in glyphosate-treated plots in the spring following the first year of the study.

following winter overseeding. However, pronamide is known to persist in soils for long periods of time and may have detrimental effects on seedling bermudagrass. As with glyphosate, however, the effects of pronamide on perennial ryegrass are not immediately visible, and this could allow bermudagrass germination and establishment before perennial ryegrass color and playability become unacceptable.

Several plant growth regulators are known to have activity on perennial ryegrass. Application of these products may reduce competition from perennial ryegrass during bermudagrass germination and establishment. It is important to test a range of plant growth regulators, as they have different modes of action and sites of entry into plant tissues.

FIELD EXPERIMENTS

This research project was designed to test chemical treatments to enhance establishment of seeded bermudagrass in existing perennial ryegrass fairway turf. The timing of seeding for successful renovation following chemical treatments also was evaluated. Experiments were conducted at the University of Kentucky's Agricultural Experiment Station in Lexington.

Existing stands of mature perennial ryegrass maintained at ⅝ inch were used. Cultivars of seeded bermudagrass included "Mirage" and "Yukon." Chemical treatments and plant growth regulators were applied at label rates along with an untreated control (Table 1).

Seeding was accomplished by aeration, vertical mowing, application of chemicals, and broadcasting seed by hand. Plots were then dragged with a steel mat. Timing treatments consisted of seeding one day or seven days following applications of chemical treatments. The seeding rate was 0.50 pounds of pure live seed per 1,000 square feet. Nitrogen was applied as

Bermudagrass seedlings emerged from plots that received glyphosate. Significant bermudagrass coverage was noted in 20-25 days after seeding in both years of the study. Nearly 60% coverage was achieved two months after seeding.

Table 1

Chemical treatments, formulations, and rates of products applied per 1,000 square feet in experiments to renovate perennial ryegrass fairways to seeded bermudagrass.

Chemical Name	Formulation	Rate (oz. product/1,000 ft²)
Roundup (glyphosate)	4SC	1.10
Kerb (pronamide)	50WP	0.75
Primo (trinexapac-ethyl)	1.5SC	0.50
Proxy (ethephon)	2SL	5.00
Trimmit (paclobutrazol)	2SC	0.75
Cutless (flurprimidol)	50WP	0.55
Control: no chemicals applied		

urea at a rate of 1 pound N per 1,000 square feet once at seeding and once every two weeks following seeding until August 15 each year.

Bermudagrass establishment was evaluated weekly following treatments. Plots were rated for percent bermudagrass cover until the end of each growing season. Bermudagrass survival within each treatment combination was also rated during the following spring of each year.

In both years of the study, Roundup was the most successful treatment in renovating perennial ryegrass to seeded bermudagrass. Plots treated with Kerb resulted in significantly more bermudagrass cover than the untreated control and all plant growth regulator treatments in 2001.

However, the percent bermudagrass cover in Kerb-treated plots was significantly less than the cover recorded in Roundup plots. None of the plant growth regulator treatments were effective in enhancing bermudagrass cover more than the untreated. There were no consistent differences between seeding one day after chemical treatments vs. seven days after treatments. It also is very clear from the data that Yukon survived the winter following renovation significantly better than Mirage (Table 2).

The results of our research indicate that applications of Roundup provide a very acceptable transition of perennial ryegrass fairways to seeded bermudagrass. However, plots treated with Roundup did not result in a smooth color transition. Kerb applied at label rates also resulted in significant bermudagrass establishment with a much smoother transition of color, but was not as successful in total renovation as Roundup-treated plots. Roundup plots were totally (100%) necrotic before bermudagrass germination.

Significant bermudagrass coverage (20-40%) was noted in 20-25 days following applications of Roundup in both years of the study, with 58-88% bermudagrass coverage by mid-August. Turf managers can expect successful renovation using Roundup, but they should also expect a significant reduction in turf quality (mainly color) for up to 60 days following application.

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Table 2

Percent of "Yukon" bermudagrass coverage[1] seeded one and seven days after applying herbicides in 2000 and 2001.[2] Plots were seeded mid-June of each year.

