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THIS IS HIS TIME

AFTER BIDING HIS TIME FOR NEARLY 30 YEARS, RONALD MCWHORTER SHED HIS TITLE AS A CAREER ASSISTANT AND TOOK ON THE MANTLE OF SUPERINTENDENT.

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THIS IS HIS TIME

After biding his time for nearly 30 years, Ronald McWhorter shed his title as a caree assistant and took on the mantle of superintendent.

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THE CONTENT OF CHARACTER

About 25 years ago, my friend Dave Heegard and I cooked up a crazy idea. A lot of you probably know Dave from his days with the Pursell/Polyon crew at FarmLinks and, more recently, his leadership of LebanonTurf. Back then, Heegs was running the old Scotts Professional business and I was overseeing the GCSAA Foundation (the forerunner to today's awkwardly named EIFG).

People forget what a powerhouse the Scotts Company was in the golf business in the second half of the 20th century. They were dominant players in the fertilizer, seed and chemical business thanks to a world-class network of tech reps who we're consulting agronomists as well as salespeople. And, under Heegard's watch, their support for GCSAA and the profession was boundless.

Pat Jones
Editorial director and publisher

Dave and I got to talking one day about a nagging problem for golf at large...the lack of diversity. Not only was it an issue in the pre-Tiger days of the Tour but a surprising number of clubs still excluded blacks and women. Moreover both the GCSAA membership and the famed Scotts tech rep network were virtually 100-percent white guys. This was a perception problem for GCSAA and, to some extent, a business issue for a big public company like Scotts.

So we cooked up a scholarship/recruiting program with a goal of attracting "non-traditional" students to the golf/turf business. Scott's put a pile of money behind the idea and the foundation jumped into action to bring it to life in 1990. And voila! The new scholarships would help bring more African-Americans and women to our business.

The Scott's Scholars program was well-conceived, well-intentioned, well-funded, well-promoted and, well...largely ineffective in achieving its original goal.

Why?

Well, for one thing, there are many scholarships and programs targeting the best and brightest young people of color. They can choose many paths and, to some I've spoken with over the years, this profession appeared to be awfully close to farming.

And, despite Tiger Woods, the First Tee and dozens of other programs, far too few young African-Americans are exposed to or interested in a career in golf course management. There is very little here to attract people of color. Or women for that matter. We may think we're welcoming to all but, outside looking in, it must still appear to be pretty homogeneous.

I hope you'll read our cover story on the long journey Ron McWhorter made from laborer to superintendent at The Landing in Georgia. He's black but it's not a story about overcoming racial bias. Yes, the fact that he is now one of only perhaps 25 black superintendents in the U.S. is cause for a small celebration. But the fact that he was a career assistant who persevered at the same facility for a quarter-century and, in a job market overflowing with good supers, was chosen to lead his operation is cause for a blowout bash.

In my mind, the color of the very humble Mr. McWhorter's skin had zero to do with his promotion. Instead, I believe he was chosen — as Dr. King said — on the content of his character. That's exactly the kind of story Dave Heegard and I hoped for way back in the day. GCI

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Bayer backs bees

Bayer CropScience opened its North American Bee Care Center April 15 in Research Triangle Park, N.C. The 6,000-square-foot, $2.4 million center will support scientific research, product stewardship and sustainable agriculture to protect and improve honey bee health, as well as educate stakeholders and the general public about the beneficial insects.

The center has a laboratory with a teaching and research apiary, honey extraction and hive maintenance space; interactive learning center; meeting and training facilities for beekeepers, farmers and educators; office space for staff and graduate students; on-site honey bee colonies, pollinator-friendly gardens and a screened hive observation area.

The North American Bee Care Center, part of the company's $12 million corporate-wide investment in bee health in 2014, brings together experts in agriculture and apiology to develop comprehensive solutions for bee health, including entomologists and apiarists, graduate researchers and more.

The facility complements Bayer's Eastern Bee Care Technology Station, a 1,200-square-foot field station that opened in November in nearby Clayton, N.C. Bayer's first Bee Care Center opened in 2012 at the company's global headquarters in Monheim, Germany.

Setting a sustainable pace for golf

The 2013 Global Soil Survey showed how turf quality and playability didn't necessarily mean heavy applications – nutrient levels could be much lower than previously thought possible. Researchers at PACE Turf and the Asian Turfgrass Center built sustainable soil guidelines using information from the survey to cut back on nitrogen, potassium and phosphorus by more than 50 percent without negative impacts to the turf.

Now in 2014, survey researchers are seeking additional turf managers who want to learn how to implement the new guidelines at their locations.

"Our findings challenge the soil nutritional guidelines that most of us have been using for years," said survey researcher Dr. Larry Stowell of PACE Turf. "While these older guidelines all produced good quality turf, they frequently resulted in unnecessary applications of fertilizer. Today, when everyone is concerned about budgets and environmental impact, anything we can do to reduce inputs is going to be incredibly beneficial."

The Global Soil Survey invites turf managers from around the world to participate by submitting three soil samples for analysis. Participants receive a kit that contains all of the materials needed to package and ship the soil samples taken from good performing areas of their facility. The samples are analyzed by Brookside Laboratories and the data interpreted by Dr. Micah Woods of the Asian Turfgrass Center and Dr. Stowell.

Survey participants receive a report that shows soil nutrient levels, predicts how much of each nutrient is required as fertilizer and shows where each nutrient is on a sustainability index. The data from each participant is also added to a large database of more than 17,000 soil samples, so that it can be used to refine and validate new, more precise soil guidelines. Available on the Global Soil Survey webpage at **bit.ly/1kTbLT4**, these "Minimum Levels for Sustainable Nutrition" guidelines and methods for implementing them will be updated periodically as the Global Soil Survey progresses, and will be accessible, free of charge, to the public.

For more information on the Global Soil Survey for Sustainable Turf or to order the $250 Global Survey kit, visit the Global Soil Survey webpage at **bit.ly/1kTbLT4** or the Global Soil Survey Facebook page at **www.facebook.com/globalsoilsurvey**.

From THE FEED

What do some superintendents have in common with Indiana Jones? As the season warms up, courses sometimes get visitors from the surrounding wilds – and some of them are more welcome than others!

Ed Martinez @emar7236
Found this guy in the pump house!!!#hatesnakes

Kasey Kauff @kaseykauff
Is that a python?

Nick Janovich @njanovich
I would never enter that pump house again.

Vinny @vinnyspano
Damn I'd rather have geese on my course than have to deal with that.

Ryan Howard @TWCRyanHoward
If that were my pump house it would be on fire right now! #ihatesnakes

Anthony Michael @AnthonysShop
Time to get a new pumphouse!

Todd Daniel @wtdaniel1
At least it's not a big one. #ihatesnakes

Join the conversation on Twitter @GCIMagazine!

Mangum returns to hall of fame

Ken Mangum

Ken Mangum, certified golf course superintendent at Atlanta Athletic Club, will add another chapter to an already storied career when he is inducted into the Georgia Golf Hall of Fame in January. Mangum will be one of four inductees in the class of 2015 and become only the third superintendent member of the Hall of Fame established in 1989. He will join Palmer Maples, Jr., CGCS, now retired, and Mark Esoda, CGCS, from Atlanta Country Club.

Mangum was inducted into the Georgia Golf Course Superintendents Association Hall of Fame in 2013.

This summer, Mangum will serve as host superintendent for the U.S. Amateur Championship. He hosted successful PGA Championships in 2011 and 2001 and the U.S. Women's Open Championship in 1990. He also prepared the golf course for the U.S. Junior Championship in 2002.

Mangum has also shown up on the cover of GCI before, in a Q&A with Bruce Williams after the 2011 championships. Check out the interview at **bit.ly/1g5veLP**.

CLICK for pics

Notice anything missing in the magazine this month? If you're reading the print edition, you're missing out on an app-exclusive video from Turf Republic's Bill Brown about using a GoPro camera effectively to show off the course. Oh, and the chance to win a brand new GoPro camera!

If you checked it out yet, use any iOS device to download the GCI native app and check out the new issue. Find the page with our exclusive video and just click the button to be eligible to win either a new toy for the course or some sweet GCI swag!

Jeffrey D. Brauer is a veteran golf course architect responsible for more than 50 new courses and more than 100 renovations. A member and past president of the American Society of Golf Course Architects, he is president of Jeffrey D. Brauer/GolfScapes in Arlington, Texas. Reach him at jeff@jeffreydbrauer.com.

GOLF SHOULD BE FUN, DAMMIT, PART 2

Traditionalists be damned, we have to learn new ways to love golf.

I inherited the title phrase from my father, who uttered it during his prolonged golfing slumps. I inherited his tendency towards golf slumps. Restrained language? Not so much.

Golf is inherently fun when I hit great shots, play with my grandson, or see kids hit rocks with sticks. I see it at Top Golf (topgolf.com) a "golf experience" combining the driving range with competition and entertainment. Players hit micro-chipped golf balls at targets and the high-tech balls instantly score each shot's accuracy and distance. Top Golf draws serious golfers, corporate outings, families, dating couples and non golfers from every walk of life.

Yes, golf has "still got it" (meaning the fun factor) even if its leaders clearly "don't get it."

In reality, the USGA and PGA aims mostly to preserve traditions for the 8 million core golfers, for whom golf has always been great the way it is. In preserving "old ways" they seem reluctant to promoting "new ways" of converting the next generation from non-golfers into "real" golfers, sometimes because they fear having to accept "reasonable facsimiles" as part of the bargain.

The persistent idea that traditions should be "preserved as is" ignores the real tradition of change in golf for over 500 years. For example, in the 1850's they removed much whins and gorse from St. Andrews. Many players of the day resisted the change as too radical, and because it made golf "too easy." Sound familiar?

Nothing is constant but change and the rate of change constantly increases. Can golf really dedicate itself to staying as it is?

Golf has changed with time and society, reflecting real life as we know it. Golf carts mimic the automobile age, distance finders mimic our information age and course within housing tracts reflect our post WWII move to suburbia. For the next generation, instant digital information may be the most important aspect, and hence the popularity of Top Golf. Traditional golf won't appeal as much without more tech. I expect this feature to work its way on to the courses within a decade. It might help sell the game to youth as a sort of real life video game. For geezers, it will be marketed as "losing fewer golf balls."

> "Golf continues with a single set of rules for all, even as most sports have slightly differing rules for all competitive levels. When asked about initiatives like Hack Golf, one official said, "They can do what they want, but we won't call it golf." Isn't 2-on-2 in the driveway recognized as basketball?

Golf continues with a single set of rules for all, even as most sports have slightly differing rules for all competitive levels. When asked about initiatives like Hack Golf, one official said, "They can do what they want, but we won't call it golf." Isn't 2-on-2 in the driveway recognized as basketball?

Golf also holds strongly to the notion of the par 72, 7,000-yard course, even when 99 percent of golfers play only 60-90 percent of that yardage. Traditionally, alternative courses receive little acceptance, but I recently played the Challenge Course at Monarch Dunes (in Nipomo, Calif., designed by Steve Pate and Damian Pascuzzo) which bucks that trend. It is a 12-hole, par-3 course designed to championship standards. Each hole has several tees, ranging from a chip shot for beginners up to a full-length par 3. Each green also features both a standard size and large cup.

We played to the large cups from a variety of tees. Some would complain that it wasn't "real golf", but I never had more fun on a course. Our group hit more shots that every golfer craves – one holed out wedge, three chip ins, and a dozen made long putts, most to win a hole and a nickel. The allure of golf is pulling off wonderful shots and shorter holes and larger cup increase those exponentially.

More excitement, less boredom. How can that not be a good thing?

The next generation needs to shape golf, just as in previous generations. We can't fear what might happen (think how golf carts, jumbo drivers, and female golfers enraged "traditionalists"). It's been said you can't force someone to love you a certain way. You have to accept that they love you their way. The USGA can't insist that everyone loves golf their way, and will eventually accept more golfers loving it in a new way. GCI

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THIS IS HIS TIME

AFTER BIDING HIS TIME FOR NEARLY 30 YEARS, RONALD MCWHORTER SHED HIS TITLE AS A CAREER ASSISTANT AND TOOK ON THE MANTLE OF SUPERINTENDENT.

BY TRENT BOUTS

Ronald McWhorter had been through some "closed door moments" in his time as an assistant golf course superintendent. The kind of moments when the latch clicking behind you signals a bullet is on its way. You know the boss is taking aim. The only question worth asking is whether you will survive the hit.

Until this particular day last November, McWhorter, 46, had survived the worst of these encounters with little more than bruised pride and his ears ringing. He was too good at what he did, too dedicated, too conscientious, to slip up so badly he should be fired. Sadly though, that standard is not always insurance enough these days. He knows good people can lose jobs to bad times.

McWhorter had 27 years in the business and every single one of them on The Landing course at Reynolds Plantation in Greensboro, Ga. He'd helped build the course, starting as a laborer barely out of high school then slowly but steadily working his way through the ranks. No one on the planet knew that acreage better than him. He'd been an assistant since 1991, the first assistant since 1998.

