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MARCH 2000

ONLINE MAGAZINE

Coming Out
of the
Biomanagement
Closet

NEW!
Audubon
Signature
Program:
Impact on the
Daily-Fee Course

The
Water
Shortage
Bomb:
Its Fuse is
Shorter
Than We
Think

Laymen's Guide
to
Beneficial
Soil Bacteria

[Table of Contents](#)

Table of Contents



THIS WEEK'S FEATURE:

Audubon Signature Program: Impact on the Daily-Fee Course

By Bruce F. Shank, Editor

OTHER MARCH ARTICLES:

- The Water Shortage Bomb:
Its Fuse is Shorter Than You
Think
- Coming Out of the
Biomangement Closet
- Laymen's Guide (and web
guide) to Beneficial Bacteria

INTRODUCTION TO US

- About PlantHealthCare.com
Online Magazine
- Meet Your Editors
- Plant HealthCare.com
Online Magazine
Subscription Information


COLUMNS

- Calendar
- Tool Kit
- Plant Health and Biology
Links to the Web

TALK TO US

- Postings: Your Comments





The
Water
Shortage
Bomb:
Its Fuse is
Shorter
Than We
Think

By Bruce F. Slink, Editor

One thread holds the entire landscape industry together, it is water. Just like a rope is paramount to the safety of a mountain climber, water is the elusive element of nature that can make or break the \$15 billion dollar landscape industry.

Can the landscape industry and all the supporting industries risk their annual revenue on weather? Are we to follow the gambling nature of agriculture, where less than one fifth of all farmers know their crops will have water when they need it? Irrigated agriculture generates nearly 35 percent of food and fiber in the United States, essentially doubling the productivity of our arable acreage. Yet, gains in irrigated acreage are negligible on an annual basis.

We simply don't take water seriously enough! We haven't built sufficient storage capacity for droughts or growth. Our pipeline infrastructure is not large enough to supply water during the summer when irrigation can more than double demand. We dump our treated wastewater into rivers and streams rather than put it to use.

We select plants that aren't adapted to our climates and use turf in many locations for lack of a better idea. We don't adjust controllers often enough to keep

(continued)



Table of Contents



Water's Short Fuse CONTINUED

application rates close to plant water requirements. We overwater many areas because we don't distinguish among plants by their water needs, a process called hydrozoning.

We have the ability to cut landscape water use by a third or more. Yet, we often choose not to because we feel we don't have to. Water is cheap. Conserving it takes effort and expense. Rather than pricing water to generate the resources for storage and infrastructure, municipalities simply shut the water off when droughts overtax water systems. It's feast or famine. Communities invite growth to generate taxes without fully considering the limitations of their water supply. Everyone realizes it's just a matter of time before we run out of options and have to face the music. The fuse of our water shortage bomb is shorter than we think.

Storage and Infrastructure

Water shortages in desert cities are understandable. However, some of the most restrictive water bans occur in areas that receive 30 or more inches of rain per year. Massachusetts, North Carolina, and Delaware use water bans regularly to solve summer shortages. They target irrigation specifically because to municipal leaders it doesn't seem as important as subsistence and hygiene. Who would argue with that?

But, when any industry is forced to shut down temporarily, there is a significant social and economic impact. The landscape industry is an important source of employment and generator of tax revenue. Landscaping reduces energy needed for air conditioning and makes locales more desirable from both the standpoints of living and shopping. Further consideration might result in favor of resolving water insufficiencies with additional storage and better planned infrastructure.

While municipalities are rethinking their water supply systems, they ought to explore the way they discard treated effluent. The value of recycled water is too great to discard it over issues such as odor and unwarranted suspicion of health dangers. Even when cities are smart enough to capture and reuse recycled water, rarely is the cost of recycled water less than potable city water. The expense of a second set of pipes, which is necessary to deliver treated water, must be borne by someone. Why not stick

(continued)



[Table of Contents](#)



Water's Short Fuse CONTINUED

the facilities using recycled water with the full bill? Because they are lowering the demand on potable water. At least part of the cost of recycling water should be carried by potable water users.

Rethinking Landscape Design

In exchange for a reliable supply of water, the least the landscape industry can do is adjust its plant palette to use more native and water-efficient plant materials. This doesn't mean replacing turf with rocks. The benefits of turf are well known and play an important role in our American lifestyle. The correct approach is to use turf wisely to maximize its benefits. Wasteful practices of maintaining turf under tree canopies, running turf up to the edge of buildings, and covering every square inch of unplanted space with turf can be curbed.

Most landscapes barely use five species of plants, while hundreds are available and they are often better adapted. Native plants are best adapted to moisture conditions in their area. Why do we insist upon shipping plants across the country to locations where they are neither acclimated or practical? Most large nurseries that are connected to retail outlets offer a number of plants that shouldn't be grown in the store's area at all. And, these same stores often don't carry plants especially adapted to the particular area because the local nurseries can't meet the large volume requirements of chains.

We need to be better designers. Great landscapes have layers, textural contrast, seasonal highlights, and adapted plant species. Even the smallest landscape can have trees, shrubs, flowers, and ground cover, not to mention water features, lighting, and most importantly, irrigation. A landscape should have no less than a dozen species of plants. Plants should be selected to provide interest in every month of the growing season.

A greater number of species means we have a wider variety of plant water needs. Four-station irrigation controllers won't do the job. Hydrozoning, the practice of assigning plants of similar water requirement to the same irrigation zone, is essential to conservation. Hydrozoning doesn't mean that plants have to be bunched together. It

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Water's Short Fuse CONTINUED

does mean that a particular irrigation station can be used to open more than one valve or pipes leading from a single valve go to other locations.