	% of Bermudagrass Cover							
	2000 Replication				2001 Replication			
Chemical[3]	Aug. 1	Aug. 17	Sept. 1	June 21, 2001	Aug. 9	Sept. 5	Oct. 3	May 8, 2002
Untreated	0	0	0	0	13	20	23	5
Roundup	66	65	87	44	17	68	92	91
Kerb	7	14	13	9	14	45	60	43

[1] "Mirage" was tested in a similar study and was found to have significantly less overwintering potential than "Yukon."

[2] No consistent differences were noted between seeding one day vs. seven days after treatment. The values were averaged for the purposes of this table.

[3] Primo, Proxy, Trimmit, and Cutless also were investigated. All were in the 0-3% and 0-28% range of bermudagrass cover over all sampling dates for 2000 and 2001, respectively.

Nest box projects breed good results.

BY JEAN MACKAY

When Charles Lange, golf course superintendent of Baymark Golf in Virginia Beach, Virginia, set out to attract bluebirds to his golf course, he didn't expect that he'd also attract positive publicity. But sure enough, Lange built good community relations right along with the 20 birdhouses he and 22 students from a local elementary school built and mounted last June.

Lange invited the children to visit Baymark and help him as a way to get youngsters interested in wildlife and at the same time restore nesting sites for cavity-nesting birds, such as bluebirds, along the Chesapeake Bay, where the golf course is located. The *Eastern Shore News* carried the story of the kids' unusual field trip in its weekend edition. The article recounted the day's events and painted a picture of golf course staff as thoughtful natural resource professionals — a far cry from the *Caddyshack*-style negative stereotyping that has long been a concern of the golf industry.

"We were really pleased with the outcome," says Lange. "Not only did we educate kids and garner some positive publicity, but half the boxes had nests within two weeks and almost all were occupied by midsummer."

ACTION AND OUTREACH — A WINNING COMBINATION

Baymark Golf is not alone in using nest boxes as a way to educate youth and foster community relations. Numerous golf courses enrolled in the Audubon Cooperative Sanctuary Program report positive results each year — in terms of not only the birds they attract, but also the goodwill they breed.

Like Baymark Golf, Cherry Creek Golf Club in Greensburg, Pennsylvania, added an educational component to its nest box project that was lauded by golfers, course homeowners, and the mentally and physically disabled students who spent a day installing the nest boxes and learning about the environment. Golf course superintendent John Nurminen was well prepared for the field visit with bird pelts, stuffed birds in display cases, and other educational materials borrowed from the Carnegie Museum of Natural History in Pittsburgh.

"When the students arrived, we used the museum materials and I gave a brief lecture about the property, animals, and various habitats we were going to see," said Nurminen. "We loaded the carts, toured the property, and installed the students' birdhouses. The day concluded with a brief golf lesson and a pizza lunch. Every one of the students left with a greater understanding of the beauty that surrounds them and a smile from ear to ear."

HOUSE FOR SALE

Half a world away on Australia's Gold Coast, Lakelands Golf Club took a different approach to its nest box project, but achieved similar success in attracting birds and positive attention alike. Golf course superintendent Stephen Marsden worked with the course's membership department to mail a letter to Lakelands' members, inviting them to "Buy a House at Lakelands."

For Sale:
Property at Lakelands Golf Club

Five good reasons to buy a house at Lakelands:

1. Live on the site of Australia's first Jack Nicklaus signature golf course.
2. Be part of an exclusive community.
3. See whose house will generate the most offspring in a calendar year.
4. Receive quarterly updates on the activity in your house.
5. Re-purchase or sell your house at the end of the year.

Results of Audubon International's yearly Nest Box Survey reveal that the 45 golf courses that responded fledged 3,928 young birds in 2001 (2002 data not yet available). With only a small percentage of golf courses reporting, the actual number of young birds born on golf courses is likely many times greater.

"We weren't sure how well this idea would be received," reported Marsden. "At worst, no one would be interested, but we would have provided eight new nest sites." As it turned out, all the birdhouses sold in two weeks.

With that encouragement, Lakelands' membership department and Marsden hit upon the idea of extending the sale of its nest boxes to local businesses and suppliers. But like all hot real-estate markets, the price shot up from $50 per house to $250 for corporate supporters. The money raised paid for additional nest boxes and other Audubon Cooperative Sanctuary projects.