Still…

So when his golf course superintendent, Lane Singleton, closed the door behind him that day, McWhorter swallowed hard. He remembers thinking, "Oh, oh. I didn't know what to expect." He'd been on course when his phone buzzed. Singleton's text was short, maybe sharp? He wanted to see McWhorter in his office. McWhorter texted back explaining that he needed half an hour to finish what he was working on. He asked if that was ok. Singleton didn't reply.

They were 30 unsettling minutes and after a couple more, once he'd arrived and Singleton started talking, McWhorter was on the verge of tears. He hadn't been fired. He'd been promoted — to golf course superintendent. He was overwhelmed.

"I felt like a little kid," he says. "I almost started crying. It was definitely a shock. We'd had some closed door moments before. Sometimes good. But sometimes for, let's say, corrective measures. But this really caught me by surprise. I was in awe. I didn't know what to think."

After 27 years, who would?

Typically, only monks invest that kind of time in one place without complaining.

That parallel is not so crazy, because McWhorter has always seen his work, his purpose, as service. It helps explain his patience, which should not be taken for a lack of ambition. "I wasn't pushing hard to get that title," he says. "That's not because I was complacent. I just wasn't going to go knocking doors down to get it. I felt time would bring about the change. My purpose is just to be a servant, to serve my company and my co-workers."

He lives by the same philosophy outside of work. Heavily involved in his church, McWhorter also occupies a seat on the Greensboro city council, winning election in 2002. He is chairman of the Greene Country Recreation Department and the Lake Oconee Area Development Authority. He was invited to run for

ALL IMAGES COURTESY OF TRENT BOUTS

council. He was appointed golf course superintendent. When service itself is your ambition opportunities present themselves, eventually … maybe.

McWhorter is African-American. Statistically at least that puts the chances of him becoming a golf course superintendent at about the same as an African-American playing on the PGA Tour. Like it or not and for reasons the golf industry has tried various means to address, the game looks like less of a mirror on American society than it does a filter.

The Golf Course Superintendents Association of America has no definitive numbers on the ethnic make-up of its membership. The association no longer asks about race on application forms and even when it did those questions were optional and therefore often left blank. Still, GCSAA's director of member relations, Scott Woodhead, CGCS, says it is fair to describe African-American membership as a "very small percentage."

This month, the World Golf Hall of Fame and Museum launches a new exhibit "Honoring the Legacy: A Tribute to African-Americans in Golf." Among the individuals celebrated is John Shippen, who in 1896 became the first African-American to play in the U.S. Open and later became the first black greenkeeper. Now here we are in the 21st century yet McWhorter is an anomaly as much for the fact he is an African-American superintendent as he is for waiting 27 years to get the title.

Last decade, GCSAA launched a committee to "identify barriers to" and "develop programs to attract" diversity. The GCSAA diversity task group operated over four years before falling victim to cutbacks driven by the recession. Rafael Barajas, CGCS from Hacienda Golf Club in La Habra Heights, Calif., served on that group.

Barajas moved to California from Mexico at 16 to help support his family. Today, he is a GCSAA director and says diversity remains part of the association's mission. His own experience as an immigrant, his observations over nearly 35 years in the business and his work with the task group lead him to make a significant distinction when it comes to the question of diversity. Rather than ask why there are not more African-Americans or other minorities among golf course superintendents, he argues, the real question is "Why don't they want to be?"

"It's difficult to pinpoint," he says. "But it's not the profession's fault. The industry is not excluding anybody. You could

Ronald McWhorter, third from left with Jim Thompson, Brandon Hayes and Tad Hopkins, all from Reynolds Plantation; Chris Thornton, from Athens Country Club; and Tom Howard, from The Creek Club, at the Georgia GCSA assistant superintendent championship in 2012.

be bright pink for all we care. We want you as a member. But how do you bring people in if they don't want to come in."

"No, you don't see many African-Americans in turfgrass management," McWhorter agrees. "But I am seeing more and more black people playing the game. I definitely hope that me being a golf course superintendent helps open some eyes for young African-Americans. But it's not just for guys. We have career days where the company sends us to speak at schools and I tell them this can be for ladies, too."

"Obviously it was long overdue," Lane Singleton says of McWhorter's promotion. "It was a great time for our crew, for Reynolds Plantation and the community. Whether it's with his church, or the number of committees he's on, Ron is a very, very busy guy. I can't say enough about him. He hardly ever takes a day off. I don't know when he sleeps."

"Some of the guys say I'm out of my mind," McWhorter laughs. "But I get in here sometimes at 4:30 a.m. just to have my quiet time and get ready for the day." Getting ready includes planning tasks for the day but often includes "a few chapters of the Bible" or whatever else he is reading at the time, most recently, Rick Warren's "A Purpose Driven Life."

McWhorter's workmates wanted to take him and celebrate his promotion and that of Brandon Hayes, who was elevated to superintendent of the Great Waters course the same day. Singleton's responsibilities had increased steadily in recent years and with the new title of vice-president of agronomy there was room for both Mc-

Whorter and Hayes and step up a notch.

A celebration seemed reasonable but McWhorter said, "No, thanks, I'm good." Instead, he texted his brother and his sister then later told his mother. "She was like a kid in a candy store, all excited," he says. "Then she says..., 'So what does that mean?' My dad didn't know what it would mean for me either." Golf had never been part of the family experience. McWhorter only took up the game itself in 1991. Today his handicap hovers around 10.

> "I felt like a little kid. I almost started crying. It was definitely a shock. We'd had some closed door moments before. Sometimes good. But sometimes for, let's say, corrective measures. But this really caught me by surprise. I was in awe. I didn't know what to think."
>
> – *Ronald McWhorter*

Perhaps there was a need for McWhorter himself to have some time to process the news. While he'd been in golf nearly three decades, he hadn't always entertained the prospect of being the main man. The spark came during a career development meeting led by Billy Fuller, the former leading superintendent who now runs his own golf course design company.

"That was the first time I had any inkling," McWhorter says. "I was content but still hungry to learn. With every promotion comes more expectation. It has led me to look now with more of a magnifying glass. Before it was okay to say, let me get back to you. Well, the buck stops here now so I have to have all the information at hand at that moment. You're like a doctor on call all the time."

In 2008, McWhorter completed a Principals of Turfgrass Management course at the University of Georgia. He is a regular at Georgia GCSA seminars but the overwhelming weight of his education has come on the job.

"I've had great teachers," he says, rattling off superintendents he has worked under: Butch Foust, Steve Brady, Dennis Echols, CGCS, and of course Singleton, who arrived at Reynolds Plantation 14 years ago and was a co-assistant with McWhorter

Echols speaks of McWhorter with similar regard as Singleton. "I have had the pleasure of working with many good assistant superintendents throughout my career," he says. "I have been honored to work with a few great assistants, too. Ronald is definitely one of the great ones. He is a true gentleman who exemplifies honesty, truthfulness and integrity...with his solid foundation of golf course management, and personal commitment of being a Godly example, he will continue his career, making positive impacts on others and the golf industry."

McWhorter certainly regards himself as part of the industry, not merely a passenger. He hopes to one day serve on the Georgia GCSA board of directors and is quietly mindful that he is breaking ground with the potential for "making positive impacts on others."

This spring he played in a fundraiser for the Georgia Golf Environmental Foundation at TPC Sugarloaf in Duluth, Ga. A story announcing his appointment as superintendent appeared in the Georgia GCSA magazine shortly beforehand. McWhorter was touched by the greetings and congratulations he received from colleagues. Still, he wasn't running about high-fiving anybody. Indeed, he still hasn't celebrated with his workmates from Reynolds Plantation.

"I'm sort of low-key when it comes to that sort of thing," he says. "I celebrate within." GCI

Trent Bouts is a Greer, S.C.-based writer and frequent GCI contributor.

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Brian Vinchesi, the 2009 EPA WaterSense Irrigation Partner of the Year, is president of Irrigation Consulting Inc., a golf course irrigation design and consulting firm headquartered in Pepperell, Mass., that designs irrigation systems throughout the world. He can be reached at bvinchesi@irrigationconsulting.com or 978/433-8972.

NEED AN IRRIGATION TECH?

They're a great asset to not only the golf course, but also to the irrigation system.

When it comes to irrigation maintenance and repair the responsibility at most golf courses usually falls to the assistant superintendent or second assistant. Why? Because repairs and troubleshooting need to be done by someone who is responsible and has the ability and understanding of how important the irrigation system is to the overall maintenance and operation of the course.

If water management is a factor, due to limited water supply or public perception, there is even more reason to have a management-level employee dealing with the irrigation system. Have you ever thought of designating someone to perform all your irrigation maintenance or hiring an irrigation technician instead of letting it fall to the assistants?

An irrigation technician is a great asset to not only the golf course, but also to the irrigation system. Having a staffer who is solely responsible for maintaining the irrigation system helps the system operate better, have fewer problems and most likely save water. Irrigation technicians are proactive with maintenance as opposed to being reactive, which is the case at most courses.

Most high-end courses have irrigation technicians, with some facilities employing more than one. Whether there is an irrigation technician (or technicians) is usually dependent on how large the irrigation system is or how much trouble it is causing.

Most high-end courses have irrigation technicians, with some facilities employing more than one. Irrigation technicians are proactive with maintenance as opposed to being reactive, which is the case at most courses.

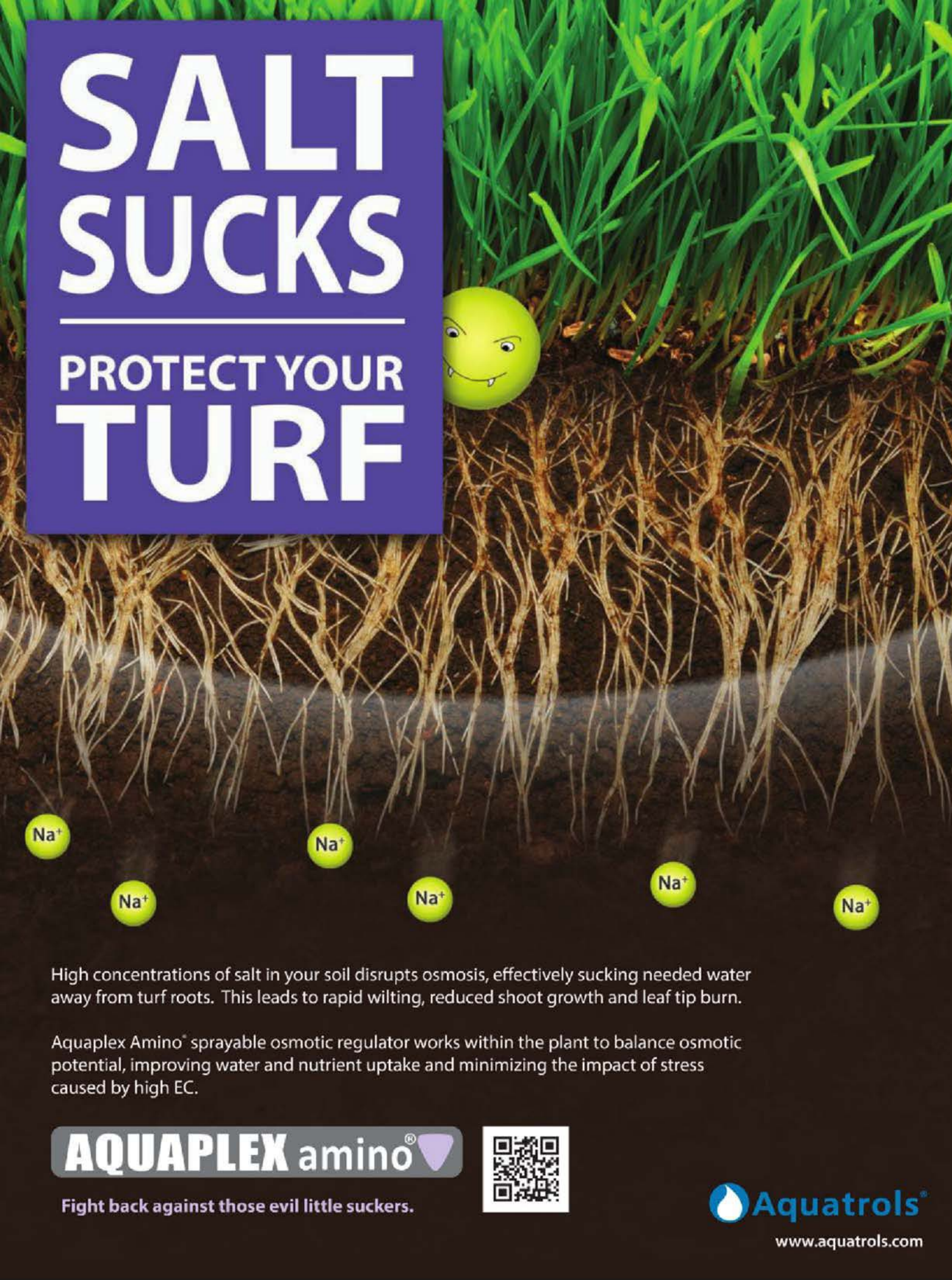
Intuitively, the more sprinklers the system has the more maintenance it requires. Likewise, an older irrigation system needs more maintenance. Consider designating an irrigation technician if system maintenance is taking too much of your or your assistant's time, or if it is taking more than 75 percent of one of your staff's time.