Higher Uniformity, Tighter Control

Irrigation, as it is understood in the aisles of a typical large hardware store or garden center, consists of sprayheads, risers, valves and pipe. Drip irrigation has made impressive advances in the retail arena. But, we are stuck in a wasteful rut because we buy the controller last. It is the most important link in the irrigation system.

First divide your landscape plants into hydrozones. Then evaluate the most efficient methods of irrigation for each type of hydrozone. Once you have determined the best type of application device for each hydrozone, add up the number of separate zones you will need. Also note the runtime for all zones. Now you can look at controllers.

If you need eight stations, buy a 12-station controller. Check the runtimes available for each station. Ask about the number of repeat cycles per station per day. Don't be surprised to find out that an \$80 controller won't do the job.

The controller can save you hundreds, if not thousands of dollars in water and plant pest control. It should not be hard to rationalize spending a few hundred dollars for a controller with enough stations, adequate runtimes, expandability, repeat cycles, water budgeting and remote control. Ask about sensor inputs for moisture, flow, and rain devices. Now you can start picking out valves, sprinklers, backflow devices, pressure regulators, drip lines, emitters, swing joints and risers.

Drip emitters need long runtimes, up to an hour or more. Bubblers work much faster than drip emitters, but that is because they were originally designed to work on sprayhead zones. What's the hurry? Your soil might not be able to keep up with a bubbler. Rotary heads need to run longer than sprayheads to apply the same amount of water. Keep flow rates in mind at all times.

Think in phases. First, a newly planted tree might require two drip emitters. As it grows, it might need better coverage in the dripline of the tree. Microsprayers can be

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Water's Short Fuse CONTINUED

added to wet that area. The same is true for groundcovers as they spread and fill in. You might need to switch to a different type of emitter as the landscape matures.

Be aware that all drip emitters have flow rates and you need a certain amount of uniformity, just as you do with turf heads. Don't mix flow rates within a zone unless you have a specific need within the zone.

Turf heads have nozzles and flow rates that can differ. Where you have the opportunity, favor rotary heads with longer runtimes over sprayheads. Rotary heads can cover larger areas and consequently you have fewer pieces to maintain. Keep in mind that corners are different than full circles. Matched precipitation heads are designed to provide the same application rate regardless of the degree of coverage.

Install pressure regulators or pressure regulating valves and strive to keep pressure within the design specifications of the sprinkler you are using. Many valves have a flow control knob, which can be used to control flow, and consequently pressure, in a zone. These tools prevent fogging and misting from high pressure and protect application uniformity.

If you notice dry spots, try to figure out why they exist before you turn up the runtime to compensate. It could be a bad nozzle, poor rotation, or a soil problem. Fix the problem instead of wasting water throughout the rest of the zone.

You can cut your landscape irrigation water use by a third simply by designing a system correctly. Equally dramatic cuts result from adjusting runtimes at least twice a month during the growing season. Evapotranspiration rates vary considerably with temperature, daylength, and wind. Don't set your turf zones to apply an inch of water each and every week from April through November. You will probably waste two thirds of the water you apply during the growing season that way. The plants don't need it, so why do it?

Rain switches are required in some areas today. They stop irrigation once a certain amount of rain has fallen. Moisture sensors are very helpful, especially for larger drip zones. Shaded and sheltered areas may not need the same amount of additional

(continued)



[Table of Contents](#)



Water's Short Fuse CONTINUED

moisture as open turf areas when weather changes. Basically, a water budget feature on a controller reduces or increases the runtimes of all stations. Microclimates within the landscape might need to be considered when using a water budgeting feature.

Reward Water Savers

Finally, irrigation should be seen as part of the solution to water shortages, not the cause of them. The potential for misuse and abuse have branded the entire industry as wasteful. Those who make an effort to use irrigation to save water should be rewarded with at least a guarantee of water when water gets tight. Those who use recycled water should pay less. Those who design turf areas to sensible proportions should be recognized.

We can all do a better job of water conservation. Mother Nature has a short memory and a short fuse. Don't count on her to protect your livelihood during the next drought. The tools are there. Use them. You have every right to ask your local water supplier to work with you. And he has every reason to prepare for the next drought.

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Coming Out of the Biomanagement Closet

By Bruce F. Shank, Editor



We are hooked on synthetic chemicals. We have been since the fifties. If you doubt this, you have your head in the sand.

Synthetic chemicals made us great...a world leader...the most advanced nation on earth. With chemicals, we thought we could save the world. The height of our chemical conceit was that we actually thought we could win in Vietnam with Agent Orange, a nonselective herbicide sprayed over forests to deny the enemy a place to hide. Ironically, Rachel Carson's "Silent Spring" was published during this "police action." We were too busy shadow boxing a foe called communism to realize that we could be damaging the very planet that all of us live on with these synthetic chemicals.

Please don't jump to conclusions about my intentions with this commentary. I lived this period, the son of a doctor whose bills were paid largely by a chemical company, Monsanto. Together, my dad, Monsanto, and the U.S. Department of Defense helped create awareness about vitamins for Americans (both native and immigrant), Peruvians, Africans, Indians, Brazilians, and Icelanders. Every Christmas our mantle
(continued)



[Table of Contents](#)

“Chemists were engrossed in plotting our future using synthetic chemicals as the cure-all.”

Standing Up for Nature CONTINUED

had more baskets of fruit and cheese from chemical companies than from relatives.

While hiding on top of the steps during my parent’s parties, I heard conversations about mandating fluoride in drinking water, forcing bakers and dairies to include vitamins in their products, creating nutrient packages for astronauts, requiring vaccinations for school children, and sneaking soy protein into hamburgers to improve their nutritional value. These chemists were engrossed in plotting our future using chemicals as the cure-all.