Marsden thanked his new "homeowners" with a letter and placed a small plaque with the owner's name on the front of each box. He updates owners quarterly with a report of bird activity.

"The members are very happy with the concept," said Marsden. "But more important, they're pleased with the fact that Lakelands values the environment in which we operate."

Nest boxes have long been a simple tool for increasing nesting sites for cavity-nesting birds. They're easy to make, mount, and monitor — and, best of all, they work. For golf courses involved in the Audubon Cooperative Sanctuary Program, nest boxes also are proving to be a useful tool for educating golfers and the public that *birds*, not just birdies, have their places on golf courses.

JEAN MACKAY *is the director of educational services for Audubon International. To find out more about placing nest boxes on your golf course or joining the Audubon Cooperative Sanctuary Program for Golf Courses, contact Audubon International at (518) 767-9051, extension 10, or visit www.audubonintl.org.*

Students from Kiptopeke Elementary School (Virginia Beach, Virginia) demonstrated their concern for the environment as they helped workers at Baymark Golf mount nest boxes.

Whose Team Are You On?

If you feel like it is you against them, you have already lost.

BY JAMES FRANCIS MOORE

Over the past few years I have had the pleasure of spending time with some of the young superintendents in my home town. These men remind me of myself when I was a young golf course superintendent. They work long days without getting tired. They are learning their craft through a combination of formal education, trial and error, and input from their peers. They tend to be too hard on their crews (probably because they have the unreasonable expectation that hourly workers should have their same dedication to the golf course). And most days, they really seem to enjoy their careers.

Many seasoned superintendents share these same traits. However, as superintendents travel along their career paths, my unfortunate observation is that a significant number begin to enjoy work less. Some even seem to adopt a "me against them" attitude when it comes to relationships with golfers, coworkers, and employees. I have always felt that if it is "you against them," you have already lost.

Of course, not all older superintendents find themselves in this confrontational position. Some love their work even more now than they did when they first started. Not surprisingly, these are some of the very best and most successful superintendents in the business.

For the sake of my younger superintendent friends, I thought it would be helpful to see what these older, successful superintendents have in common. I picked five men who I consider to be the best superintendents I have known in my career and identified the following shared traits (listed in no particular order).

- **They have lives outside the golf course.** These five men contribute to their communities in many ways. One is involved with scouts. A couple are very active in their churches. One coaches his child's baseball team. Another mentors children without father figures at a local school. As a result, these men don't have to explain to others that they know more than mowing, watering, and fertilizing — their community involvement makes it obvious to everyone around them. They not only work to improve the turf on their golf courses, they work to improve the community in which they live.
- **They spend their employer's money as if it were their own.** I know this might sound a little corny, but this spending philosophy has been somewhat forgotten by many in the industry. Far too many superintendents are willing to spend large sums of someone else's money on unproven products and technologies. Such individuals often base their purchasing decisions on testimonials, Web sites, and marketing claims instead of science and hard data. The five men at the top of my list monitor new ideas as they are introduced to the industry. However, they also evaluate the cost-effectiveness of the new products. They not only evaluate whether or not the product works as advertised, they also determine whether or not the purchase is economically justifiable.

  Next time you get ready to spend someone else's money, ask yourself two questions. First, would you make the purchase if you owned the course? Second, is this purchase so necessary that you would be willing to individually approach each of the golfers/members you work for and ask them to take the money out of their wallets to buy this product?
- **They rely strongly on basic turfgrass management principles.** Having made many visits to my top five over the years and closely reviewed their turf management practices, I am always amazed at the simplicity of their agronomic programs. There is nothing magic, overly complex, or secret about their methods. They rely primarily on the principles they learned in Turfgrass 101. Their turf grows well because they make certain it has a good growing environment in which to flourish.

  As simple as this sounds, it is by no means easy to implement. It takes a lot of hard work to provide proper drainage, good irrigation coverage, plenty of light and air movement, and to implement sound cultivation, mowing, fertilization, pesticide, and traffic control programs. My top five have managed to successfully combine them to achieve a very positive synergistic effect. They concentrate their efforts on programs they know have the biggest overall turf impact and not waste valuable time, money, and effort searching for miracle fixes.
- **These five men know a lot about the game of golf.** While none is likely to play on the tour, they are all reasonably good players, understand the rules of the game, know the proper way to mark a course for tournaments, and are familiar with the history of the

game as well as current events. They promote golf at their courses and are constantly looking for ways to make the game more enjoyable to *their* players. As a result, golfers look at these men as authorities on the game they love, not just as caretakers of the grass on which it is played.