There's no hard and fast rule. I know many 18-hole courses without an irrigation technician, and at least one course with three. One irrigation technician can maintain approximately 2,000 or so sprinklers with their associated controllers, valves, wiring and piping, but this will vary by course and number of holes.

What duties will an irrigation technician perform? First and foremost, addressing issues as they occur. These will include: broken pipes, leaking fittings, weeping sprinklers, non-operating sprinklers and controller or wiring issues. Routine work includes troubleshooting the system as necessary, as well.

When immediate issues do not have to be addressed, the technician can level sprinklers and set them to grade, check sprinkler arcs and nozzles and perform audits to

(VINCHESI *continues on page 62)*



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This research project in partnership with BASF

A touch of COLORANTS

Turf colorants have gained in popularity and have become a go-to tool for many superintendents. Our exclusive research offers some insight into this trend.

THE EDITORS

It seems colorants are having a real impact on the superintendents who are using them, and influence those who aren't to get with the program, according to recent research.

Golf Course Industry, in partnership with BASF, engaged in a three-year research project that identified superintendent trends with regard to colorant use as a turf management tool and how those attitudes changed during that time.

The research identified that the majority of superintendents (70 percent) are using colorants at their course, primarily to enhance their turf's aesthetic look. Secondary uses include as a marking agent for pesticide apps, and for colorants' plant health benefits.

This was a 5 percent increase from three years ago, when about 65 percent of superintendent respondents indicated they used turf colorants.

More than half (56 percent) of superintendents say that they use colorants for their plant health benefits, primarily to protect turf from sun damage and stress. In addition, superintendents say they also utilize the benefits colorants provide in improving turf growth in the spring.

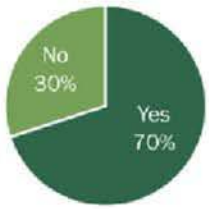
On average, superintendents are budgeting around $2,900 annually on colorants. This spending has increased over the last three years for 56 percent of superintendents. Of those superintendents, 22 percent indicated they're

COLORANTS: By the numbers

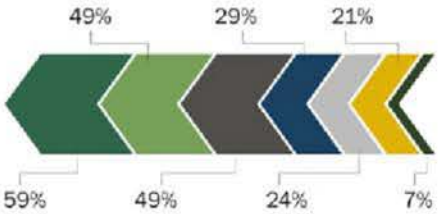
The majority of superintendents (70 percent) indicate they are using colorants at their course, primarily to enhance their turf's aesthetic look. Some secondary uses include as a marking agent for pesticide apps, and for colorants' plant health benefits.

On average, superintendents are budgeting around $2,900 annually on colorants. This spending has increased over the last three years for 56 percent of superintendents. Of those superintendents, 22 percent indicated they're spending 20 percent or more than they were three years ago.

Do you use colorants at your course?



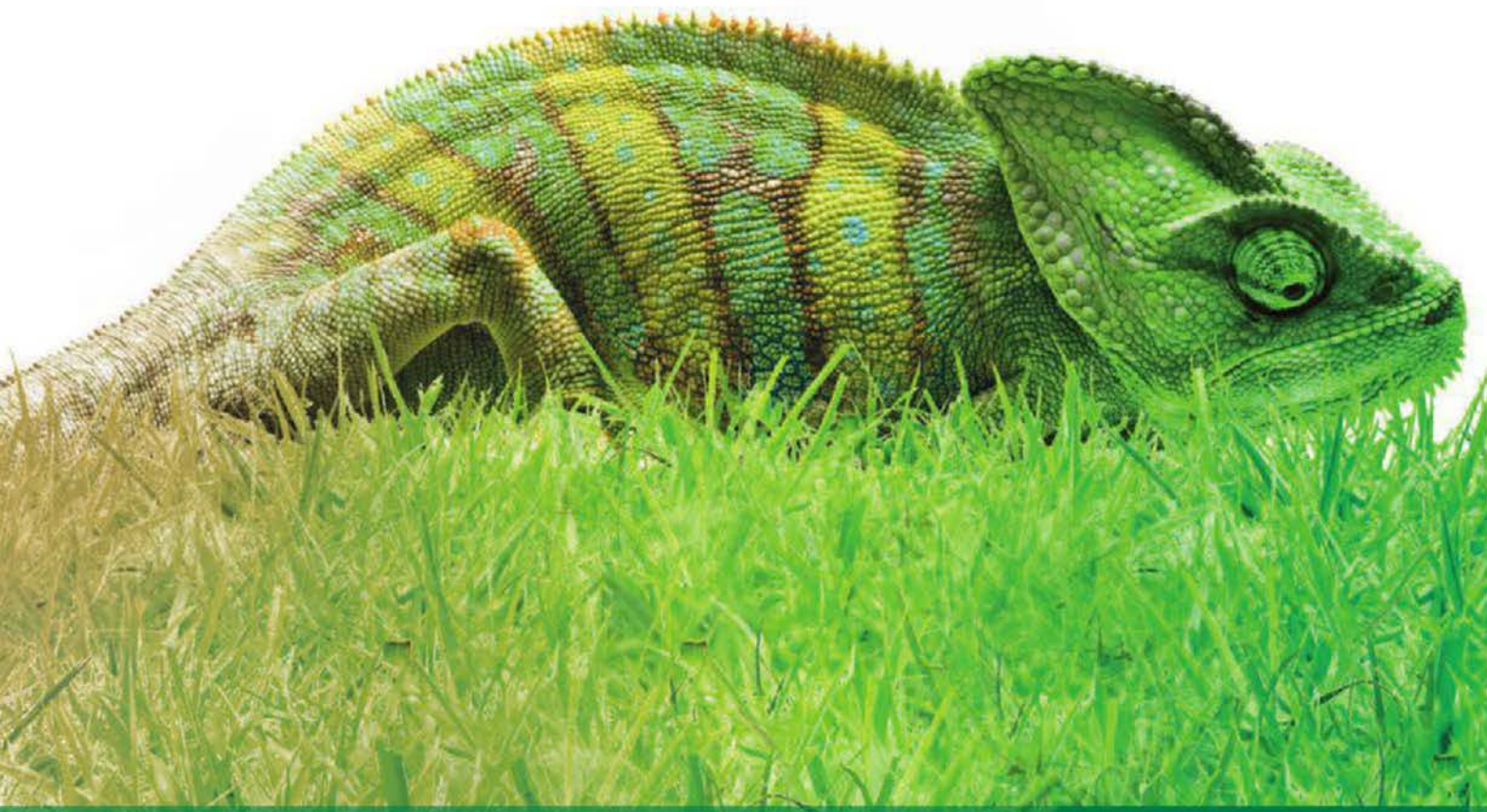
How are you using colorants?



- Enhance aesthetic look of turf
- Marking agent for pesticide applications
- Plant health benefits
- Mask discoloration of damaged turf
- Avoid and/or reduce overseeding
- Special events or tournaments
- Other

"Other" included divot mix, sand colorant, and warming up turf as it emerges from winter.

A smooth transition.



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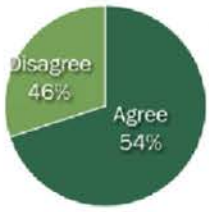


Add Pigments vs. Pre-colored

Slightly more than half (54 percent) of superintendents say, for tank mix solutions, they prefer to select and add pigment colorants with other products over pre-colored, pre-mixed products.

AVERAGE ANNUAL AMOUNT BUDGETED FOR COLORANTS $2,900

spending 20 percent or more than they were three years ago.

We sat down with Joe Lara, the senior product manager for BASF's turf and ornamentals group, to discuss some of the findings.

GCI: THE RESEARCH INDICATES AN INCREASE IN THE NUMBER OF SUPERS WHO ARE USING COLORANTS AS A TOOL IN TURF MANAGEMENT SINCE WE FIRST CONDUCTED THE SURVEY THREE YEARS AGO. WHAT DO YOU THINK ACCOUNTS FOR THIS INCREASE IN POPULARITY?

JOE LARA: Even before the recent elevated interest in pigment colorants, many superintendents were looking at colorants as a way to add a green hue in to some of their fungicide tank mixes that would leave a residual color on their golf greens. Some premix fungicide products on the market contain a green colorant and I think superintendents were looking for a way to simulate that residual colorant effect.

That said, and to address your question, I would account the recent increased interest to a couple of factors.

From our view, I think a key influence that pushed the early-adopters in the superintendent ranks was related to constricted or reduced maintenance budgets during this last economic recession. I don't think anyone would disagree that during this time superintendents were expected to accomplish the same or possibly more with lower budgets. The superintendents who had some working knowledge and experience with colorants were the first to consider these products as one way to way to manage through maintenance cutbacks and provide an acceptable cosmetic appearance to their properties. Responding to an even more challenging decision, there were turf professionals who made changes to their fall overseeding practices for economic reasons. As a result, I believe this gave them the opportunity to experiment with colorants to see what could be possible and acceptable to their club members and golf clientele for winter play.

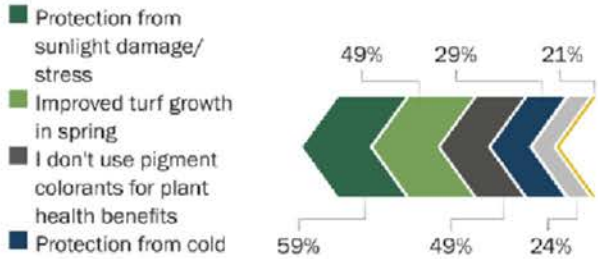
Plant health

More than half (56 percent) of superintendents indicated they use colorants for their plant health benefits, primarily to protect turf from sun damage and stress. Coming in a close second, superintendents say they also utilize the benefits colorants provide in improving turf growth in the spring.

I use pigment colorants in my turf management practices primarily for plant health benefits.

DISAGREE 44% **AGREE 56%**

What plant health benefits do you derive from the use of pigment colorants in your turf management practices?



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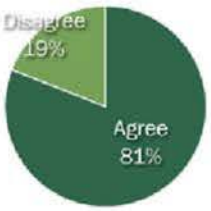
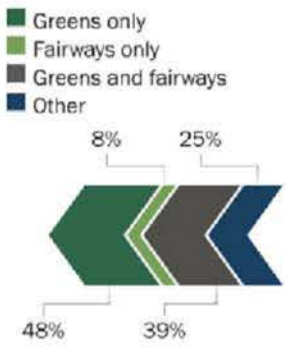
Dye vs. Pigment

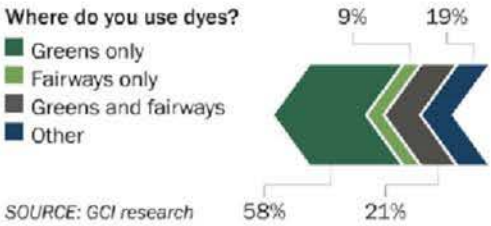
You understand the difference between dye colorants and pigment colorants and how they're used in turf management.



Where do you use pigments?



Where do you use dyes?



"Other" responses included: divot mix, spot spraying misc. areas, driving range, tees, landscape beds, in conjunction with Roundup.

SOURCE: GCI research

Underlying some of these changes to traditional fall overseeding practices was the expectation of a potential agronomic benefit in an improved spring emergence of their warm-season turf without the presence of a competing cool season perennial rye stand. I think the tough economic conditions provided the momentum for proponents of this concept to actively put out trials on the golf course for closer evaluation. Many I know have found success in taking this approach and have embraced the addition of a pigment colorant to this program, creating a very acceptable green appearance on dormant winter turf

The second factor contributing to what we see is the attention now from regional university and independent turf researchers. In the past few years we've seen field trial work performed by institutions like North Carolina State, Purdue University, Clemson University, University of Florida, The Ohio State University and the University of Arizona in collaboration with USGA turf agronomists. Their efforts have helped golf course superintendents and other turfgrass professionals gain a better understanding of the performance characteristics of turf colorants. What we see today is increased confidence by superintendents to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use colorants in a variety of ways as these independent field research trials provide more information about the choices they have and what can be expected from these products.

WE KNEW ENHANCING TURF'S AESTHETIC LOOK WOULD BE A TOP USE, HOWEVER, TIED FOR SECOND WAS USING COLORANTS FOR HEALTH BENEFITS. IS THIS A NEW TREND AND WHY?

There is more discussion today among suppliers and turf professionals around the topic of plant health. Quite frankly, there are many ways to influence the growth and health of plants – starting with the basic foundations of what is required for plant growth, i.e. soil, water, air, nutrients, sunlight. Many different cultural practices and commercial products can be introduced into a growing environment to influence the performance and ultimately the health of plants.