Chemicals did get us this far and will get us farther. However, we are beginning to look in the mirror to see what we overlooked while we were changing the world.

In our chemical craze, we blew past kelp, yucca, various natural sources of vitamin B, and the fuzzy white stuff on the roots of healthy plants in natural environments. “Natural” was just too simple to be “real” chemistry. We totally ignored the origin of our first vaccines, which were derived from our own immune systems. As a polio survivor, I owe my life to physician chemists. Too often we forget the war against viruses was initially fought with natural solutions. There is nothing to be ashamed of about using nature as a partner in solving our problems.

But, it seems many golf course superintendents and landscape managers are cautious about mentioning the fact that they use “natural” or “biological” products. They seem to be in the natural closet in the chemical world. They find it hard to explain the value of natural products to greens committees and municipal boardmembers. They can’t claim rock-solid guarantees to back up the expense. Problem and solution, prove it or loose it! I’m not aware of a single drug, herbicide, or fungicide with a perfect record.

The fact is biologicals have never been easy to promote. We assume that products we synthesize in a laboratory are more controllable than ones nature has generated through natural selection. This selective characteristic of biological products makes them more specific, but there are millions of them. We have only begun to tap the possibilities of nonchemical pest control.

Synthetic chemicals tend to be less specific and faster acting. They fit our need for
(continued)



[Table of Contents](#)

“Some of us are still embarrassed to stand up for nature’s own creations.”

“There is absolutely no reason to hide our interest and support of natural solutions.”

Standing Up for Nature CONTINUED

broad-stroke solutions and impatience. Our attraction to chemicals started with Bordeaux Mix for control of fruit diseases. More than a century later, Bordeaux Mix is still talked about for control of orchard diseases. Last weekend, I sprayed my apple trees with a lime and sulfur mix. However, we were smart enough to curb the use of certain products, such as arsenic and DDT, despite the fact that they both made tremendous contributions to human health and productivity in their time. We are refining our chemicals to be more specific at lower concentrations. We have seen some endangered species bounce back. We are compromising and it is working.

Even as we are curbing and fine tuning chemical use, some of us are still embarrassed to stand up for nature’s own creations. Why do we discuss natural solutions with a confidential group of friends rather than with anyone who will listen? It’s not one way or the other. We should embrace every resource we can find. We have only scratched the surface of solutions that lie undiscovered in nature. It only makes sense that natural selection has done more research in millions of years than we have in the last 50.

My son worked for a gifted golf course superintendent who hid the fact from his greens committee that his crew was spraying a mixture of fish emulsion, kelp extract and molasses on ryegrass fairways to counteract a shallow and not well mixed layer of topsoil. He wasn’t the construction superintendent. He inherited the problem that bulldozers created and was trying to bring nature back into the equation. He couldn’t deliver the complete package because he was afraid of the reaction by his superiors. He tried to sneak the expense into his budget, so in retrospect, he didn’t have the money to restore biological health to the soils.

My dad is in his late eighties now. Like all of us, he wishes he’d done some things differently. He wishes he’d been more aggressive with the nutritional minimum daily allowances his committee put together for the U.S. government over a period of 20 years. He wishes that he had included herbs into the scheme of recommendations. He is proud that his team at Washington University in St. Louis brought exercise into the realm of cardiac health. He wishes he hadn’t been so critical of doctors of osteopathy. It is hard for him to come out of the closet, even at his age.

(continued)



[Table of Contents](#)

“Be able to say... “I did the best I could with what I understood at the time.”

Standing Up for Nature CONTINUED

Before we label people quacks for backing nature, let's stop and think about our earth and what makes it tick. Keep our minds open and observe the big picture. There is absolutely no reason to hide our interest and support of natural solutions. We don't have to abandon our use of synthetic chemicals to maintain a balance. We do, however, need to find ways to use the synthetics and the naturals together or in succession without one destroying the benefits of the other.

Don't let all those baskets of fruit and cheese cloud your awareness of the ultimate decider of success—nature. We are a new generation, able to mix the synthetic with the natural. You are educated, you are capable of reason, and people rely on you for answers to protect millions of dollars of investment every hour on the job. Listen carefully to your synthetic chemical salesperson, because you must understand what she is saying. But don't be shy about balancing her sales pitch with what you know works for your course. Don't let anyone narrow your possibilities or tell you that natural products aren't real and reliable. Everything on earth is made up of the same basic elements and no single technology has a corner on the market.

Be able to say when you retire... “I did the best I could with what I understood at the time.” But, like my dad, realize that you might look back one day and question why you minimized nature at the expense of the commercial. We all are influenced by what feeds our families. All I ask is that you include one more chair at the dinner table...for the chairperson of the board, Mother Nature. Your great grandchildren will thank you for it.

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[Table of Contents](#)

Laymen's Guide (and web guide) to Beneficial Bacteria

By Felicia L. Gillham, Managing Editor

Death and
decomposition
bring forth new life.

Tibetan monks revere all living creatures, believing them to be a potential reincarnation of a previously deceased soul. This belief presents some problems. The very act of digging in the soil could harm the organisms, or the reincarnated relative or friend, that reside there.

Tibetan beliefs are centuries old and reflect a wisdom of the ages. Unknown to early Tibetans was a collection of life forms—bacteria—that without which, we humans, could not exist. Bacteria are nature's recyclers, and through this critical role, they reflect a true cycle of life.

