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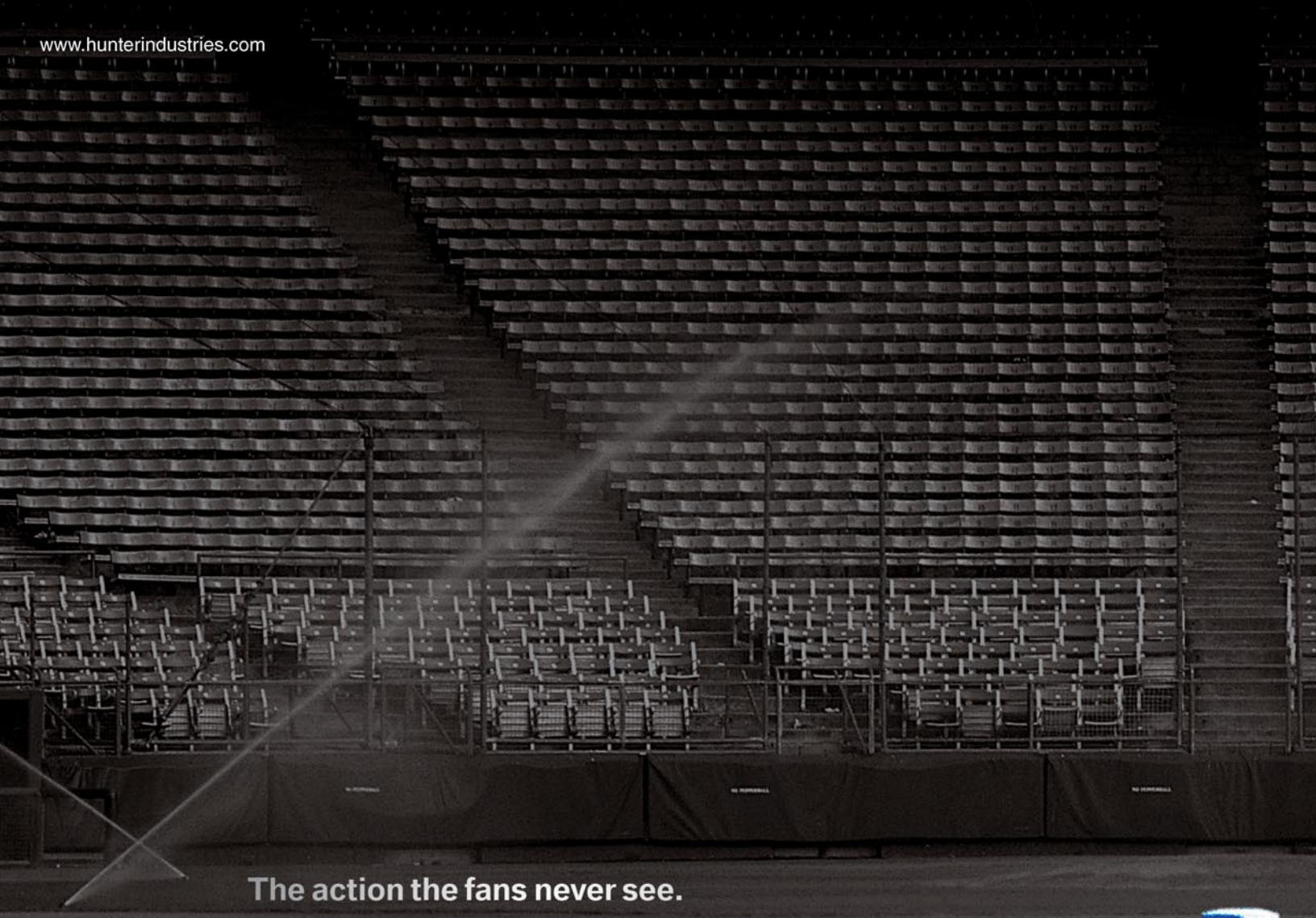

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est preservation. More-advanced research includes the development of fast-growing trees and grasses and deciphering the genomes of carbon-storing soil microbes.