What you are referring to today are the claims made by a few manufacturers that pigment colorants influence the way a plant functions. I think there is a trend to use pigment colorants predominantly to create a visual effect. Is there something more than cosmetic? I think there is still a lot of discussion and debate around factors like preferred color hue, canopy and soil temperature, and light levels that may directly or indirectly create a plant response. From my experience, the environmental growing conditions, time of season, and cultural practices are the larger external drivers that set the stage for how a plant grows and performs. Any physiological responses initiated from topical additions of a pigment colorant may be temporal, transitional, or incremental at best. It's not a substitute for practicing the essentials and fundamentals of turfgrass management, much of which includes cultural practices to move air and water into the profile, a proper regiment of nutrients, and management of disease and insect pests. Healthy resilient plants begin with strong active root systems that are necessary to help the turf plant growth through various stress events. It may be found that colorants, under certain conditions initiate

(**COLORANTS** *continues on page 62)*


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STAY SHARP

IT'S SO EASY TO ERR WHEN GRINDING AND SHARPENING MOWER REELS AND BLADES. HERE SIX COMMON MISTAKES AND SOME WELL-HONED TIPS TO AVOID THEM.

By William Olmstead

Properly maintaining mowing equipment is essential to successfully maintaining turf. While the principles behind responsible equipment management are dogmatic, the methods of blade and reel sharpening are more widely debated. GCI reached out to equipment industry leaders to find out what works, what doesn't, and how superintendents get the most out of their reels and blades year.

When turf managers and technicians run into with quality-of-cut issues they often overlook the most basic question: Is the mower operating with a sharp reel and bedknife? "Going out to mow with dull reels and bedknives is like running a stock car race with improperly inflated tires," says Lynn Westbrook, principal engineer at Jacobsen. "You'll never get the performance you need and the results will be less than perfect. It's amazing how many guys either forget or neglect reel and bedknife sharpness."

Here are six common mistakes superintendents and technicians make when grinding.

NO RELIEF

Unfortunately, technicians often leave relief grinding out of their normal routines. "The key to relief grinding is to stay on top of it and not wait until quality-of-cut issues present themselves in the grass," says Klasie Baard, Jacobsen sales training manager. "Technicians should supplement their spin grinding with relief grinding at appropriate intervals. When you lose the relief grind on the blade edge, it creates additional contact and friction between the bedknife and reel blades, which demands additional horsepower. In fact, studies have shown that five reels running without relief use significantly more horsepower than five reels with relief." Maintaining a relief on the blade edge does more than save on wear-and-tear and horsepower. "A good relief angle will also throw grass into the baskets more effectively," says Baard. "A flat grind will actually fan the grass rather than cut it effectively."

NOT USING OEM PARTS

"If there are any two parts you should buy directly from the manufacturer it's the reel and bedknife," says Westbrook. "They are designed to work together and have very precise

metallurgy to ensure the highest performance. When you add in a 'may-fit' reel or bedknife into the mix, the performance of the machine will be sacrificed and the results will show up in the grass. Another benefit is having the backing and support of a manufacturer if you run into any issues."

NOT CHECKING THE CONDITION OF ROTATING COMPONENTS

While technician's typically focus on grinding the reel and bedknife, it's important to not to overlook the rollers, roller bearings, and reel bearings to ensure a stable grind. Any wear in the rotating components can cause the reel or bedknife to

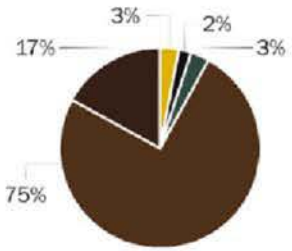
By The Numbers

Last year GCI, in partnership with Foley United, conducted research to gauge reel and blade maintenance trends and practices among superintendents and equipment technicians.

How do you determine when to grind?

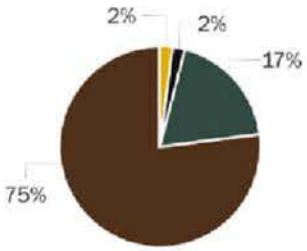
- Based on hours
- Based on weeks
- Based on weeks
- Whenever it needs it
- Other

Editor's Note: "Other" responses included end of season, annual, and winter, as well as when labor was available.



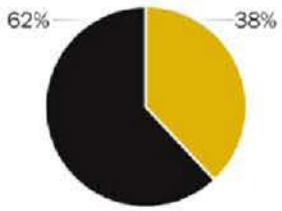
How committed are you to your current grinding practice, regimen or philosophy?

- I don't know
- Definitely need to change my practices
- Would not change
- Open to hearing other opinions



Do you spin grind only?

- Yes
- No



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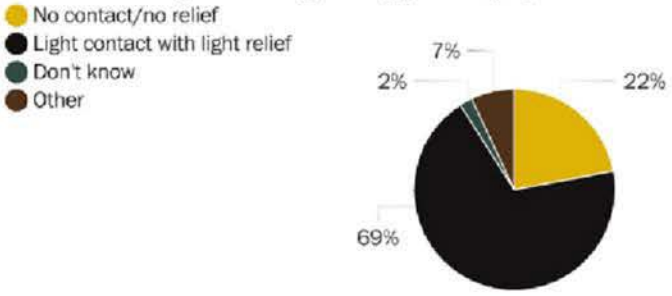
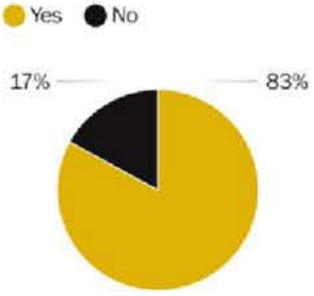
By The Numbers cont.

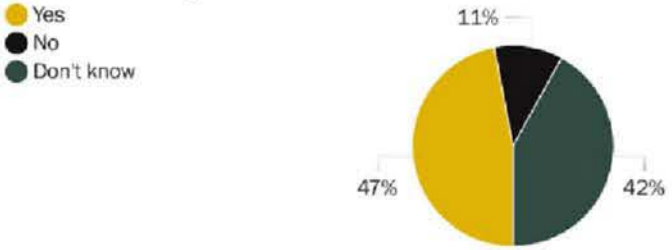
Do you subscribe to the "no contact/no relief" or "light contact with light relief" grinding philosophy?



Do you grind new bedknives?



Do reels stay on/cut longer when maintained to the manufacturer specifications?



move during grinding.

"A brand-new $60,000 grinder will give you a bad grind if your $5 bearing is shot, so make sure everything is working properly," says Baard. "While you have the machine off the floor, it's also a good time to check other things like hardware, seals, etc."

NOT TRUING THE BEDKNIFE

It's another simple step that technicians often skip. After you've married the bedknife to the backing, the top and front faces of the bedknife need to be ground to make sure they are straight and true.

EXCEEDING REEL DIAMETER LIMITS

OEM reels are designed to work within certain parameters. Going beyond the manufacturer's reel diameter tolerance limit alters the original geometry of the reel and bedknife setup, says Westbrook. "For example,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Consider all of the variables

There are a large number of parameters and variables to evaluate to find the best course of action on any given day, says Foley United's Jim Letourneau. Making the decision to completely refurbish reels in the winter is an easy decision. What needs to be done to correct a poor quality of cut situation for a short period of time requires more complete evaluation.

"In most cases the manufacturers have tested and developed cutting units that will stay sharp, use the least amount of horsepower, and stay on cut the longest amount of time if they are returned to the manufacturer's specifications," Letourneau says. "However, there are many methods that work and produce a high quality of cut and the best program may use a combination of all practices."

- Understand the entire process and what labor and equipment are needed to execute the plan.
- Establish a realistic reel maintenance program that meets both the expectations and budgets is essential to quality turf management.
- Have the right tools in place to perform the tasks is essential to the program and lack of them may limit the options that are available.
- Start with a quality assessment and an establishment of goals, then looking at the methods needed to achieve those goals, and then ensuring the budgets are capable of supporting the program should be done carefully.

Letourneau recommends a program established by the team, not an individual, unless that individual is truly capable of understanding every facet of the reel maintenance program as it relates to the overall course maintenance program.

on a 5-inch reel, you don't want to get below a 4.5-inch diameter. When you see the reels worn past that diameter, the reel is simply unable to provide a good quality-of-cut."

PREP WORK

One of the biggest mistakes is not fully understanding that the reel and bedknife are not properly prepared for the task they are being asked to do, says Jim Letourneau, Foley United's president and COO.

"Using dull reels and expecting a perfect cut will not result in the reels meeting the expectations of the user," he says. "Doing a partial overhaul and sharpening job and expecting the reels to stay on cut for the entire season will also lead to disappointment."

When it comes to reel grinding, Tracy Lanier, John Deere Golf product manager, says everyone has their own method that works best for them. But that doesn't mean a program should be inflexible. "The most common problems that we see are on courses that use a grind-only program," says Lanier. "These courses tend to grind too much, which can lead to increased cost due to reduced life of reels or bedknives. It can also lead to cut issues during times of stress."

Lanier recommends a more balanced approach, using backlapping and reel grinding to maintain a good quality cut. Using this approach ensures the bedknife and reel stay sharper for longer. **GCI**

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Henry DeLozier is a principal in the Global Golf Advisors consultancy. DeLozier joined Global Golf Advisors in 2008 after nine years as the vice president of golf for Pulte Homes. He is a past president of the National Golf Course Owners Association's board of directors and serves on the PGA of America's Employers Advisory Council.

RETHINK CAPITAL PLANNING

Not the sexiest of subjects, but easily the most important to be involved in.

Emerging from a recessionary cycle that required most clubs to defer capital replacements and acquisition, club leaders are scrambling to prepare for much-needed capital investments.

"Many clubs fell behind the planning curve and are now playing catchup to put their plan in place," says Paul Mueller, who runs Milwaukee-based Club Capital Planners. "Everyone knows that capital planning is important. But it becomes a tiresome exercise for many because they're too busy or don't understand the steps in an effective planning process."

Here are five steps that will result in an effective capital plan:

INVENTORY EVERY ASSET. Prepare a preliminary list of everything with a useful life of more than one year and costs more than $1,000. This time- and base-price reference point is a starting point in answering, "What should be considered a capital asset?" This first-step requires a thorough listing of furnishings, fixtures and equipment (FF&E) in each department. From water fountains to greensmowers, list everything.

EVALUATE CURRENT CONDITION. Does the asset show greater-than-normal wear and tear? Has it been in use for too long? Will it operate properly with routine maintenance? Your evaluation serves as the baseline for the capital plan. Consider the buildings, parking lots, pathways, and facility signage.

CROSS-REFERENCE USEFUL LIFE. The club accountant or an accounting expert can provide a standard useful life table showing an objective reference point for how long most golf course and club equipment should be depreciated. In its simplest form, a depreciation term indicates how long the equipment or asset should last and continue to be effective. Most courses stretch the useful life to its limit. Bear in mind that aged and outdated FF&E brings with it uncertain performance and risk for the operator and users.

SAFETY AND SECURITY. Aging FF&E that threatens the health and safety of members and staff must be replaced.

> "Your evaluation of the current condition of each asset serves as the baseline for the capital plan. Consider the buildings, parking lots, pathways, signage and all aspects of the facility."

ESTIMATE REPLACEMENT COSTS. What will it cost to replace the asset? Consult vendors, suppliers and peers to understand the market on goods or services required to replace the asset in question. According to Mueller, most clubs can obtain updated costs from vendor websites or from distributors, supplier or manufacturers' representatives.

PLAN FOR THE FUTURE. Following a time when so many capital purchases were delayed because of the recession, most clubs are surprised and sometimes overwhelmed by the amount and cost of replacements. Replacements must be prioritized as few clubs can afford to replace everything in one year. In fact, most clubs plan for replacement every year. The amount in any given year varies. For example, replacing an entire irrigation system will cost millions while the resurfacing of the tennis courts will be a fraction of the cost. Scheduling replacement and expense is one of the most critical steps in the capital planning process, requiring patience, discipline and understanding of value.

While there is no rule-of-thumb answer to prioritizing replacements, planning criteria include:

Ensuring that the facility is secure and maintains low risk levels is also vitally important. Jeff Magoon, CMAA's risk management executive, says most insurers will provide guidance concerning asset replacement risks.

MISSION CRITICAL. What is the club's mission? If best-in-class conditions are a non-negotiable requirement to uphold the mission, course needs must be prioritized. The same holds for any asset that supports and sustains the mission and member expectations.

REVENUE ELASTICITY. In clubs where there is constant pressure to keep revenues flowing, assets that generate revenue are the next priority. Kitchen equipment and capabilities that sustain food and beverage revenue are important. Golf cars that yield high-margin revenues need attention and replacement. It is important for each manager to fully understand what assets produce the greatest revenue potential. GCI

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SO SAYS NOSTRA-BOB-MUS

IN 2010 GCI'S BOB LOHMANN MADE 10 PREDICTIONS ABOUT THE INDUSTRY IN 2020. FOUR YEARS OLDER AND WISER, HE TAKES STOCK OF HIS CLAIRVOYANT ABILITIES.