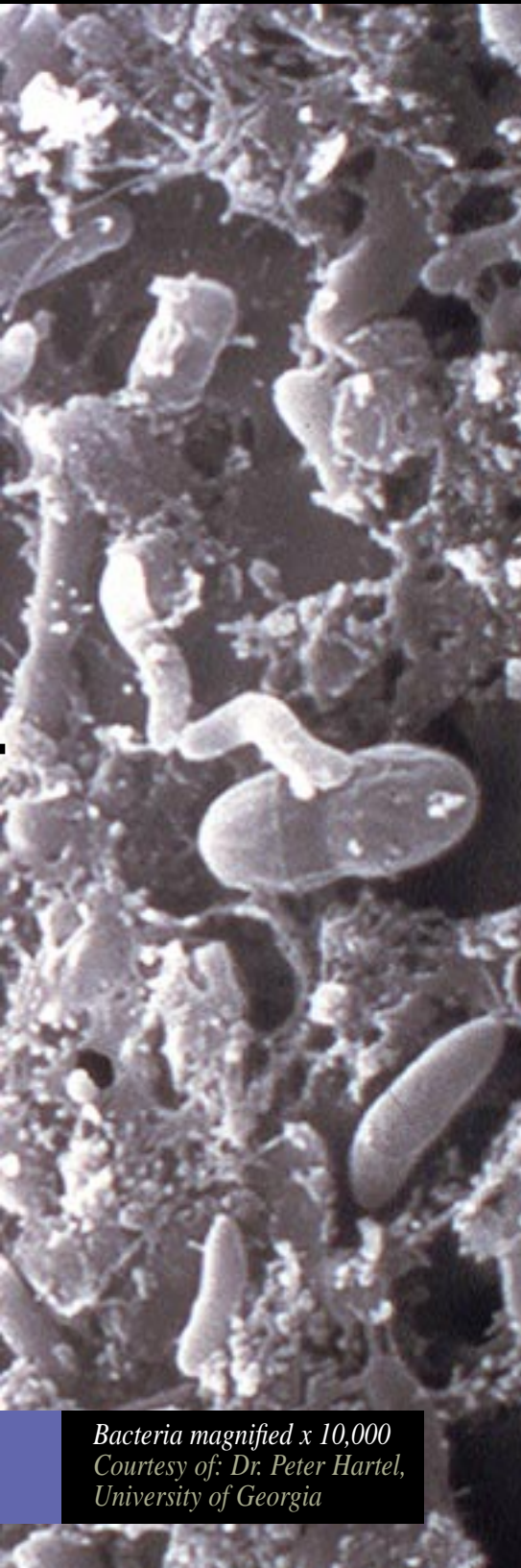
Bacteria are “and always have been—the dominant forms of life on Earth,” writes Harvard University Professor Stephan Jay Gould, in a November 13, 1996 article in [The Washington Post](#).

Even as the dominant life form on our planet, bacteria don't get much coverage in the press. When they do, it's usually negative and most often features the destruction wreaked by the most-hated bacterium of the moment—*E. coli* (*Escherichia coli*). Sadly, the negativism about bacteria belies the fact that for every 30,000 good bacteria that enhance our lives, there is only one that can hurt us. Even the dastardly *E. coli* can be

(continued)



Table of Contents



Bacteria magnified x 10,000
Courtesy of: Dr. Peter Hartel,
University of Georgia

Soil Bacteria—Nature’s Recyclers CONTINUED

benign to most of us. According to Gould, 50 percent of the content of the human colon is made up of bacteria, primarily by, yes, *E. coli*.

It is also a fact that as the managers of plant health, we owe our livelihoods to bacteria. The role they play in decomposition, in conversion and provision of nutrients to plants, and in soil health is critical. But like everyone else, the attention and management practices we associate with bacteria are mostly centered around the bad bacteria—those that can cause plant and animal diseases. Perhaps we should adopt a more Tibetan frame of mind: Honor bacteria for the good they do, and learn what we can to nurture them for the betterment of plant and soil health. This can be a wise decision.

Today we have commercial products, generated from bacteria, that allow us to improve soil productivity and combat pests. But in the future, we can expect the study of bacteria to create wholly new products that may change the way we manage plants entirely.

Meet the Bacterium

If you haven’t invested much time studying bacteria, you can be redeemed in the knowledge that until recently, scientists believe they miss-classified bacteria all together. We were all taught that there were two kingdoms: Plants and Animals. Today, through the insights of DNA sequencing, scientists now believe there are three domains in the branch of life: Archaea (organisms that live in extreme environments), Eukaryea (plants, animals and fungi) and Bacteria. This finding, a reassignment of life as we know it, and the elevation of the bacterium to its own domain, was the outcome of the Botanical Congress held in St. Louis in August, 1999. (Click here for more on [Archaea and Eukaryea](#).)

Bacteria are either ball-shaped (coccus), rod-shaped (bacillus) or corkscrew-shaped (spirillum), but they are all one-celled organisms that synthesize proteins differently than multi-cellular organisms (plants, animals and fungi) making them dependent on external supplies of carbon energy. They are the simplest and smallest forms of life—

(continued)



Table of Contents



Bacteria are the dominate life forms on our planet.

Soil Bacteria—Nature’s Recyclers CONTINUED

the larger bacteria seldom exceed 0.0002 inches in length, and the smallest can be half that size.

They are primitive and they are old. Earth is approximately 4.5 billion years in age. Although estimates vary, early fossil records indicate that bacteria-like organisms have populated the planet for 3.5 to 3.8 billion years.

There are also an awful lot of bacteria on this planet. Accomplishing the unthinkable, William Whitman and his co-researchers at the University of Georgia conducted the first-ever bacterial census. Whitman estimates that 5 million trillion trillion bacteria live on Earth. They have been found living 40 miles high in the atmosphere, existing miles deep in the Earth, and thriving in the scorching conditions of deep-sea vents where temperatures can rise as high as 650 degrees F. The majority, or 94 percent of bacteria, Whitman found, live in the top 1,300 feet of the Earth’s surface. For a summary of Whitman’s findings and other interesting facts about bacteria, check out *Discover* magazine’s web site at www.discover.com and do a search for “bacteria.”