- **These guys know who they work for.** How many people who play your course do you know? Ride around the course with my top five and you will be amazed that they seem to know everyone on the course and address them by name. It is not just the "high-rollers" and low-handicappers who receive these men's attention. They also know the elderly couple who come out in the evening for a relaxing nine and couldn't care less about the daily Stimpmeter reading. This is customer service at its best.

Obviously, learning so many faces and names is difficult and requires a concerted effort. Start with the people who are on your course the most often. Check the handicap roster and select the 25 people who play the most rounds. Once you have them down, you will find it easier to learn the next 25.

- **Finally, every one of these five men make it known that they enjoy their work.** Sure they have problems and have to lobby for additional support for the golf course. But there is a big difference between constant griping to whoever happens to be within earshot and making a professional presentation to the leadership of the course. All five of these men are true team players. They work together with and support the efforts of the manager, the golf professional, and the leadership of the course. Disagreements among the management team are resolved in the meeting room, over breakfast, or maybe even during a round of golf — never through back-channel lobbying of the players/members.

Obviously, there are many other traits shared by the most successful superintendents in our industry. Honesty, a good sense of humor, a supportive spouse, patience, and fortitude all improve your chances of success. Good financial planning helps offset the worry and stress of working in an industry where employment is sometimes tenuous. Learning to trust key employees and give those around you a chance to excel will give you more time to enjoy life in general.

Even with all this going for them, my younger superintendent friends will encounter many potholes during their careers. It is important to remember that potholes are a part of every career worth pursuing, and the road never becomes perfectly smooth. The key is developing work habits that make the ride along the way as enjoyable as possible.

JIM MOORE *is director of the USGA Green Section Construction Education Program.*

MAKING ROOM FOR NATIVE POLLINATORS

If you think pollinators aren't important to you directly, think again. It is estimated that one out of every three mouthfuls of food we eat and beverages we drink are made possible by pollinators. Pollination, the transfer of pollen from one flower to another, is a vital stage in the life cycle of flowering plants. Eight-eight percent of plant species rely on this critical process that brings us cocoa, coffee, tomatoes, and melons, just to name a few. Butterflies, beetles, and flies are valuable pollinators, but native bees are the most important.

The USGA recently published *Making Room for Native Pollinators: How to Create Habitat for Pollinator Insects on Golf Courses.* These guidelines help golf course superintendents plan and manage out-of-play areas for beneficial pollinating insects. Written by the Xerces Society, this publication is a product of the USGA's Wildlife Links program. The Xerces Society is a nonprofit organization based in Portland, Oregon, dedicated to preserving the diversity of life through the conservation of invertebrates.

Making Room for Native Pollinators: How to Create Habitat for Pollinator Insects on Golf Courses (#PG5002) is available for $5.00 through the USGA Order Department at 800-336-4446 or www.usgapubs.com.

AND OTHER PUBLICATIONS

A variety of books and publications are available to help manage the golf course. To order, contact the USGA Order Department at 800-336-4446 or visit the Web site at www.usgapubs.com (shipping charges are not included in the listed prices).

Turf Management for Golf Courses. 2nd Edition. By James B. Beard and the USGA Green Section staff. PG1100. $125.00.

A Guide for Green Committee Members. Designed to help guide Green Committees past common pitfalls. PG1715. $2.00.

Reviewing Golf Course Proposals: Materials for Local Officials. By B. J. Hance and Jim Morris. An informational packet oriented to community land use planners. PG1718. $5.00.

2002 Turfgrass & Environmental Research Executive Summary. NS 1651. No charge.

Bird Conservation on Golf Courses. By Scott Gillihan. Practical, hands-on reference manual. PG5250. $34.95.

Golf Course Management & Construction: Environmental Issues. Edited by Drs. Balogh & Walker. PG5275. $104.95.