Way back in 2010, I was asked to play Nostradamus at the annual Wisconsin Golf Turf Symposium. I guess they thought I was old enough – at that point, we'd been in business for 26 years – to come up with plausible golf industry predictions.

Just the other day, with four years more experience, I happened upon those predictions. I want to share them with you – along with some current comments about how I did – or, in some cases, did not – hit the mark.

Maybe, when I come down from the euphoria of nailing so many of these, I'll forego another round of predictions and take this uncanny ability straight to the stock market.

PREDICTION

CHINA WILL ECLIPSE THE RECORD U.S. COURSE OPENINGS FROM THE 1990S, BUT WILL REPEAT THE MISTAKES OF THE U.S. BY BUILDING TOO MANY DIFFICULT, UP-SCALE FACILITIES AND NEGLECTING THE NEED FOR BEGINNER GOLF.

China hasn't been opening golf courses at a rate of 300 or 400 a year, which was the high water mark here in the States back in the go-go '90s. It's been more like 75-100 per year since 2010, though it's difficult to get reliable numbers in a country where the government has imposed a course-building moratorium – and developers go ahead and build them anyway, under the radar. Anyway, I was all wet on the numbers. But I'll stand by the "repeating mistakes" part: Nearly all these new Chinese courses are private, very expensive to join, and many are relying on real-estate components to make them economically viable. And we all know where THAT leads.

PREDICTION

COURSE CLOSURES (750 TO 1,000 BY 2020) WILL CONTINUE TO OUTPACE OPENINGS. NEW OPENINGS WILL INCLUDE ALTERNATIVE AND MIXED-USE FACILITIES.

In 2013, the U.S. golf market experienced its eighth straight year where course closures outpaced course openings. There were 14 openings in 2013 and 154.5 closures (all but five of them public courses). The net loss of approximately 140 18-hole equivalents has held steady the last three years. While the annual net losses were smaller from 2006-2010, do the math. Methinks I nailed this one. This correction could well persist through 2020, and the idea that we'll see more than 100 new openings per year? Those days seem gone forever.

PREDICTION

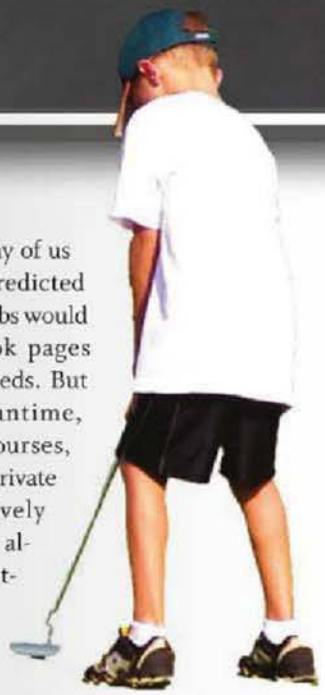
COURSES WILL LOOK TO ALTERNATIVE SOURCES FOR PLAYER DEVELOPMENT, MEANS OF REVENUE, AND USE OF THEIR PROPERTY.

I hinted at this in prediction No. 2 and here again. The bottom line is, we see evidence of this more and more, both first-hand and anecdotally. I think we all had a sense that programs like the First Tee would result in "alternative" practice facilities and short courses. If you've read my columns here at GCI.com, you know that we are supportive of First Tee, but also Links Across America, which we consider an even better model (we've personally been involved in designing/creating/opening three such alternative facilities). So this prediction was something of a no-brainer. What we didn't see coming (but which I predicted just the same) was the advent of disc golf and even footgolf at existing "traditional" golf facilities. We have two client courses that will be incorporating the latter into their routings starting this spring. These alternative uses are being incorporated into golf courses, in the same way fishing derbies, winter sports and hiking trails are being incorporated. The pace of this has surprised me, but it was only a matter of time. Especially at public courses, what's the difference between setting up a disc course within the traditional golf course, and having a wedding in the clubhouse? Revenue is revenue.

PREDICTION

CLUBS, ESPECIALLY PRIVATE, WILL HAVE TO FIND WAYS TO MARKET TO THE NEXT GENERATION.

I think the advent of social media strategies is enough proof that this has taken hold, in a huge way. Four years ago, I don't know that many of us would have predicted that private clubs would have Facebook pages and Twitter feeds. But they do. Meantime, look for all courses, but especially private clubs, to actively and creatively alter courses setups to allow for 3- and 6-hole loops, for folks short of time and attention span.



PREDICTION

EXISTING COURSES WILL CAPITALIZE ON ALTERNATIVE MEANS FOR FUNDING RENOVATION EFFORTS.

Again, I'll take credit for being spot on with this one – but with so many publically owned facilities struggling today, as we've noted above, it's really a matter of renovating or closing their doors. What I couldn't foresee, but perhaps should have, is the way some municipalities have leveraged stormwater and water-quality management projects to pay for these renovations. We at LGD and Golf Creations have been involved in dozens of projects where our renovation work aided a city's water-retention and/or water-filtration efforts. But we didn't see this coming in 2010: New state statutes recently obliged the city of Appleton, Wisconsin to improve water quality and stormwater retention, vis a vis the nearby Lower Fox River. The city wisely used Reid Municipal GC to make this happen – and the city paid for what turned out to be a substantial course renovation, because you can't add all those ponds and wetlands without radically changing a course routing. This is a model that should be followed elsewhere, including private clubs.

PREDICTION

COURSES WILL DO "MORE WITH LESS," EMPLOYING UNIQUE, AFFORDABLE RENOVATION STRATEGIES TO MAKE IMPROVEMENTS AND UPGRADE INFRASTRUCTURE.

Hardly rocket science, this prediction. The way golf courses spent money in the years prior to the economic downturn of 2008 simply wasn't sustainable. To me, however, the solutions golf has deployed in response to tighter budgets is the lemonade we've created – having been handed such a big basket of lemons. The gas and regrass option, for example, has proved a fine alternative to costly, full-on greens renovation/reconstruction. Ditto for push-up greens construction. Four years ago, I would never have dreamed our renovation jobs would feature so much in-house labor, meaning course maintenance crews. The biggest and most significant cost-saving advance might just be the Asset Management Plan, or AMP, whereby we at LGD deconstruct a master renovation plan, break it into affordable chunks, and help clubs work those projects into annual budgets.

PREDICTION

COURSE MANAGERS WILL CHALLENGE TRADITION IN THE WAY THEY SETUP AND MARKET THEIR PRODUCT.

I'm not a marketer, but I think golf still has a ways to go in the non-traditional marketing department. So the jury's still out on that front, and we're making slow progress on the set-up side. Here's one step forward: Mike Sprouse, the super at Randall Oaks GC in Dundee Township, Ill., has experimented with allowing golfers to tee it up wherever they choose. No markers. This essentially allows people to "Tee It Forward", the program promoted by the ASGCA. But Mike's experiments are unique in that they also provide him real useful information on usage and wear, i.e. where his teeing grounds should be bigger, smaller or eliminated altogether. We know Mike because we designed a Links Across America short course there at Randall Oaks, back in 2010 actually, and have been helping him upgrade the 18-hole course since the 1980s. I will probably talk to Mike further for an upcoming article, because I love what he's doing. In the meantime, I'm still waiting for the tech revolution to allow for flexible course rating and handicapping, meaning from all yardages, using GPS.

PREDICTION

MANAGEMENT COMPANIES WILL CONTINUE GROWING THEIR PORTFOLIOS IN THE PRIVATE AND PUBLIC SECTORS.

If courses are going out of business in such numbers, a certain percentage of those courses can surely be plucked by management companies for pennies on the dollar. So, it's no surprise that management portfolios are growing. The NGF confirms that here. Of course, I think the economic downturn probably separates the truly competent management companies from their less competent competitors. I'd like to see some figures from the NGF that show the number of course closures where the facilities had been under third-party management the previous 36 months.

PREDICTION

COURSES WILL INVEST IN UPGRADES WITH LONG-TERM SUSTAINABILITY AND IMPACTS ON MAINTENANCE.

I think golf did an all-around admirable job of developing more efficient irrigation control, water conservation, water sourcing and heat/drought-tolerant turf species before the downtown. So it's no surprise that these efforts have taken on more urgency in the four years since this prediction. Of course, it's one thing to have these advances available – the powers that be at golf facilities still have to pay for them, and that's a tall order these days. Look at Better Billy Bunkers. These are proven cost-savers in the long run, especially in terms of man-hours. But they require a significant investment. And lookee here: GCI poobah Pat Jones weighs in with a whole new generation of technical diagnostics, most of which should lead to economic or resource efficiencies. Unfortunately, it's not clear to me whether enough golf courses are making the necessary technological investments today.

PREDICTION

GOLF COURSE ARCHITECTS WILL BE RELIED ON MORE TO BE TEAM FACILITATORS RATHER THAN MERE DESIGNERS.

There is no better example of this prediction coming true than the AMP process. I never thought we'd be so intimately involved with a client's long-term budgeting, which is a facilitating role if there ever was one. But when you're economizing, it's a no-brainer. And architects are uniquely placed to serve in this role, because our relationships with clients are normally long-term. It's already happening and I'm convinced that what we architects refer to as "the creative process," once limited to drawing pretty pictures, will increasingly focus as much on implementation and delivery as it does on the design itself. **GCI**

Bob Lohmann is founder, president, and principal architect of Lohmann Golf Designs and a frequent GCI contributor. Check out his blog at lohmanncompanies.blogspot.com.

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WHAT'S KILLING MY TURF?!?!

DON'T BE QUICK TO BLAME DISEASE FOR YOUR TURF WOES. ANY COMBINATION OF ABIOTIC FACTORS MAY BE THE TRUE CULPRITS.

BY JOHN TORSIELLO

There is a plethora of abiotic causes for poor turfgrass quality, including traffic stress, compaction, improper fertility, incorrect use of pesticides, shade, poor drainage, too much or too little water, high temperature (especially soil temperature), cold injury, and other factors. And all of these issues are one big headache for superintendents who must deal with them on their course's playing surfaces.

"They are widespread. I have seen abiotic issues across the country," says Dr. Lee Miller, extension turfgrass pathologist at the University of Missouri. Black layer, heat stress, drought stress, shade stress, too much moisture, mechanical damage, layering of sand-based putting greens are some of the many problems in turfgrass systems and actually from the perspective of our diagnostic lab they significantly outnumber biotic problems of turfgrass systems."

Common abiotic disorders associated with winter include deicing salt injury, crown hydration, winterkill or low temperature kill, and desiccation. Some of the common abiotic disorders during the growing season include oversaturated soils, compaction, wear, drought, wet wilt, nutrient deficiency or toxicity, and chemical phytotoxicity.

"In our turfgrass diagnostic lab, approximately 50 to 60 percent of the damage in received samples are caused by abiotic disorders and not the result of an infectious disease," Miller says.

"The No. 1 abiotic disorder we observe in our diagnostic clinic is an oversaturated rootzone," he adds. "This condition can be caused by over irrigation or too much organic matter, which acts like a sponge and holds the water. Add a bit of heat or physiological stress onto a creeping bentgrass green with a saturated soil condition, and decline can occur very rapidly. We use the acronym SHRS, or soggy hot root syndrome, to describe this decline."

Other than oxygen deprivation in a pore-filled rootzone, a variety of factors can result in decline. For example, water resiliently holds onto its temperature, so once the soil solution heats up, it takes an extended

duration or level of cool temperatures to bring it back down. Secondly, fungal pathogens such as pythium root rot thrive in a waterlogged soil, and appreciate the resultant weakened and compromised root tissue to infect. Soil nutrients and beneficial aerobic microflora also may be diluted in a flooded soil profile, so nutrient availability for turfgrass health, defense or recovery may be limiting.

Abiotic causes for turfgrass problems can be widespread, and many times they are mistaken as biotic causes, such as turfgrass diseases, says Dr. Brad Fresenburg, assistant extension professor with the University of Missouri's Division of Pant Sciences.

"So if we look at the weather, extreme heat (high soil temps reduce root mass) or cold (extreme cold temps can cause winter desiccation of warm-season grasses like Bermudagrass and zoysiagrass) can have an impact on turfgrass quality," Fresenburg says.

Too much rain (saturated soils reduce soil oxygen and reduce nutrient uptake) versus too little rain (leads to wilting and dormancy) are abiotic. Imbalances of nutrients in the soil can cause symptoms of nutrient deficiencies and slow growth. Ice salt, chemical spills (such as gasoline), misapplications of pesticides, underground gas leaks, animal urine and shade from trees are all abiotic causes to poor quality turfgrasses, since all have an impact on the normal growth of that plant on a continuous basis.