In a gram of soil alone, Scandinavian researchers have identified approximately 4,000 different species of bacteria. It’s impossible to guess how many species have yet to be identified. We might not have enough years, hands or brain power on this planet to ever accomplish the task.

Soil Fertility Specialists

Soil bacteria are not dummies. (For more on the minds of microbes, see “[MICROMINDS](#),” an article by Paul Pietsch based on a story in the October, 1983 issue of *Science Digest*.) Although they lack heads, soil bacteria are smart enough to locate themselves in or adjacent to their food sources—carbon in organic matter and nutrients from plants. As plants grow, their roots release a variety of organic compounds into the soil in the form of chemical exudates, sloughed cells and nutrients that are fed upon by bacteria. In the top 12 inches of soil, specifically the rhizosphere—the area of soil that is in contact with non-woody plant roots, is an area

(continued)



Table of Contents



Approximately 30 years are needed to decompose a pine needle.

Soil Bacteria—Nature’s Recyclers CONTINUED

of intense interactions between bacteria and plants. Bacteria are typically found in much higher numbers in the rhizosphere of non-woody roots than in soil not influenced by the presence of growing roots.

One of the most important roles soil bacteria play is decomposition, the primary process that recycles nutrients back into the soil. Consider the pine needle. As seven to 10 years pass, a fallen needle degrades by 70 percent. After about 30 years, 98 percent of the needle decomposes. This recycling of the pine needle back into the carbon and nutrients that helped form it is due to bacteria and the other organisms found in the soil. Decomposition, which actually begins on the tree with the sloughing off of the pine needle, can involve more than 300 to 500 individual species. (These fine pine needle facts are in a series of [lectures](#) from the University of Wales—Bangor, School of Agricultural & Forest Studies.) The remaining 2 percent of the pine needle is likely to contain complex phenolic material, which can last up to 10,000 years until it is finally degraded. This timetable shows that decomposition follows a common-sense route. Degradable compounds are broken down in the following order:

First: Simple carbohydrates, fats

Second: Cellulose, hemicellulose and protein

Third and last: Phenolics, waxes and lignin

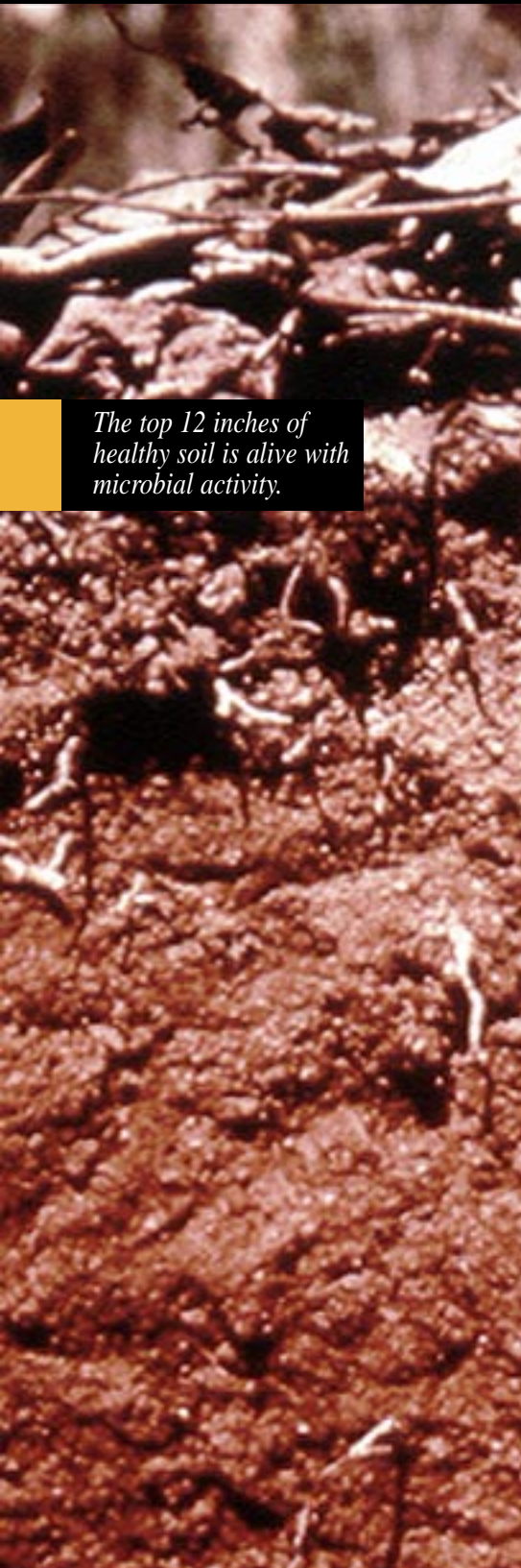
Temperature, moisture and number of organisms in the soil, all enter into the timing factor for decomposition. For example, decomposition is a much speedier process in the moist and warm tropics than it is in the hot and dry Mojave Desert.

From decomposition, the soil ecosystem gains two major benefits: Nutrients that are released and readily available for absorption and use by plants; and humus, or humic acids, that improve the cation exchange capacity of soil, water retention, soil texture and other factors.

(continued)



[Table of Contents](#)



The top 12 inches of healthy soil is alive with microbial activity.

Soil Bacteria—Nature's Recyclers CONTINUED

Nitrogen Cycling

Nitrogen, of course, is vital to plant growth. If we remember our basics, we know that the largest amount of nitrogen is found in the atmosphere primarily as N_2 gas.