Landscape Restoration Handbook. PG5270. $115.00.

How to Select the Best Sand for Your Bunkers. PG1116. $1.50.

IPM Handbook for Golf Courses. By Dr. Schumann. PG5255. $59.95.

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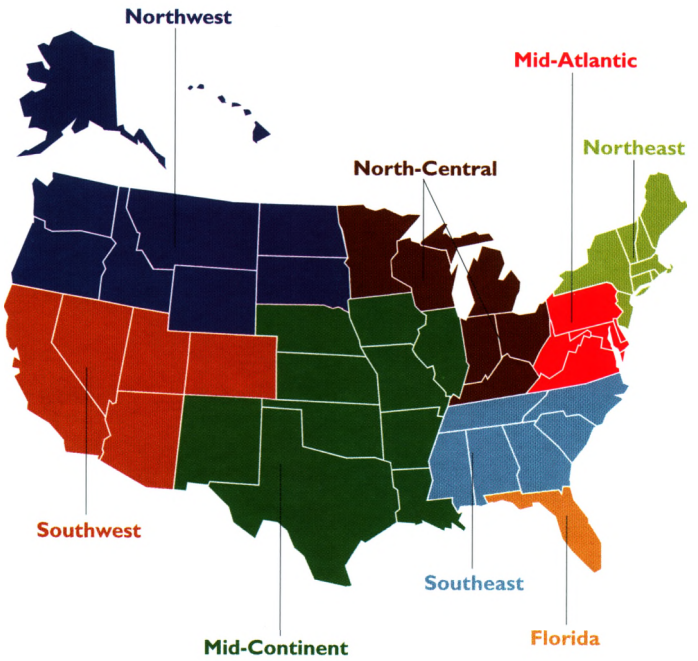

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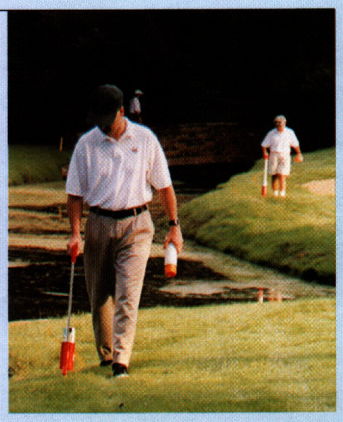
Turf *Twisters*

Q: I've heard from several courses in my area that our regional golf association paid for a Green Section Turf Advisory Service visit for their course. How did they qualify for such a visit, and how can my course receive one? (Ohio)

A: We offer a discount to local and state golf associations that purchase multiple visits. Some associations give a visit to a course as a way of saying "thank you" for hosting an event. In other cases, a Green Section visit has become part of association membership benefits, with each member course receiving an on-site visit every few years. Bottom line, the criteria for distribution are determined by the local association. Visits and reports are still done in confidence, addressing the specific needs of the recipient course. Talk to your local golf association about receiving a free visit or about the possibility of starting such a program.

Q: Our course has been incorrectly and incompletely marked for years. Who should be assigned to mark the course? (Idaho)

A: The initial marking of the golf course should be a collaborative effort between the golf course superintendent, the golf professional, and knowledgeable representatives from the men's and women's golf associations at your course. Proper marking should include both stakes and paint. Once the course is marked, the maintenance staff can repaint the lines as they begin to fade. If paint is not used during the initial marking, only those familiar with the Rules of Golf should attempt to replace stakes that have been removed accidentally or intentionally.



Q: We live in a mild climate where golf is played year-round. During the winter, the grass stops growing but generally remains green. Our superintendent stops putting seed in the divot sand mix from November through February; thus we have "mini-bunkers" on the fairways in March. Is it better to replace our divots in the winter, or should 100% sand still be used for divot filling? (Washington)

A: Unless you have a persistent problem with crows flipping the divots in search of food, it is always best to replace divots during the cooler, wet months in your climate. It will take many weeks or even months for nearby grass to cover a sand-filled divot without seed during the winter. Replacing your divot will generate root growth that will reestablish the turf within 2-3 weeks. Just as many golf courses change their policies on carts during the winter months (paths only), players should be instructed to replace divots because recovery will be much faster than sand without seed.

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