In addition, poor cultural practices for turfgrass management can also be considered abiotic. Mowing too close or scalping the turf can produce poor quality. Lack of soil testing and improper fertilization can lead to nutrient imbalances. Lack of aeration or soil cultivation can lead to compacted soils therefore reducing root mass and leading to a weak plant being more susceptible to drought. Lack of or too much irrigation can have the same impacts as too much rain or too little rain.

Richard Buckley, coordinator of the Plant Diagnostic Laboratory at Rutgers University, believes many researchers and superintendents think of abiotic stress in terms of physical (temperature and moisture extremes), chemical (problems with pesticides, fertilizers,

What is it?

According to Dr. Brad Fresenburg, assistant extension professor with the University of Missouri's Division of Pant Sciences, the keys to distinguishing between abiotic problems and biotic problems are as follows:

- Disease may start small and increase in size and severity over the period of a few days. "So the idea here is to closely monitor the areas as they develop or if they develop." Mark the perimeters of the affected areas with paint. If it is a disease the perimeter will continue to expand. Typically (there are always exceptions in biological systems) abiotic problems do not expand and if they do they rarely expand at rates typically of a disease.
- Diseases usually develop in random patterns. "The key is to take a step back and examine the distribution of symptoms. Look at the symptoms from the edge of the green or from 15 to 20 yards away and try to see is a specific pattern exists. In other words diseases normally do not develop in squares, triangles, straight lines, etc."
- Look at the perimeter of the affected area closely. The best time to do this is in the morning when dew is present or before temperatures start warming up. If it is an active disease then the perimeter will usually transition from dead to healthy. "In other words many times the perimeter of a disease is typically a different color or the plants are exhibiting different symptoms around the outside of the affected area."
- Examine the soil closely. "Is rooting different between affected and non-affected areas. Ask yourself why? Is there a layering issue? Did I do something that may have induced this? Did we make an herbicide application that could have drifted to this area? Does the soil smell funny? This could mean black layer or anaerobic conditions."
- Look at the individual plants. Are there symptoms that are indicative of a disease? "Use resources to help you such as the Compendium of Turfgrass Diseases. If nothing looks familiar then could nutrition be off? If you don't want to deal with any of this, then send a sample to a diagnostic lab."

and other plant health care products), and mechanical (traffic, scalping, etc).

"I also like to think of damage from abiotic causes in terms of the weather, site condition and infrastructure, and people problems," he says. "In our laboratory, we diagnose about 38 percent of our samples with abiotic stress. Temperature and moisture stress – extremes hot/cold and dry/wet – or some combination of both cause most of the problems."

Some abiotic stresses are site-specific, related to management practices or events at that location, says Dr. Megan Kennelly, associate professor at Kansas State University's Department of Plant Pathology. Others are more widespread, such as winter injury across a whole region, or summer decline from hot, humid conditions across a large area.

For example, 2010 was a hot, humid summer in Kansas and many other states and hot, water-saturated soils led to wide scale turf decline, Kennelly says. In contrast, 2012 was a major drought in many places, and water quantity and quality issues were a big story that year.

"In early spring we see a lot of areas are with some cold damage as the grasses are greening up," he says. "During hot, stressful summers there can be abiotic decline across large areas."

Abiotic turfgrass problems can develop into specific patches and symptoms that may mimic root diseases.

"There are numerous instances when we look at a turf sample that has symptoms that resemble a root disease such as take-all patch, pythium root rot, or Bermudagrass decline, but after examination we cannot find enough of the causal organism to conclude a disease has truly developed," Kennelly

says. "Plus we also look at the soil structure, rooting, salt accumulation and with all of that data plus a record from the golf course superintendent, we conclude that something abiotic is the main cause of the problem."

Turfgrass is a very dynamic system with an abundance of microbial activity. Most if not all common turf pathogens are present in soil samples, Kearns says, but turf managers have to make a judgment call on when the symptoms, the signs of the organism (and the amount) and environmental conditions are correct for a disease."

"The disease triangle is a fundamental concept in plant pathology that states that a virulent pathogen, a susceptible host and a conducive environment must come together in a specific point in time in order for disease to develop," Kearns says. "Thus, disease is actually a relatively rare event in nature. Since golfers demand a monoculture and certain playing conditions, golf course superintendents are required to manage their playing surfaces on the verge of death, essentially. Therefore abiotic and biotic problems plague golf course turfgrass. The key is developing a good relationship with a diagnostic lab that can help managers distinguish between abiotic and biotic problems."

If a crew member burns the grass with a pesticide or hydraulic fluid there will be an unmistakable pattern. Temperature and moisture stress, however, are often non-

Helpful hints

Richard Buckley, coordinator of the Plant Diagnostic Laboratory at Rutgers University, provides some additional helpful hints to diagnose abiotic stress in your turf.

1. Know your pathogen so you can rule out diseases; real diseases are easy. "Who doesn't know red thread or brown patch?"
2. Know your grasses. "By understanding the agronomic requirements for the grasses you are using, it will be very clear when environmental conditions are having a negative impact."
3. Understand your site. "Nothing illustrates infrastructure problems like a little environmental stress."
4. Look for patterns. With the possible exception of pink snow mold or pythium blight, diseases don't make stripes, blocks, uniform patches, or similar sized specks over a green.
5. Recognize symptom progressions. Living organisms grow, spread and move. There is a time dynamic associated with the pathogen life cycle. Heat stress or spray burn happen, it is usually quick and often the grass will recover.

"Careful observations of your site, the weather, and your treatment effects will tell you what happened – just open up to the possibilities.....and use a professional for help," he says.

Overly wet soil conditions can lead to a multitude of other biotic and abiotic issues, such as the black layer shown here.

descript and manifest as general yellowing and thinning, both symptoms used to describe any number of diseases.

Determining the root cause of damage on putting greens or any turfgrass area can be challenging. Plant symptoms often look very similar, and a superintendent should be wary of advice coming solely from a "six-foot" (or standing height) perspective.

The first step is to ask: What is different about this green or area from others that look fine? Is there more water or is it not draining well? Was there a product misapplication? Is it shaded or tucked in the corner?

Secondly, look for patterns. Damage caused by an infectious disease is often randomly scattered across an area, and most diseases can only infect or are more aggressive on one turfgrass species (bentgrass vs. *Poa annua*) as opposed to another. Also, infectious diseases normally don't occur in straight lines, which is a stand symptom indicative of an equipment leak or chemical misapplication. Lastly, get a diagnostic visit, send or take a sample to your local turfgrass pathologist.

To determine what may be going on with your turf is to document symptoms with photos or try to see patterns. "The key to diagnosing many odd abiotic possibilities is to ask questions about what may have been done recently cultural practices, pesticide applications, weather information," Dr. Fresenburg says. "Sometimes those actions can point a finger to the cause and you can remedy the problem."

Buckley believes diagnosing abiotic stress amounts to "proving the negative." The turf should be carefully examined for disease and insect pests. Once they are ruled out, evaluate cause and effect. "What was the recent weather? Did we do anything to the grass? Is the irrigation system functioning, sprayer calibrated, mower set up right, etc. With an abiotic stress the cause and effect is usually clear if one is honest about the current conditions. Think `it was 100-degree on Tuesday, what did I miss?' or, `I you put nine products in the tank, what do I expect?'"

Diagnosing turf problems – both abiotic and biotic – can be tricky, Kennelly says. When in doubt, it is best to work with a diagnostic lab. Sign up for newsletters, blogs, and social media from your region's turf specialists who can tell you what is going on in your area.

"However, a few key pointers are to look for patterns in space and time," Kennelly says. "Diseases are more likely to start in one area and then get worse over time." Abiotic issues are more likely to be "all at once." But, there is still a lot of variation. "Think about the weather conditions and what sorts of stresses or diseases could be occurring. Consider any activities at the golf course over the past few weeks – has there been anything unusual? What has the weather been? Taking photos and notes over the time can help you keep track of when/where issues started. This can be valuable within one season and from year-to-year." **GCI**

John Torsiello is a Torrington, Conn.-based writer and frequent GCI contributor.

John E. Kaminski, Ph.D. is an associate professor, Turfgrass Science, and director of the Golf Course Turfgrass Management Program at Penn State University. You can reach him at kaminski@psu.edu.

WINTERKILL

A note to golfers about this winter and its impact.

This was a tough winter for most turfgrass managers. The discussions surrounding winterkill in both cool- and to a lesser extent warm-season turfgrasses was prominent throughout the industry. Many shared their stories of death and destruction while others were happy to be able to post images of healthy greens.

Winterkill on annual bluegrass putting greens was rampant on many courses throughout the mid-Atlantic and Northern US. Even our research plots at the Valentine Turfgrass Center were pretty much a total loss. Thankfully, I didn't have any ongoing research in these areas and we hope to have them back to full capacity by the time our anthracnose trials begin in June.

The bad part about our death and destruction is that we had originally thought that we made it through with minor problems. We did exactly what we preached to all of you out there and pulled samples from various areas, placed them in a greenhouse and waited to see if anything survived. Surprisingly, we observed pretty good recovery in nearly all samples that we pulled in early March.

Unfortunately, the winter didn't want to let go and the damage had yet to be done. Despite what appeared to be relatively unharmed in March, April thaws and refreezes coupled with prolonged periods of cold weather put the final nail in the coffin. We ended up with 100 percent death. It was like an episode of Game of Thrones when Ned Stark was about to be freed only to have his head chopped off. So much hope killed with one swing of the sword.

Just like us, many of you who thought that you made it through the season in decent shape didn't come up with a contingency plan to deal with the death. This means unexpected increases in labor and budget to get the turf back in playing conditions. It also means delayed openings, reduced rounds and decreased income for the club. Based on this, members will be pushing to get things back to normal.

> "Despite what appeared to be relatively unharmed in March, April thaws and refreezes coupled with prolonged periods of cold weather put the final nail in the coffin. We ended up with 100 percent death. It was like an episode of Game of Thrones when Ned Stark was about to be freed only to have his head chopped off. So much hope killed with one swing of the sword."

For those superintendents that had to deal with (or are dealing with) dead turf, there will be nothing normal about this season. While overseeding and resodding may have taken place and the putting surfaces now look like they are in prime condition, they're likely far from it.

If you were one of the fortunate ones who got the go ahead to resod with creeping bentgrass, you will probably be in the best spot. However, you will still be dealing with very young and relatively shallow rooted turfgrass as we head into the summer.

For those that did what we did in our research plots and simply poked as many holes as possible to allow the existing Poa seed to germinate, you may be in for a struggle. These young seedlings have about 1-2 months to become as healthy as possible before the summer stress wallops its punch. There's a reason we don't open a golf course 2 months after seeding.

So what do the members and golfers need to know?

They need to know that this was one hell of a winter and you're not alone in your struggles. They need to realize that there's a reason the course

(KAMINSKI *continues on page 62)*

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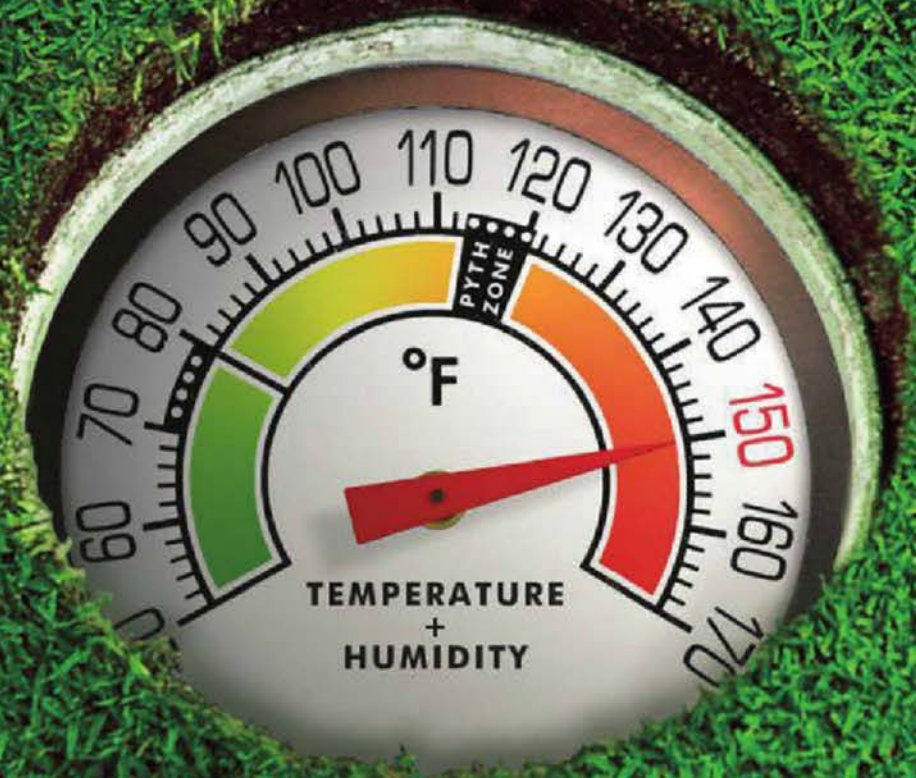

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Monroe Miller retired after 36 years as superintendent at Blackhawk CC in Madison, Wis. He is a recipient of the 2004 USGA Green Section Award, the 2009 GCSAA Col. John Morley DSA Award, and is the only superintendent in the Wisconsin Golf Hall of Fame. Reach him at groots@charter.net.