According to the web site lecture "[The Nitrogen Cycle](#)" by Michael Pidwirny, Ph.D., Department of Geography, Okanagan University College in British Columbia, Canada, the total nitrogen found in the atmosphere is more than one million times larger than all the nitrogen contained in living organisms. Other large supplies of nitrogen are found in soil organic matter and the oceans.

Plants, although they might be surrounded above and below ground by nitrogen, can only take up and use nitrogen in the form of ammonium and nitrate. Decomposer bacteria chemically modify nitrogen from organic matter into ammonia and ammonium salts. Specific autotrophic bacteria (*Nitrosomonas* and *Nitrobacter* species) convert ammonium (NH_4^+) to nitrate (NO_3^-) by combining it with oxygen from the air. Nitrates are highly soluble and easily accessed by the largest number of plants.

Almost all nitrogen found in soil ecosystems originally came from the atmosphere. The majority of that nitrogen is biochemically fixed by bacteria and other soil microorganisms. It is estimated that nitrogen fixation adds approximately 140 million metric tons of nitrogen to the Earth's ecosystem every year.

Nitrosomonas, *Nitrobacter* and other bacterial species are free-living bacteria that fix atmospheric nitrogen, adding it to the soil nitrogen pool. Other nitrogen-fixing bacteria form associations with leguminous plants, such as clover, peas and alfalfa. The most famous and studied of these bacteria are the nitrogen-fixing root nodule bacteria *Bradyrhizobium*, which grow inside root nodules on the root system of legume plants. Present inside the nodule, the bacteria provide plants with organic nitrogen that promotes plant growth.

Other nitrogen-involved bacteria provide the ecosystem with a check and balance, but can be a problem in certain soils. Denitrifier bacteria convert nitrates back into

(continued)



[Table of Contents](#)



Leaves fall, and carbon, nitrogen, oxygen, phosphorus and sulfur are recycled.

Soil Bacteria—Nature’s Recyclers CONTINUED

elemental nitrogen which volatilizes into the atmosphere in a process called denitrification. Typically, a good quality organic matter provides soil with a 12:1 carbon to nitrogen ratio. If the carbon to nitrogen ratio is higher than 50:1, denitrifier bacteria will out-compete plant roots for nitrogen absorption. Denitrification can be a concern in poorly drained soils where oxygen levels are low.

Soil Texturizer

The role that bacteria play in soil texture is not often thought about. Elaine Ingham, Ph.D., owner of Soil Foodweb Incorporated, covers the role of bacteria in [“Matching Compost to the Plant to Be Grown.”](#) According to Ingham, bacteria produce “slime layers” around their bodies, which allow them to glue themselves to surfaces and not be washed out of the soil. The sticky substance helps bind soil particles into small aggregates, thereby improving water infiltration, water-holding capacity, soil stability and aeration. Soil that is well aggregated is important for bacteria. Without it, Ingham writes, the soil doesn’t offer hiding places for the bacteria to escape their predators.

Pathogenics and Natural Pest Control

It’s a fact of life that where you have good guys, you often also have the bad guys. Pathogenic bacteria can be the bullies on the block by infecting plants and causing diseases, such as fire-blight and crown gall. In a balanced soil ecosystem, however, the good bacteria compete, antagonize or control pathogenic bacteria through predation to keep their numbers in balance. Some soil bacteria even produce antibiotics that help keep the bad guys in check.

Bacteria also play a role in the control of insects and other pests. The naturally occurring soil bacterium, *Bacillus thuringiensis* (Bt), produces a protein that when ingested kills caterpillar pests. Formulated for sale commercially, Bt bioinsecticides have been used successfully for more than 30 years. The reason lies, in part, in the specificity of the bacterial-based biocontrol products. A toxic protein in Bt bacterium is specifically lethal to Lepidoptera (worms), such as loopers, leafrollers and Diamondback moth larvae. That same protein, however, cannot harm other pests,

(continued)



Table of Contents



Beneficial bacteria added to bedding plants enhance flowering and plant health.

Soil Bacteria—Nature's Recyclers CONTINUED

humans or animals. This makes bacterial-based pest control low in risk, and because it has no impact on the environment, they are good stewardship products, as well.

Promoting Bacteria In Soil

The down-and-dirty fact about dirt is that bacteria are vital. To nurture them, we need to perform consistent, common sense soil and plant management practices. In general, what is good for plants is good for bacteria.

Urban soils, however, often lack viable, sustainable populations of bacteria due to low amounts of degradable organic matter. Today, commercial products that contain bacteria and their food can be used as supplements to upgrade the soil's productivity. Commercial products can include:

Plant-growth-promoting rhizobacteria: These bacteria produce a variety of chemicals that stimulate plant growth. The bacteria grow and persist in the rhizosphere of non-woody roots.

Non-symbiotic nitrogen-fixing bacteria: Discussed previously, these bacteria are also available commercially. These very specialized bacteria fix atmospheric nitrogen and increase plant growth through increased nitrogen nutrition.


Phosphate-solubilizing bacteria: Certain soil and rhizosphere bacteria that produce phosphatase enzymes that, in turn, solubilize phosphorus from insoluble mineral sources.

To promote good growing conditions for beneficial bacteria use proper watering techniques and organic matter. Bacteria need water to either swim to their food (the organic matter) or to have their food move to them through a process called diffusion. A complete lack of water can either kill bacteria outright or put them into a dormant stage, from which plants reap no benefit. Too much water is also a problem, because it displaces oxygen in the soil. Ninety-five percent of *Bacillus* bacteria die after two weeks without oxygen—they asphyxiate. Key bacterial processes slow down in high water situations.