Rather than sports turf, NETL's terrestrial sequestration R&D is focused on reforesting and amending mine lands and other damaged soils and analyzing various land management techniques, including no-till farming, reforestation, rangeland improvement, wetlands recovery, and riparian restoration. There is a heavy agricultural and forestry bent to the NETL program. While ag research is important, it leaves out the contribution of sports turf. Taken together, however, natural areas will help reduce CO_2 emissions.

This is no easy task. Roughly speaking, NETL figures it would take about 220,000 acres to offset emissions from a single, average-sized coal-fired power plant. That is a lot of soccer fields, golf courses and baseball diamonds. The NETL figure assumes an average coal power plant from the existing fleet and a forest uptake rate of three tons of carbon per acre per year. Terrestrial sequestration is conceptualized for use in conjunction with CO_2 capture and storage to provide fossil-fired power generation with zero net greenhouse gas emissions. It is expensive to capture the last 5-10% of CO_2 emissions from a fossil fuel conversion plant, due to the law of diminishing returns.

Sports turf and trees are not the final answer. NETL figures a cost-effective approach for zero emissions is to capture 90% of emissions and offset the remaining 10% with terrestrial sequestration. NETL does point out the many collateral benefits of this kind of program, including flood protection, wildlife/endangered species habitat, restored ecosystems, and the like.

Soil carbon is both organic and inorganic carbon contained in soil. During photosynthesis, plants convert CO_2 into organic carbon, which then is deposited in the soil through their roots and as plant residue. Organic carbon is found in the top layer of soil, the A horizon. Inorganic soil carbon comprises carbonates that form through non-biological interactions. They are a minor amount compared with organic carbon, but are considered more permanent. Large plant roots, such as those of trees, are considered biomass and not part of the soil, but the organic matter, if you look closely, includes many fine root hairs, where much of the CO_2 exchange from the plant to the soil occurs.

But Qian sees ways sports managers can help with carbon in ways that go beyond carbon sequestration. "Turf managers should look at carbon sequestration as only one side of the equation," Qian says. "The other side is carbon emissions."

By this, she means managers have to look at ways to minimize their carbon footprint…whether from chemical use, from vehicle use, or other carbon-generating uses.

"Some vehicles are more fuel-efficient," she says. "It's another area of the carbon question that needs work." ■

Chris Harrison is a free lance writer who specializes in turf and agriculture.

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>> **SAND SLITTING** can increase percolation and break up compacted layers.

Tips from David Frey

David Frey has more than 45 years of experience in maintaining, renovating, designing and building all types of fields. He should be considered a "founding father" of STMA; Frey succeeded the legendary Harry C. Gill as STMA president from 1983-1985 when he was the head groundskeeper at the old Cleveland Stadium. He was involved in developing new types of mound clay, a powered device for field tarps, and using geotextiles for bench tarps and field protection. He currently owns Field Specialties, which builds and renovates natural grass fields. Here are some tips from the master:

THE BEAUTY OF A NATURAL GRASS surface is that with maintenance, it can last forever. I spend a great deal of time fixing and improving surfaces and I have been asked how I develop a plan to evaluate them. Grade and consistency come first, followed by drainage and then grass cover.

You may notice that I like to use the word "surface" rather than field. A field is an area, be it level and true or not, that is used for pasturing and raising crops. A surface is a specific area that is designed for a particular activity, with defined dimensions, grades and variations.

Some surface changes are a matter of time and/or use. Changes to the requirements of particular sports have required the surfaces to change size, position of the goals, and room around the outside of the playing surface. Incorporation of other sports to be played on the same surface requires other considerations.

For example, NFL fields have changed dramatically. In the beginning the teams basically would play anywhere they were allowed. Fields were not even the correct length (Tiger Stadium and Wrigley Field). Practice areas were totally different than the training centers you see today. Many teams practiced on only a field and a half and the indoor work was done in a warehouse.

But times have changed, and grasses and soil mediums have changed too. Better varieties and higher sand/soil mediums make for better wear and drainage. High sand profile baseball fields have improved the use of grass fields in competition with artificial surfaces. Of course, separate facilities for each discipline have been the greatest change in baseball and football.