HELPING WITH TURF RESEARCH

Wisconsin turf profs band together to consolidate funding resources.

I read John Kaminski's March column with great interest. I'm glad he wrote it and, for the most part, he's right on the mark. I suspect most of his academic colleagues would agree with him, too.

Funding has been an issue for as long I as I have been in the turf profession. The lack of industry financial support was the catalyst for the Wisconsin Turfgrass Association in the early 1980s. A serious turf disease was having a negative impact, especially on sod production, and a group of sod producers visited the University of Wisconsin's college of agricultural and life sciences dean for action. In a nutshell, his response was: "You'll have to help with funding."

> "...I do know that in a relatively small state in terms of population, Wisconsin turf professionals have done an excellent job in support of our land grant university and its turf program."

The WTA is an umbrella organization that covers golf turf, sod production, lawn care, sports turf, cemeteries, manufacturers, and distributors. From the beginning, there has been a broad base of support. Our success is due to our focus and hard work supporting turfgrass research at the UW-Madison, just like the dean suggested. We zero in on faculty need. In addition to membership dues, we started a field day, a winter conference and a golf fundraiser. Various turf groups now have their own events to raise money for the WTA.

We started giving scholarships and making research grants. The amount of funding wasn't large, but we had priorities in mind. We had our eyes on a really big project – to conceive, design, build and gift to the university an agricultural research station for turfgrass like most other states already had. Being the last to build a turfgrass research station allowed us to learn and build the best. Due to good timing and fortunate politics, we acquired the land we needed contiguous to the new university golf course that was underway.

Once fund raising started and was well known, we had an anonymous donor step up and match what we raised, which shortened our time frame. Before we knew it, the building was designed and The O.J. Noer Turfgrass Research and Education Facility was open and ready for business. By the way, we didn't deed the farm and all the amenities over to the state until we were completely finished. We did it all our way.

Our support of faculty has covered other areas. Over the past 25 years we've averaged half a dozen scholarships each year. The WTA has funded the first-year salary and benefit package for two new turf profs to secure their hiring. We've funded individual projects, purchased all kinds of equipment from computers and data loggers to mowers and trucksters. Equipment and soft goods manufacturers have been extremely supportive as well. Our ARS has hosted urban field days, our own WTA Turfgrass Field Day, Grandparents University and even the TPI Field Days. The Noer Facility houses our turf diagnostic lab, a development that happened only after we built the station. The WTA also funds half of the program assistant's salary.

Another big step was taken when we established a relationship with the UW Foundation. This organization helps with fundraising, manages our money and deals with legal and investment issues. The WTA now has four WTA Wisconsin Distinguished Graduate Fellowships, each one supporting a grad student. This fellowship fund gives access to the earnings of our $2 million corpus and is accessible only to turfgrass faculty for grad students. We also have a WTA Turfgrass Research Sustainability Fund in the UWF to support research requests. And we are initiating a legacy endowment fund in the UWF to help industry people with estate planning, legacy gifting and similar needs. This fund does not allow any invasion of the principal; only the earnings support research.

To John's point about decreased GCSAA research funding, I am guessing GCSAA dues and income are at the point of what traffic will bear, and I doubt they can help it.

But I do know in a relatively small state, Wisconsin turf professionals have done an excellent job in support of our land grant university and its turf program. Our mission is to keep it going; after all, we are only helping to help ourselves. **GCI**

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BY MARK J. MACKEY, GRANT M. CONNETTE, WILLIAM E. PETERMAN, RAYMOND D. SEMLITSCH,
DIVISION OF BIOLOGICAL SCIENCES, UNIVERSITY OF MISSOURI

Do golf courses reduce the ecological value of headwater streams for salamanders in the southern Appalachian Mountains?

Strategies to prepare Bermudagrass fairways for overseeding in the Desert Southwest have changed dramatically over the past five years.

ABSTRACT

Recent studies indicate golf courses may have a potential role in biodiversity conservation and management in human dominated landscapes. To serve this ecological role, effects of current golf course management practices must first be better understood. We sampled larval, juvenile, and adult stream salamanders in transects located upstream, through, and downstream of managed fairways of 10 golf courses in western North Carolina, USA. We measured in-stream and riparian habitat characteristics and tested for nitrate and pesticide chemicals to explain trends in salamander abundances and diversity. Stream transects located directly on fairways contained lower abundance of larval, metamorph, juvenile, and adult salamanders than either upstream or downstream transects. The species diversity of aquatic larval and metamorph salamanders on fairways was also reduced but only compared to the upstream transects, and terrestrial juvenile and adult diversity did not differ among the three transect locations. Our analysis found that leaf litter depth, CWD, soil moisture, and buffer width parameters found within several models were positive predictors of salamander abundance and diversity. Nitrate was not detected at any of the stream reaches and two of the 16 pesticide chemicals screened were only detected in negligible proportions. Our findings suggest golf courses in western North Carolina can currently provide viable habitat for stream salamanders in reaches upstream and downstream of managed areas of courses and streams running through fairways may be enhanced through simple management practices such as retaining woody debris, leaf litter, and restoring a riparian buffer.

INTRODUCTION

The ecological value of streams and rivers globally is influenced by increasing human land use (Allan, 2004). Currently, there are estimated to be more than 31,500 golf courses worldwide (Tanner & Gange, 2005). With over 18,300 golf courses in the U.S. alone (Baris, Cohen,

EDITOR'S NOTE

Due to the length of the original research report, the following is a modified version. To read the report in its entirety – including full content, references, and accompanying charts & graphs – see either the app version of this issue, or enter **bit.ly/1IYgeow** into your browser to access the pdf.

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Barnes, Lam, & Ma, 2010) encompassing over 2.7 million acres (Colding, Lundberg, Lundberg, & Andersson, 2009), golf has become an appreciable portion of land use in the United States. The ecological impacts of golf courses are not always straightforward, and popular opinion of the impacts of golf courses on the environment can be in direct opposition of scientific studies (Wheeler & Nauright, 2006). Further, results from the scientific literature can be seemingly as contradictory in their reporting (see below). To better understand the ecological impacts of golf courses, it is necessary to move beyond the deceptive dichotomy of "good" or "bad" (Sheil & Meijaard, 2010), and to measure impacts using ecologically meaningful responses for target organisms.

A major focus of discussion regarding known or suspected eco-logical impacts of golf courses has been water quality, typically focusing on chemical toxicology (Wheeler & Nauright, 2006). Golf courses depend on agrochemicals for pest control, turf management, and esthetic purposes. Although there have been many studies on agricultural chemicals in groundwater and surface water, it is usually not appropriate to extrapolate results from agricultural monitoring studies to golf course studies due to the significantly different management practices, plant canopy, surface mat, and root system of turf (Cohen, Svrjcek, Durborow, & Barnes, 1999; Kenna, 1995). A study in southeastern North Carolina reported generally greater nitrate levels in streams leaving golf courses compared to streams entering golf courses (Mallin & Wheeler, 2000), though concentrations varied considerably among courses. A study conducted on two golf courses under construction and five in operation in Canada found course construction and operation had a significant impact on alkalinity, nitrogen, and base cation concentrations of streams downstream of courses compared to forested reference streams (Winter & Dillon, 2005). A similar study found significant differences in certain benthic algal taxa in headwater streams downstream of golf courses compared to reference streams (Winter, Dillon, Paterson, Reid, & Somers, 2003). Differences were attributed to greater nutrient enrichment, higher pH, and higher disturbance from the golf courses.

Not all studies on the effects of golf courses find significant impacts on water chemistry. A study conducted on three golf courses in North Carolina examined the presence of chemicals in surface waters and found no chemical impact (Ryals, Genter, &Leidy, 1998). Another study in the Pacific Northwest monitored surface waters monthly following the application of fertilizers and pesticides and found no significant detection of chemicals (Hindahl, Miltner, Cook, & Stahnke, 2009). In fact, the most extensive meta-analysis to date of golf course water quality monitoring analyzed data from across 40 studies involving 80 courses over a 20-yearperiod and found relatively few pesticide detections or exceeded limits in surface water (Baris et al., 2010). The authors attribute this finding to the combination of two factors: (1) the fact that turf systems act as a living filter, and (2) the practice of applying minimal pesticides to the roughs, which typically surround the more intensively managed tees, greens, and fairways. As turf science has developed due to public scrutiny and pesticide registration evaluations by the U.S. Environmental Protection Agency under the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA; Bariset al., 2010), it is possible that water chemistry and chemical runoff is no longer the foremost ecological concern at many golf courses.

The other primary impact of golf course development and maintenance is the physical alteration of the landscape. Habitat alteration and destruction is known to be one of the biggest threats to biodiversity (Wilcove, Rothstein, Dubow, Phillips, & Losos, 1998), and is therefore an obvious focus of ecological research. The clearing of natural vegetation, deforestation, the destruction of natural landscapes and habitat, and changes in local topography and hydrology are all possible land use effects that result from golf (Wheeler & Nauright, 2006; Winter

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et al., 2003). A study in southeast Queens-land, Australia found many golf courses to have negligible value as terrestrial habitat refuges which supported mostly urban-adapted species compared to reference eucalypt forests (Hodgkison, Hero, & Warnken, 2007). In stream ecosystems, reach-level channel morphology is influenced by valley slopes, bed and bank material, riparian vegetation, and the supply of upslope water, sediments, and wood (Montgomery & MacDonald, 2002). Human actions at the landscape scale can disrupt these factors that maintain stream processes and their associated biota and often result in habitat that is both degraded and less heterogeneous (Allan, 2004). Landscape level experiments have documented how such physical alterations to the terrestrial landscape can have downstream impacts on habitat and water quality of streams through alterations of hydrology (Likens & Bormann, 1974). Headwater streams in particular represent the maximal interface between aquatic-terrestrial systems (Lowe & Likens, 2005), and their sensitivity to land disturbance makes them both important and useful for studying land-use impacts.

> "Considering ecological processes are now more widely accounted for in golf course design and management, courses could increasingly become an asset in ecosystem management and biodiversity conservation and serve as models for ecological awareness and sustainability.

Despite the potential negative impacts golf course development and maintenance can have on landscapes, a number of studies have found golf courses to have a general positive conservation value on the species studied, including amphibians(Boone, Semlitsch, & Mosby, 2008; Colding, Lundberg, Lindberg,

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& Andersson, 2009), butterflies (Porter, Pennington, Bulluck, &Blair, 2004) pond breeding macroinvertebrates (Colding, Lundberg,Lindberg, & Andersson, 2009), reptiles (Harden, Price, & Dorcas,2009; Mifsud & Mifsud, 2008), birds (Merola-Zwartjed & DeLong,2005; Rodewald, Rodewald, & Santiago, 2004), and mammals(Eisenberg, Noss, Waterman, & Main, 2011). A review of the scientific literature studying land-use effects of golf courses on biota found that the ecological value of golf courses increased as the anthropogenic impact on the surrounding land increased (Colding & Folke, 2009). Therefore, the ecological impact and conversely the conservation value of a golf course will depend upon the landscape in which the golf course exists. Additionally, studies of golf course impacts have often focused on single species or closely related taxa most likely as a result of logistical constraints of field work. Many of the species studied have dramatically different life histories and therefore respond differently to landscape alterations. Having a clear understanding of species life history in conservation efforts offers good opportunities to gain insight into the mechanisms behind species response to land-use change (Verheyen, Honnay, Motzkin, Hermy, & Foster, 2003).

> "As the golf industry becomes more open to land stewardship, sustainability, and ecological awareness, a valuable opportunity is provided for researchers to collaborate with this group of managers and provide constructive ecologically-based guidelines for improvement of water quality and wildlife habitat.

Salamanders are especially prolific in headwater streams of eastern North America where they are the most abundant vertebrate organism (Peterman, Crawford, & Semlitsch, 2008; Nowakowski & Maerz, 2009). Because they are highly philopatric, long-lived, and occur in relatively stable populations, stream salamanders may be more appropriate and reliable indicators of biodiversity and habitat quality in stream ecosystems than many fish or macroinvertebrates (Welsh & Ollivier, 1998). Stream salamanders may also be useful indicators of ecosystem health because they are adversely affected by deforestation and physical disturbance (Orser & Shure, 1972; Petranka & Smith, 2005; Willson & Dorcas, 2002), siltation (Lowe, Nislow, & Bolger, 2004; Welsh & Ollivier, 1998), and stream acidification (Kucken, Davis, Petranka, & Smith, 1994). Stream salamanders also have complex life cycles; reproduction and larval growth occurs in aquatic habitat followed by metamorphosis and sexual maturation interrestrial riparian habitat (Petranka, 1998). Thus, unlike some organisms, their persistence in headwater streams is explicitly dependent upon the quality of both aquatic and terrestrial systems.