(continued)



[Table of Contents](#)



Bt bacteria provide environmentally friendly control of pests.

Soil Bacteria—Nature's Recyclers CONTINUED

Avoid compaction, construction debris and other factors that can clog and close soil pores. Aeration provides bacteria with more oxygen and distributes organic matter more evenly throughout the soil profile.

Read pesticide labels carefully and research the impact the products can have on bacteria and other helpful microorganisms. Fumigants, such as methyl bromide, kill beneficial bacteria along with harmful disease-causing organisms.

Nutrient-poor soil is as limiting to bacteria as it is to plants. Supplement soils with organic matter whenever possible.

And remember that a healthy soil is, indeed, a living and diverse soil. Soil bacteria share their world with other beneficial microorganisms: [Mycorrhizal fungi](#), [protozoa](#), [earthworms](#) and many more. Each has a role in plant health and each organism should have a place in the landscapes you manage.

- [Learn more about the author Felicia Gillham](#)
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[Table of Contents](#)

The Audubon Signature Program's Impact on the Daily-Fee Course



The United States has a unique and distinguished group of citizens who represent the goodness of our democracy. We are largely a nation of immigrants. Among them was the Haitian-born, illegitimate son of a French sea captain who reminded us at the beginning of the Industrial Revolution that nature is fragile through his precise depictions of bird life. Perhaps John James Audubon's father had ingrained in him that the presence of birds meant landfall was near, that weeks of travel from Europe by sail and steam were successful.

Environmentalism has strong roots in North America, roots that have partially balanced the myopic interests of commerce. This has enabled our economy to be admired by the world without devastating our natural resources. American presidents, including Abraham Lincoln and Theodore Roosevelt, recognized that we, as a nation, have no strength without a respect for our landscape. In turn, they started saving millions of acres of land for future generations.

So, it is no wonder that the Audubon name still has clout today. When developers and builders contemplate building a new golf course, they often

(continued)



[Table of Contents](#)



Audubon Program Yields Positives CONTINUED

face considerable public scrutiny over changes in wildlife, water and air. Ironically, the habitat-creating industry of golf faces many of the same hurdles as the smokestack industries. One way to help voters and legislators distinguish between “pure commerce,” where take is greater than give, is to invoke the name of John James Audubon and to highlight the natural positives of acres of well-kept wildlife habitat.

To associate a project with a famous figure is one thing. To prove it is another. That is why the venerable Audubon Society was founded in 1905 to protect the mass destruction of egrets and herons for their feathers. One chapter of the Society in New York took Audubon’s name up another notch when it started its Cooperative Sanctuary Program in 1991. Since then, Audubon International has been the watchdog of the famous ornithologist’s name when applied to golf courses, schools, residential developments and industrial parks.

Golf Showcases Habitat Restoration

Audubon sees its Cooperative Sanctuary Program as a tool to educate Americans about the importance of protecting wildlife habitat and the natural balance of our environment. Golf courses are one of the most visible and largest examples of this type of stewardship. That is why Audubon International developed two programs for golf courses, the Cooperative Sanctuary Program for existing courses and the Signature Program for courses in the planning stage.

All types of golf courses participate. There is an erroneous belief that the Audubon Program is geared only to big-ticket private courses. This is far from the truth. Because the goal of the program is largely educational, the Organization endeavors to reach municipal, daily-fee and resort courses too.

Daily-fee and resort courses, being the profit-driven members of the golf family, have special attributes that make them a natural for Audubon certification. Costs must be justified. And, as we have learned in other parts of the landscape industry, doing something good can generate business.

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Audubon Program Yields Positives CONTINUED

“Following the guidelines of the program can actually save a course money,” explains Joellyn Zeh, Audubon staff ecologist. “By taking areas out of play for habitat, you reduce maintenance costs. And, contrary to general opinion, you can discourage geese by providing buffer areas and tall aquatic plants around lakes. Geese evolved on the tundra and prefer to have an open line of sight around them at all times. We have seen significant improvement with trained border collies. The key word is trained.”

Habitat planning can be selective to certain types of wildlife. Nest boxes for purple martins, bluebirds, and bats encourage species that eat massive amounts of annoying insects. Screech owls, falcons and osprey, which help control rodents, snakes and fish, can be attracted by changes and additions in habitat. “We are proud to have been a part of a salmon restoration project in the Pacific Northwest and the reintroduction of gopher tortoises in the South,” Zeh adds. “We have witnessed increases in herons, bluebirds, and egrets. Superintendents select the types of wildlife they want to encourage. Part of our job is to help courses promote these success stories.”

Recognition as an Audubon certified course can come as quickly as ten months, but usually takes one to three years, Zeh says. For as little as \$100 per year, a superintendent can start the basic Sanctuary process. Audubon supplies the materials to create a habitat development plan. Certification can be achieved with photos and progress reports. No inspection by an Audubon representative is required for the Sanctuary program. See the Organization’s web site www.audubonintl.org for more information.

The Signature Program

The Signature Program is more demanding in both time and money. Only 15 out of 66 courses have achieved Signature certification so far, reports Nancy Richardson, program director located in offices in Audubon’s hometown, Henderson, KY. At least two visits by Audubon staff are involved in the Signature certification process. The annual fee is \$500, on top of a one-time fee of \$9,000. Signature courses are audited by staff every two years to gauge progress.

(continued)



Table of Contents



Audubon Program Yields Positives CONTINUED

The Signature Program is serious business. Its requirements are taken seriously by developers and construction superintendents. Because it is for courses in the planning stage, it takes years to get certified. “If an existing course adds another nine, it can’t claim Signature status without meeting the requirements for the entire course,” Richardson says.