Most surfaces that I review are those that have been used for many years and hopefully have some good basic structure. Baseball requires good drainage, particularly from the infield area. Fields that are built backwards are those where the grades run toward the infield. They are not easy to fix without lots of changes and cost.

In most cases for baseball, I find the first thing I change is to raise the height of home plate, usually about 4 inches. Home plate and the mound are where everything starts. If they cannot drain the game is over. Do not get carried away with the idea that the plate and the bases have to be at the same height. Good plan, but does not always work unless you are in Florida. Raising home plate will raise the mound and the increases the grades on the infield grass, therefore providing better drainage.

GRADE AND CONSISTENCY

My approach to a football or soccer surface starts with the grade and consistency. Hopefully the surface was built with enough height to help the surface to drain. One rule of thumb is that you should be able to run at full speed and look over your shoulder and know the footing is consistent. Therefore, the grade might not be to specifications, but it should be consistent. The center of the field must not be lower than the sidelines. Bad or uneven grades would be reasons to rebuild the field. This

In most cases for baseball, I find the first thing I change is to raise the height of home plate, usually about 4 inches.

Home plate illustration ©istockphoto/XonkArts

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has to do with safety and playability. If the grade is within reason both the drainage and grass cover can be fixed without rebuilding.

I like to see the grade slope to be about 1% from the center line at the most. Less than a ½% slope will develop low areas and there is not enough slope to move water through the grass. I do not like the surface to be lowered at the ends. It changes corner kicks and goal play in soccer and end zone play in football.

Let's say the basic grades are good, but there are depressions or holes. Another possibility is to true up an existing surface using a sandy mix of more than 85% sand and a laser box to spread the material over the entire surface. Do not use topsoil as it will seal off the drainage. Straight sand is okay, but tougher to get the new seed to germinate. The grass from below will come through at some point if the layer is not too deep.

PERCOLATION

Okay, the grades are acceptable, but the field is worn and the complaint is poor drainage. There are several methods to increase percolation in a sports surface. Installation of sand slitting, or several of the new thin pipe materials serve to move water, and break up the compacted layers.

In my opinion, a drainage pipe installation in existing grass is not a good plan. Look at the process. First you trench the surface every 15 or 20 feet. Then you install pipe and backfill with either a sand or stone. The two problems that happen will be to get grass established over the trench and keep the grass during drought situations. If you add soil to establish the grass, the soil acts to seal off the drain. French drains along the perimeter are great to capture water off the surface. The same drains in foul territory can greatly solve water runoff problems from the surrounding areas of the diamond. I do not put drains under clay infields as the clay will not percolate and if you backfill with sand the ball bounce is inconsistent.

I am always amazed that schools balk at strong overseeding and fertilization programs. It is a low cost method to improve a surface. Compare that to the cost to seal the old parking lot each year. And do not forget the practice surfaces. Football players spend almost every day on the practice field and 1 day every 2 weeks on the playing surface.

Grass cover not only improves the surface appearance, it improves playability. Grass needs to be grown aggressively which means a good fertilization program needs to be in place. Compare that cost with the renovation cost. Do not try to seed into a well-established stand of grass, as the germination rate is very low. Remember that seed count is important. There is a big difference between ryegrass and the bluegrasses. My suggestion is 20% to 30% ryegrass in a blended mix in new seeding to help the bluegrass to get established. I do not recommend seeding any bluegrass into a stand that has rye as it cannot compete. Do not forget annual ryegrass for those seedings that have to happen now. ■

John Mascaro's Photo Quiz

John Mascaro is President of Turf-Tec International

Can you identify this sports turf problem?

Problem: Green turf with brown turf surrounding
Turfgrass area: Research area on football practice field area
Location: Ames, Iowa
Grass Variety: Patriot Bermudagrass

Answer to John Mascaro's Photo Quiz on Page 33

Background illustration courtesy of istockphoto.com

Converting a field from Kentucky bluegrass to hybrid bermudagrass

>> **A NEW CAMBRIDGE DRAINAGE SYSTEM** was installed before the inter-sprigging of the bermudagrass into the bluegrass playing surface. One-inch perforated drain tiles were installed on 10-foot centers across the entire field and then backfilled with gravel and sand. >> **Inset Image: THE KENTUCKY BLUEGRASS** playing surface of Thompson Field at Virginia Tech in Fall 2008.

