A diminishing water supply is forcing the green industry to take a hard look at conservation and alternative sources of water for irrigation.

by Jeff Sobul, assistant editor

Water. It is a resource we have long taken for granted. But like the Great Plains buffalo in the 19th century, it is one we can also drive to near-extinction.

Though 70 percent of this planet's surface is covered by water, only one percent of that water is fresh and usable.

Groundwater, our hidden resource, is a major contributor to our water supply. But humans syphon an average of 82 billion gallons of water each day from groundwater, only 61 billion of which is replaced through rainfall and runoff.

We put increasing demands on water resources as the United States modernized this century, and demands will continue to increase into the next.

STOPPING GLUTTONY

The most obvious way to avoid waste is through water management. Millions of gallons can be saved by adjusting irrigation practices to maximize water efficiency without changing the landscape.

To begin with, stop watering sidewalks, driveways and parking lots by adjusting sprinkler heads. A landscape manager must know the water needs of the turf or plant material. Overwatering is common.

"By far," says Suzanne Butterfield of the California Department of Water Resources, "landscape plants suffer more from overwatering than from underwatering."

Knowing evapotranspiration (ET) rates (the amount of moisture which is returned to the atmosphere via evaporation from the soil and transpiration through plant leaves) will give the precise amount of irrigation needed, expressed in inches.

The Water Conservation Office of the Denver Water Department, upon request, provides a simple device for converting inches of irrigation into time. Denver's Water Office also announces the ET rate daily. Check local papers or water department offices for ET rates in specific areas.

Increase water efficiency further by adjusting the time when irrigation is done. If it's sunny, 85 degrees with a breeze and the sprinkler system is on, as much water is probably evaporating as is reaching the roots of the turf. Irrigate when the chance of evaporation is at its lowest. "Water between midnight and 10 a.m.," instructs Mike Agnew, Ph.D., of Iowa State University.

"Because of past drought, we only run our water system between 4 p.m. and 10 a.m., with most starts between 10 p.m. and 12 a.m.," says Gary Tollison, highway landscape supervisor for District 7 in California. With less chance for evaporation at this time, more water reaches the plant root zone where it does the most good.

Agnew also recommends deep and infrequent watering. In heavier soil, though, he says "a gradual soaking in short periods is more effective."

Water management also includes finding and developing new sources of water for irrigation. Most of the country's aquifers and surface water supplies are already known. Therefore, developing new sources of water is becoming necessary.

The most promising new source is really an old one: effluent or reclaimed water. The water is recycled, filtered so it can be re-used. Applications so far are limited mostly to golf courses, though this will soon expand. Effluent use is only in its infancy, but a rapid maturation is in the offing.

Researchers say that certain cultural practices will help turf conserve water naturally. The key, says Virginia Tech's John Hall III, Ph.D., is to "maximize root development."

The deeper root system provides more water-drawing potential for the plant. Hall emphasizes using late fall fertilization. At this time, the plant's energies are focused more on root development than shoot development so the nitrogen will work more on that end of the plant. Higher potassium rates are also beneficial, he notes.

Mowing heights can also be adjusted for optimum root development and water efficiency. A higher mowing height helps root development, though height restrictions can come into play on golf courses. There is, of course, a trade-off. The longer leaf blades use more water. Hall says that to keep the use rate constant increase mowing frequency, for home lawns perhaps from once to twice a week.

Thatch is another area of concern. "Thatch is an inefficient water holder," Hall says. Spring aeration and coring prior to periods of limited rainfall, Hall notes, will maximize infiltration.

A SPLASH IN THE FACE

Effective water management will invariably have to go beyond simple adjustment of cultural and irrigation practices. One key will be public education, notes Gene Williamson, superintendent of parks for the North Jeffco Metropolitan Recreation and Park District Parks Department, Arvada, Colo.

Williamson's department has been meeting with citizens and homeowner associations to convince them that low-water landscapes such as xeriscapes (see story page 29) are beneficial. But, Williamson says, "they want nothing but bluegrass in the parks. And that's costing us money. We tell them the grass might not look quite as good, but it's just as healthy."

Waking up a doubting public to the present and future water situation in Denver's semi-arid climate has been difficult at best for the parks people. Williamson notes that when a park planning meeting with a homeowner group occurs, "we ask them what they want, we tell them what they need, and then we compromise."

For now, his district has reduced watering where it can, implemented isolated xeriscapes—low turf, water efficient landscapes—and experimented with more drought-resistant turfgrasses.

Extensive research is being con-
ducted to determine and breed more drought-tolerant and drought-avoidant turfgrass varieties.

"Drought avoidance is actually more important than drought tolerance," says Robert Shearman, Ph.D., of the University of Nebraska. "The plant just doesn't wilt. It avoids wilt symptoms."