The purpose of our study was to examine the influence of golf course management on the abundance and diversity of stream salamanders in the southern Appalachian Mountains. We focused on habitat changes that may have affected the abundance of both aquatic larvae and terrestrial juveniles and adults. Our primary hypothesis was that land-use effects would be greatest in stream samples that occurred directly on the golf course

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fairways because they would be directly impacted by habitat alteration during construction and routine maintenance of fairways compared to upstream or downstream areas that had no direct alteration or maintenance. We hypothesized that habitat alteration would either directly or indirectly affect aquatic larvae and terrestrial juveniles through loss of canopy cover, siltation, and a reduction in leaf litter, woody debris, and soil moisture based on similar studies in reference streams in the surrounding Nantahala National Forest (e.g., Crawford & Semlitsch, 2007, 2008; Peterman & Semlitsch, 2009). Secondarily, we tested whether chemical runoff in downstream samples was detectable at levels that might influence the abundance and diversity of salamanders on golf courses. Our objectives were to sample larvae, juvenile, and adult salamanders across a replicate set of 10 golf courses and test our hypotheses by comparing abundance and diversity between samples from streams located upstream, downstream, and through the fairway of each golf course. Further, we use an information theoretic approach to identify specific habitat features that are associated with either the abundance or diversity of stream salamanders.

CONCLUSIONS

Considering ecological processes are now more widely accounted for in golf course design and management (Jackson, Kelly, & Brown, 2011), courses could increasingly become an asset in ecosystem management and biodiversity conservation (Colding & Folke, 2009) and serve as models for ecological awareness and sustainability. With an estimated 27.1 million golfers in 2009 in the United States alone (NGF, 2010), integration of ecological principles to golf courses has the capability of reaching a large audience that otherwise may not be exposed to conservation concepts and practices. Golf courses can serve as opportunities for demonstration, the translation of scientific understanding into metrics of performance and cost under real world conditions, that is key in the progression of fundamental research to applied science (Hall &Fleishman, 2010). From the application of our results, and building on previous studies, we suggest several procedures to improve golf course management: (1) maintain or restore riparian vegetation that includes a buffer at least 15 m from the stream edge, (2) maintain or restore a tree stocking density of ~50% within the riparian buffer to shade and provide a source of leaf litter, and (3)maintain or add small woody debris dams that retain leaf litter in streams to provide increased refuge, maintain soil moisture, and provide food sources for salamanders. Further, these management techniques suggested for golf courses can potentially be used in other systems with headwater streams such as parks, cemeteries, historical sites, and a number of other hwman land uses that affect the quality of stream habitat. As the golf industry becomes more open to land stewardship, sustainability, and ecological awareness, a valuable opportunity is provided for researchers to collaborate with this group of managers and provide constructive ecologically-based guidelines for improvement of water quality and wildlife habitat. **GCI**

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(COLORANTS *continued from page 26)*

that then influences some growth metric.

But I am not convinced that colorants grow roots. There is more work to be done to better understand how the use of pigment colorants applied to a plant leaf surface influence all the ways a plant could respond.

THE MAJORITY OF RESPONDENTS INDICATED THEY WILL CONTINUE TO USE COLORANTS AS A TURF MANAGEMENT TOOL. WHAT CAN WE EXPECT TO SEE IN THE COMING YEARS?

We see today that colorants do have a place in the bigger picture of turfgrass management practices by golf course superintendents. Their current uses have expanded considerably in these recent years, largely driven by economic forces. Where there was once much skepticism and avoidance, there is now general acceptance of these pigment colorants as a result of early-adopters looking for new ways to not only solve turfgrass management problems, but to maintain and even enhance the game experience by their golfing clientele. I would say the place of colorants and how they may be used in more innovative ways will depend on where they fit as a component that superintendents use to create the kind of golf experience that draws greater participation and enjoyment of the game by future generations. **GCI**

(VINCHESI *continued from page 18)*

improve irrigation scheduling. They can perform preventive maintenance, such as cleaning out controllers, exercising gate valves, tightening grounding clamps, replacing and leveling valve boxes, and cleaning and painting the pump house and pump station.

Above all else, patience is necessary to provide these services. Troubleshooting a strict sequence and customer service as the irrigation technician is always out among the members and players making repairs.

Of course, being mechanical oriented and not being afraid to get dirty doesn't hurt, either. Wire tracking and fault finding is a necessary skill, but unfortunately it is one only perfected with experience. With new technologies – such as integrated decoder type systems and the use of HDPE pipe – more skills and training are needed because these systems use more sophisticated equipment.

Most superintendents determine the watering schedule and have the irrigation central control system in their office. However, in some cases, the irrigation technician may be watering or implementing the schedule. Usually the technician maintains the irrigation system central controller database. As we have discussed in this space before, it is essential to have an accurate database. The irrigation technician is best positioned to ensure that the correct sprinkler, nozzle and arc that they have serviced in the field are reflected in the database. By performing audits, they can also use the data collected to fine tune precipitation rates and runtimes.

Unfortunately, good irrigation technicians are hard to find and they are beginning to earn higher salaries. There is no real training program other than experience. Much like a spray technician, if you can identify someone on your staff with the right skillset you can train them on irrigation repair and send them to electrical troubleshooting or auditing classes.

Irrigation technicians can be well worth the cost especially if you have an aging irrigation system that has continual problems as they are less expensive than a new system.

If you have the budget to hire or the available staff, an irrigation technician will improve the operation and lengthen the life of your irrigation system. It should also provide for better playing conditions as the irrigation system will cause less issues on the course and have improved uniformity when compared to an irrigation system only maintained and/or repaired when necessary. **GCI**

(KAMINSKI *continued from page 48)*

down the street didn't lose turf and you did. They need to realize that there's a real difference between the creeping bentgrass greens on the neighboring course and the annual bluegrass on yours. They need to realize that the hybrid Bermudagrass they thought was a bulletproof choice on their greens may be challenged in a winter like this.

They need to know that it's not your fault that one of the greens on your course died while another didn't. They need to understand that variation in drainage or shade on golf course surfaces as well as microclimates from one green to the next can have a tremendous impact on plant health and survival.

They need to understand that preventive maintenance practices help to reduce the possibility of these dramatic events, but that even the best laid plans are sometimes not enough.

Hopefully one thing that will come out of a winter like this one is that clubs will start to realize the potential negative impacts of a harsh winter (similar to harsh summer) and allow for modifications. These may include converting from annual bluegrass to creeping bentgrass or installing internal drainage to improve water movement. Each case is different and the only person who knows what best for the course is the individual superintendent managing the course.

The bottom line is that the members and golfers out there need to realize a few things.

- The death experienced this winter was unavoidable
- Recovery is going to cost money and take time
- Reconditioned greens will struggle this year, especially in the summer
- The superintendent's recommendations to improve the overall growing conditions of the turf (e.g., internal drainage, tree removal, etc.) should be taken into serious consideration

Although the golfers will likely feel angry and upset about the conditions and/or delays in course opening, I can assure you that the superintendent and their staff will be feeling 10 times the pressure and stress. Believe me, they hate losing turf more than you. **GCI**

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Travels With Terry

Globetrotting consulting agronomist Terry Buchen visits many golf courses annually with his digital camera in hand. He shares helpful ideas relating to maintenance equipment from the golf course superintendents he visits – as well as a few ideas of his own – with timely photos and captions that explore the changing world of golf course management.

Terry Buchen, CGCS, MG, is president of Golf Agronomy International. He's a 41-year, life member of the GCSAA. He can be reached at 757-561-7777 or terrybuchen@earthlink.net.

UNIQUE WORK BENCHES

A listing on Craigslist for two brand new metal workbenches ($1,500 total) were a great find by the maintenance staff at the Waynesborough Country Club in Paoli, Pa. Each one measures 120 x 39 x 40 inches with 20 drawers each, where the top three drawers (sliding on ball bearings with a 60-pound weight limit) measure 30 inches deep, 15½ inches wide, and 4 inches high. The bottom drawers are 11½ inches high with the same depth and width, but equipped with an 80-pound weight limit. With four drawers per column each is separately lockable. Each drawer has a 52-font, laminated ID label. One workbench has a 2-inch thick solid wood top ($500) and the other has a ½-inch thick metal top – both acquired locally – with three quad electric outlets above each workbench. Ben Kovacs, golf course superintendent, Derek Mohler, senior assistant golf course superintendent, and Joe Brown, equipment manager, make a great team.

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A simple but very effective way to level sprinkler heads is accomplished by using a 4 x 4 x ¼ inch piece of aluminum angle bar at $36 acquired from a local metal supply shop. The two Vise-Grip pliers ($19.95 each) clamps the top of the sprinkler head to the aluminum bar after it is placed at the desired finish turf height. Once the soil is backfilled and tamped to within 6 inches below grade, where the sprinkler head and swing do not move, then both pair of pliers and the aluminum bar are removed prior to completing the backfilling and sod installation. The aluminum is obviously lightweight and fits easily in the bed of a turf vehicle. Robert H. Gamble, superintendent, and George Tuccanardi, irrigation technician, developed this great inexpensive idea at The Pearl Golf Links in Calabash, N.C.

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DIRTY THOUGHTS

When the TV show "Dirty Jobs" first hit the airwaves in 2005, I was mildly amused by the idea of this actor guy who subjected himself to performing nasty tasks like hog castration, snake sexing and bird vomit inspection. We yukked it up along with Mike Rowe and his crew as they got very, very dirty and we learned about the weirder side of America's lesser-known workplaces.

But, along the way, the stinky and gooey parts of more than 300 different filthy jobs began to take a backseat to another aspect of the show: getting to know typical Americans who work hard behind the scenes and do important things that benefit others.

Sound familiar?

Over the years I became a regular viewer of "Dirty Jobs," but I also became a fan of Mike Rowe himself. Here's a guy who faked his way into an opera singing job 20+ years ago and since then has become an iconic TV host, voiceover king, corporate spokesman for Ford, CAT and others, big fan of the Green Industry and, more recently, an advocate for the idea that not everyone needs a college degree and that labor – hard work using one's own hands – is a rewarding and valuable thing.

In short, I think Mike Rowe is far more in touch with the pulse of America than any member of Congress or big city mayor. I also like the fact that he's apolitical. It's not about politics... it's about common sense. You can learn a lot of great stuff about his foundation and what he's trying to accomplish here: www.profoundlydisconnected.com.

I decided I had to talk about Rowe this month after a simple Facebook post he wrote last month pretty much blew my mind because it perfectly captured the whole Millennial angst problem but it also speaks volumes about America today. A young person wrote him for career advice and he responded... well, read it for yourself. Here's a shortened version. You can find the whole thing on his site:

Hey Mike!

I've spent this last year trying to figure out the right career for myself and I still can't figure out what to do. I have always been a hands-on kind of guy and a go-getter. I could never be an office worker. I need change, excitement, and adventure in my life, but where the pay is steady. I grew up in construction and my first job was a restoration project. I love everything outdoors. I play music for extra money. I like trying pretty much everything, but get bored very easily. I want a career that will always keep me happy, but can allow me to have a family and get some time to travel. I figure if anyone knows jobs it's you so I was wondering your thoughts on this if you ever get the time! Thank you!

Rowe responds:

"Consider your own words. You don't want a career - you want the "right" career. You need "excitement" and "adventure," but not at the expense of stability. You want lots of "change" and the "freedom to travel," but you need the certainty of "steady pay." You talk about being "easily bored" as though boredom is out of your control. It isn't. Boredom is a choice. Like tardiness. Or interrupting. It's one thing to "love the outdoors," but you take it a step further. You vow to "never" take an office job. You talk about the needs of your family, even though that family doesn't exist. And finally, you say the career you describe must "always" make you "happy."

"Stop looking for the "right" career, and start looking for a job. Any job. Forget about what you like. Focus on what's available. Get yourself hired. Show up early. Stay late. Volunteer for the scut work. Become indispensable. You can always quit later, and be no worse off than you are today. But don't waste another year looking for a career that doesn't exist. And most of all, stop worrying about your happiness. Happiness does not come from a job. It comes from knowing what you truly value, and behaving in a way that's consistent with those beliefs.

"Many people today resent the suggestion that they're in charge of the way they feel. But trust me, Parker. Those people are mistaken. That was a big lesson from Dirty Jobs, and I learned it several hundred times before it stuck. What you do, who you're with, and how you feel about the world around you, is completely up to you."

This is remarkable advice on a bunch of levels. First, it's a nice slap upside the head to a generation of young workers who aren't particularly interested in working. Second, it reminds us that the simplest things matter most: I'll take someone who's hard-working and reliable over someone who crushed their ACT or interned someplace fancy anytime. Finally, he really nails it by stating flatly that happiness doesn't flow from your title... it comes from walking the talk.

This country needs way less Kim Kardashian and way more Mike Rowe. Let's never forget there is honor and great reward in simple hard work. And let's teach our kids that lesson, too. GCI

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