STRESSFUL, TIME CONSUMING, PROBLEMATIC, EDUCATIONAL, EXPENSIVE…from a sports field manager's position, these are all words that can be associated with the process of renovating an athletic field. A renovation might encompass anything from a simple re-sodding to the complete reconstruction of a field from the ground up, but the end result is hopefully an enhancement of the safety and playability of a field.

During Spring 2009, the Virginia Tech athletic department initiated a unique renovation project of their competition soccer field. Thompson Field is home to the Hokie men's and women's soccer teams in the fall, as well as the women's lacrosse team during the spring. It was originally completed in Fall 2003 as a native soil, Kentucky bluegrass playing surface with a sand-slit (Cambridge) drainage system to enhance water removal from the field. One inch perforated drain tiles were installed in the sand slits on 10-foot centers across the entire playing surface along with an in-ground Toro irrigation system.

When I arrived at Virginia Tech in Fall 2007, I was fortunate enough to be entrusted with the management of the soccer facilities. I quickly learned the difficulties of managing a field for multiple teams and the high expectations of the coaches for their field. While the coaches were always satisfied with the playing surface, I was always under constant pressure to increase the

Eventually, we reached a point where we felt we could no longer decrease the mowing height and ensure the safety of the field so we began "planting" the idea for a possible renovation of the field surface to bermudagrass.

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speed (and therefore decrease the mowing height) of the field.

Eventually, we reached a point where we felt we could no longer decrease the mowing height and ensure the safety of the field so we began "planting" the idea for a possible renovation of the field surface to bermudagrass. By switching we felt we could provide a more dense, uniform, and faster playing surface than what we had on the original bluegrass field.

Unfortunately, while the suggestion was welcomed by the coaching staffs, there were limited financial resources available to allow for stripping the old and installing the new. For this reason, we continued to play on the Kentucky bluegrass surface, but continually kept the idea of a field conversion alive by discussing it with our coaches and administrators.

TIME TO ACT

During Fall 2008, I began to notice some drainage issues with the field in the fact that it became spongy and remained wet for days after a rain event. At one point a game had to be cancelled due to unsafe playing conditions 2 days after a half-inch rainfall event. This caught the attention of our administrators. While the financial situation hadn't really changed, we had reached a point where definite action had to be taken on the drainage system.

We began to make plans to install a new Cambridge drainage system into the field following the completion of the spring lacrosse season. Knowing that we would have a fair amount of field disruptions with the new drainage trenches, but that we still could not afford a complete re-sodding of the field from bluegrass to bermudagrass, I began to explore other options. Through my work as a graduate student with Dr. Mike Goatley, I learned of a process of converting a cool-season athletic field into bermudagrass by sprigging directly into the existing playing surface. Dr. Goatley had conducted several successful research trials and had been involved with similar conversions at other schools.

After multiple questioning sessions with Dr. Goatley about the process, I began presenting the idea to my supervisor to be presented to the athletic department administration. The biggest selling point of this approach was that by using sprigs instead of sod, the overall cost of resurfacing the field could be drastically reduced. In order to fully educate and prepare our coaches for the process, Dr. Goatley was brought in for a meeting to present them with the process and answer their questions.

PLAY MUST GO ON

The primary difference between our renovation plan and the previous successful conversions at other schools was that we had to take a 2-year approach as the field would still be used for the fall playing season instead of being allowed to develop and mature for a year without any activity. The upfront education process for our coaches and administrators was the key to the success of this project. By explaining to them what would happen and preparing them for how the field would look, there were no surprises or unmet expectations throughout the renovation process.

The coaches' primary concern was that the field would still play consistent and true during the conversion process and the aesthetics

>> **THE CUSTOM SPRIGGING MACHINE** used by Carolina Green in action. The Patriot bermudagrass was inter-sprigged into the existing bluegrass at the approximate rate of 800 bushels per acre.