Turfgrasses of this variety "maintain adequate water potential with low use rate or get water from the soil better," Shearman says. He adds that Adventure and Mustang tall fescues are the best examples of turf that combine both drought tolerance and wilt avoidance.

Plant breeder Terry Riordan, Ph.D., works with Shearman. He is trying to breed the most water-frugal and hearty plants. One grass variety Riordan is working with is buffalograss, a warm season variety native to the Great Plains. "This (buffalograss) is the area we're most optimistic about now," he notes. "It already has a lot of good characteristics."

Riordan’s research project to find low water-use grasses is in the third year of a seven-year project funded by the USGA and GCSAA. Through his work, he has made some major improvements in the buffalo species. The biggest improvement has been in germination time. "A buffalograss burr (which holds the seed) normally requires a year to germinate. We've got that down to three days," he says.

Perhaps the biggest strike against buffalograss in cool-season climates is its dormancy. "Most people don't want the dormant tan color for five to six months of the year," notes Dorothy Borland of The Turf Expert, Denver.

But Riordan sees buffalograss being used in golf course roughs, industrial sites, roadsides and even home lawns. He notes that a couple of lower budget golf courses in Nebraska are actually using buffalograss on fairways.

Another problem with buffalograss is that it is "not very competitive with cool-season grasses" like blue or rye, Riordan explains. However, he says, "applications of simazine at normal rates keep cool-season grasses at bay so buffalograss can propagate."

Riordan believes buffalograss will be able to adapt to the heavier soils of the Southwest, though Florida soils could be a problem because they are rather sandy. In all, he concludes, "I think we've made significant progress."

Further benefit can be gained by implementing native shrubs and trees into the landscape instead of import-
ing less adaptive breeds. Natives tend to require less water after establishment and grow well in local soils. "Natives are emphasized in xeriscaping," notes Cyrus McKell, Ph.D., of Native Plants, Inc., a plant biotechnology firm. He recommends also selecting plants with greater stress tolerance.

According to Landscape Management research, nearly 52 percent of the magazine's readers are engaged in some form of irrigation. In 1986, readers spent over $101 million on irrigation equipment, $59 million on sprinklers alone.

Expenditures on electronic irrigation controls increased more than $5 million from 1984 figures, to $20.8 million.

"Irrigation will become more computerized and automatic," comments Steve Bock, an assistant golf course superintendent in Papillion, Neb.

"One advancement would probably be a control box that could be placed in the office," adds Gregg Wilson, co-owner of Southern Turf, a landscaping/lawn maintenance firm in Goldsboro, N.C. "With it, all systems could be programmed or controlled. This would disincent any hustling to a site in case of rain during the time set for irrigating."

**CHANGING TIMES**

"The computer is really the thing that's going to change the irrigation industry," says Vince Nolletti of Buckner, Inc. Adds Tom Fermanian, Ph.D. of the University of Illinois, "Over the next 20 years they will be widely accepted in the industry."

Much of the technology needed for efficient systems exists already, and some of it is not new at all. Computers already run irrigation systems.

Computers can make use of the latest technology that reads the environment. Golf courses can now have weather stations installed as part of irrigation systems. Weather stations monitor atmospheric and ground moisture conditions to determine the evapotranspiration (ET) rate and adjust irrigation rates and timing accordingly (see sidebar below).

Included in weather stations are tensiometers, instruments measuring soil moisture content. Palm Springs, Calif., recently experimented with tensiometers. According to Ronald L. Baetz of the Desert Water Agency, the city took a 6½-acre park served from two irrigation meters, divided it in half and installed tensiometers in one half. For the two-year life of the project, water use was cut by 54 percent on the fitted half, translating into a savings of $11,000, just for that one small area. Not surprisingly, "the city is following a program to retrofit most of its landscaping with tensiometers," Baetz says.

Edward Hunter of Hunter Industries sees low-cost plastic rotors replacing the fixed heads used today. To use tensiometers effectively, sprinklers must "apply evenly and at an acceptable rate. Most apply too fast for absorption." Hunter says, about 1½ to 2 inches per hour.

These new heads are likely to operate.
ate under lower pressure. Low-pressure irrigation is a new concept for which technology and equipment have only recently been developed and implemented (see story page 20).

Low-pressure systems work at lower P.S.I. than present systems, delivering a more accurate amount of water at lower pump energy, saving money on both water and energy. Pumps will be designed more efficiently, as will other equipment used in irrigation systems, such as piping.

According to Rain Bird’s Ed Shoemaker, pump technology has advanced significantly over the last 10 years. Improvements have been made in controls, pressure regulating valves and surge tanks.

A key to the future, he says, will be to match irrigation systems to pumping plants for the most efficient system.

Pumping systems are designed now as a series of smaller pumps installed with demand sensors which control pump flow. If someone is just using a hose to water flowers around the clubhouse, only the first, smallest pump will be activated to provide water to save energy and wear and tear.

Computerization of the pumps and low-pressure systems will make them even more accurate.