Because many courses are built before the superintendent is hired, Audubon can assist developers in writing a natural resource development plan on a fee basis. Follow-up implementation reports are carefully reviewed for compliance. “We have found when visiting Signature certified courses after they have been built that they usually exceed the resource management plan,” Richardson remarks. “We take that to mean that the benefits of the program are being realized and are valued.”

There are three levels of the Signature Certification, determined partly by the amount of involvement in the project by Audubon staff. The basic program is the two-visit version with completion and implementation of a Natural Resource Development Plan (NRDP). The NRDP must address nine areas. They include site characterization, environmental planning, integrated pest management, water conservation, water quality management, waste management and energy conservation, wildlife conservation and habitat enhancement, development of a natural resource management center, and finally, efforts in the area of educational outreach.

In the Silver program, Audubon staff works with the development team, conducts five site visits, and prepares the NRDP. Annual audits are part of the Silver level.

The Gold level partners Audubon International with the developer. Five plans are involved in the Gold level with increased assistance in the area of public outreach and sustaining the plans. Annual audits complete the package.

Superintendents should understand that some of the Signature requirements are tough. For example, they state that drainage water from a managed area must be filtered before entering any body of water on the course. The program requires a reasonable minimum amount of turf and that must be appropriate to the region. Finally, there are

(continued)



[Table of Contents](#)



Audubon Program Yields Positives CONTINUED

strict guidelines (yet fairly consistent with OSHA) for the maintenance building area and storage of fuel and pesticides. All rinse water must be recycled.

Meeting the Audubon Signature Program requirements is largely an endorsement by an outside, respected source that environmental issues have been addressed. It can have influence in both local public approval of a course, and conceivably, liability insurance costs. In cases where water is limited, course drainage must avoid sensitive lakes and rivers, and wildlife is closely guarded. The Audubon Sanctuary program makes great sense from a public relations and cost standpoint.

Not Just for Golf

Audubon International also has specific programs for schools, commercial sites and multi-family residential sites. The Sanctuary Program's impact on a golf course might be greater in areas where Audubon programs are already in place and popular. While preserving habitat is important, public education is the ultimate goal. Superintendents who have teaching skills and make local contacts can do wonders for their golf courses and their own job security.

When water shortages do hit, golf courses rich in wildlife habitat will receive higher priority. Because a course has exhibited a commitment to conserve water, protect water quality, and shelter wildlife pressured by suburban growth, it can reasonably expect to enjoy the acceptance and protection of the local community. To a business, such as a daily-fee golf course, that can mean the difference between success and failure.

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Audubon Program Yields Positives CONTINUED

For more information on Audubon International's Cooperative Sanctuary Program, call the Selkirk, NY office at (518) 767-9051 or visit www.audubonintl.org. For Signature Program questions, direct them to the Henderson, KY office at (270) 869-9419. You can get started for the cost of a utility vehicle.

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Meet Your Editors

Editors

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Bruce Shank is owner of BioCOM, a horticultural communications company based in Palmdale, CA. He is the editor of *Irrigation Business & Technology*, managing editor of *TurfGrass Trends*, and former editor of *Landscape & Irrigation*, *Landscape Management* and *sportsTURF* magazines. He was graduated by the University of Missouri—Columbia with a degree in agricultural journalism in 1973. He is a past president of the American Society of Business Press Editors and a member of the Turf & Ornamental Communicators Association.

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TOOLKIT

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A fast, powerful search utility.



Calendar of
Industry Events

Calendar

March

6-9

New England Turfgrass Conference, Newport, RI. (401) 848-0004.

9

New York State Turfgrass Association Western Regional Conference. Buffalo.
(800) 873-8873.

24-25

Plant Biology Workshop, Plant Health Care, Inc. Education Center, Frogmore, SC.

■ [Click here for more information.](#)

April

5

New York State Turfgrass Association Adirondack Regional Conference, Lake Placid.
(800) 873-8873.

26

Massachusetts Arborists Association Arbor Day Celebration, Worcester.
(508) 653-3320.

June

21

University of Massachusetts Turf Research Field Day, South Deerfield.
(413) 545-3066.

(continued)



Calendar of
Industry Events

CONTINUED

July

11-16

American Nursery and Landscape Association Annual Convention, British Columbia, Canada. (202) 789-2900.

13-16

American Landscape Contractors Association Summer Leadership Meeting, San Diego, CA. (800) 395-2522.

22-24

International Lawn, Garden and Power Equipment Expo, Louisville, KY. (800) 558-8767.

26

Massachusetts Nursery and Landscape Association Summer Meeting, Boyleston. (413) 369-4731.

31

Kansas and Missouri Joint Landscape and Nursery Summer Meeting and Trade Show, Kansas City, MO. (816) 233-1481.

August

4-6

Southern Nurseryman's Association Conference and Trade Show, Atlanta, GA. (770) 953-3311.

15

Cornell University Field Day, Ithaca, NY. (607) 255-1792.

18-21

Texas Association of Nurserymen Nursery and Landscape Exposition, Houston. (512) 280-5182.

24-27

Ornamentals Northwest Seminar and Farwest Show, Portland, OR. (800) 342-6401.

(continued)



Table of Contents

Calendar of
Industry Events

CONTINUED

September

15-16

Tennessee Nursery & Landscape Association Trade Show, Nashville, TN.
(615) 889-1000.

21-23

Florida Nursery and Allied Trade Show, Orlando. (407) 295-2994.

October

13-14

Plant Biology Workshop, Plant Health Care, Inc. Education Center, Frogmore, SC.

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November

3-4

Plant Biology Workshop, Plant Health Care, Inc. Education Center, Frogmore, SC.

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Calendar



Table of Contents