Advanced technology for irrigation efficiency will be simplified further through portable infrared thermometry instruments. “Infrared thermometry reads the canopy temperature to schedule irrigation times,” says Bob Carrow, Ph.D., University of Georgia.

“The canopy temperature rises when moisture stress begins and before wilt shows,” Carrow says. The technology is designed to prevent both over- and under-watering. Irrigation efficiency will be simplified further.

A hand-held monitor that measures plant stress much like a weather station is being marketed by Standard Oil. The ST-27 Turf Monitor, a “gun” attached to a computer worn at the waist on a shoulder strap, monitors the physiological state of the turf. After measuring the plant’s leaf temperature, ambient temperature, relative humidity and solar radiation load, the data is processed by the computer. The resulting “stress index” gives the turf manager information needed to analyze irrigation effectiveness and project irrigation requirements.

“Its ultimate purpose is to serve as an additional set of ‘eyes’ for the superintendent,” notes Steve DeSutter of Standard Oil.

New water-saving technology is not just limited to hardware. Indeed, most turfseed marketers are currently studying varieties with better drought-tolerance characteristics. It is generally known that Bermudagrass, zoysiagrass, tall fescue and creeping bentgrass have excellent to good heat hardiness. As improved varieties are released over the next few years, water use promises to decrease—as it must.

—Jerry Roche
gation models have been developed for a number of turfgrass species.

Three companies market infrared thermometry instruments: Everest Instruments, AgriTemp and Standard Oil. Carrow says only Standard Oil has combined the thermometry with a computer.

According to Standard Oil's Bronson Gardner, the six-pound unit combines a thermometer gun with a 64K computer worn by a strap over the shoulder.

"Based on field research, we've developed a model which measures what the canopy temperature is and should be," Gardner says. "There doesn't seem to be a difference from warm- to cool-season grasses in evaporation rate and canopy temperature."

In some respects, says Gardner, the instrument works like a portable weather station. Called the ST-27 because it can store information for up to 27 holes on a golf course, it monitors air temperature, humidity, sunlight intensity and canopy temperature for fairway, green, tee, rough and another spot of choice on each hole.

Steve DeSutter, sensor technologies manager for Standard Oil's Engineering Materials Company, says that, since the ST-27 is portable, it is more area specific than a weather station, giving more accurate readings for more areas on the course.

The computer makes readings four times a second and can recall a three-day history for each spot and print the history in graph form when downloaded onto a printer. From this data, a landscape manager could work out an irrigation schedule. The ST-27 was expected to be in distribution at the end of June.

"The sky's the limit" for technological advancements, notes Neil J. Bustamante, a superintendent at a Hawaiian resort golf course. But, he cautions, "it should be remembered that those assigned the responsibilities of operation of these systems have their 'limitations.'" LM

A dry idea, sort of

It is water conservation brought to an art form. And it draws from every aspect of water conservation. The only thing new about the concept is its name: "xeriscaping," a term that originated in the Denver area less than 10 years ago.

The name is appropriate, though slightly inaccurate. It is derived from the Greek "xeros," meaning dry. However, xeriscaping is not a totally dry method of landscaping. All living plants require a certain amount of water.

Rather, xeriscaping is a combination of landscape design techniques: reducing areas of ever-thirsty turf, using water-conserving plants well-adapted to native soils grouped together in "hydrozones" (areas containing plants with like irrigation needs), and efficient irrigation systems used only when necessary.

Xeriscaping is based on seven fundamental principles:
- Start with a good design.
- Improve the soil.
- Use mulch.
- Limit lawn areas.
- Choose low water-use plants.
- Irrigate efficiently.
- Practice good maintenance.

Mulch is recommended to reduce soil moisture evaporation, decrease weed growth and control soil temperatures, eliminating extremes.

Adjusting maintenance practices is also a benefit. Applying less fertilizer, weeding quickly to reduce competition for water, raising mowing heights and mowing more frequently, and aerating for improved water penetration are all beneficial.

Research has been conducted to find the most drought-resistant and water-efficient turfgrasses for use in xeriscaping.

Dorothy Borland of The Turf Expert in Denver recommends buffalograss or buffalograss mixed with blue grama for low water use and drought tolerance. But, she notes, the warm-season grasses go dormant from October to May. "Most people who choose buffalograss know something about it," she says.

An added benefit, she notes, is that the native buffalograss only grows to about six or eight inches, and is therefore low-maintenance. But, she stresses, "I am still careful before recommending this grass. It has poor shade tolerance and when thinned by too much water or shade, bluegrass and other weedy plants will invade." She notes that the grass also has a long dormancy period.

In addition, Borland recommends using wheat grasses and smooth brome grasses. Borland says she also has been satisfied with the drought tolerance of improved tall fescues.

The major objective is to reduce bluegrass areas, Borland says, but also for more areas on the course.

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