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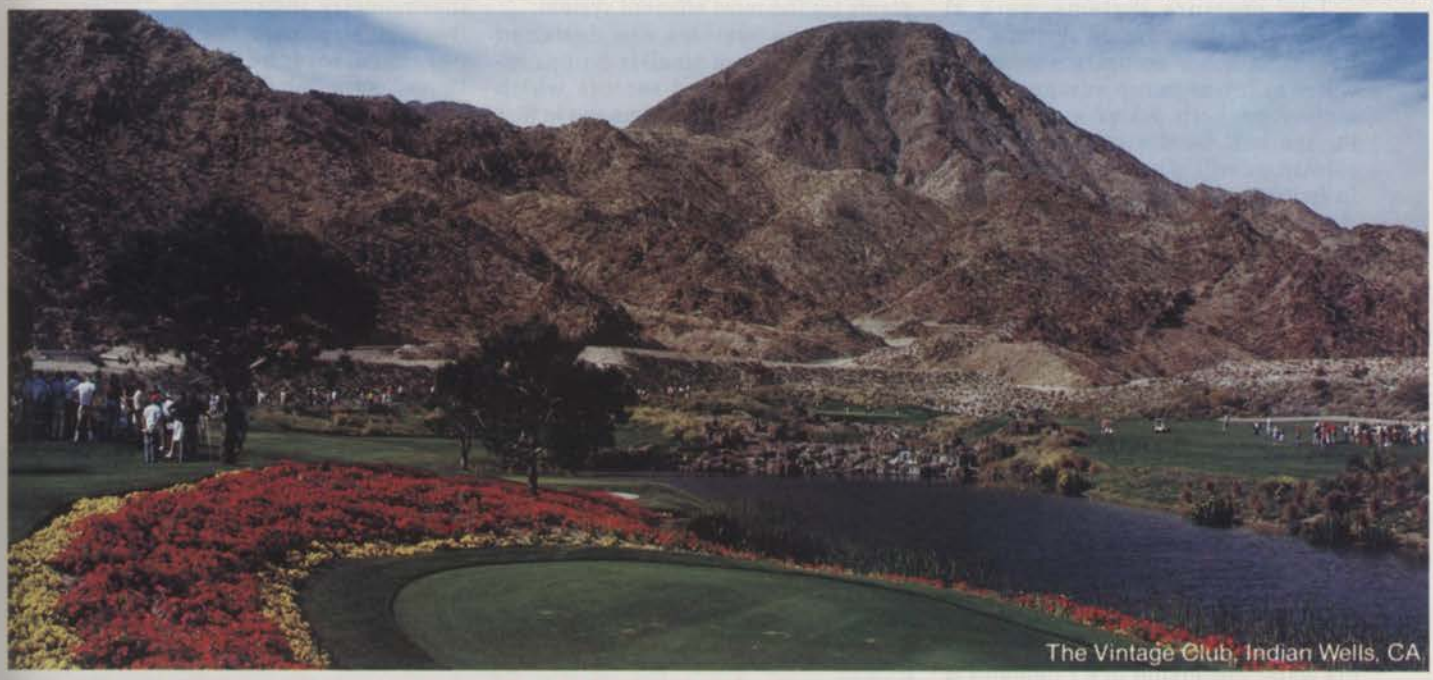

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. . . TO THE LAST DROP *from page 20*

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. Irri-

continued on page 24

More 'eyes' for turf managers *from page 20*

tem's IBM personal computer. With nozzle radius, spacing, and flow data entered, the precipitation rate can be accurately determined for each Network 8000 station, and the desired water flow more closely matches actual ET.

A further enhancement of matching water dispersion to ET demand is accomplished through entering data from each station into the system. "We knew that turf managers would want to customize their watering based on the characteristics of each course," says Toro Irrigation's Terry Mylne, "and that's really the only way you're going to be sure you're not over- or under-watering.

"Our solution was to create a system that assigned values for type of soil and turf, soil compaction levels, and slope of soil for each station. Special groupings such as north or south facing slopes, and rocks, trees and beaches may also be entered. All of these 'attachments and attributes,' as we call them, become associated with every station, and can all be scaled up or down for relative importance."

Motorola has been using weather station technology in agriculture for about 15 years, according to Motorola's Eric Scott. But it has only been within the last year that the company has entered the golf course market with a weather station-equipped irrigation system. The reason: "The education of superintendents is increasing, and these people are becoming more aware of these things," Scott says. "The industry is more receptive to high-tech."

Motorola's systems, the 3500 and 5000, gather data which is transferred by radio, technology which the company is noted for, to a central computer which adjusts the system accordingly. Software for the system was written along Motorola specifications by International Hydrological Services, a consulting firm of former irrigation industry members.

Rene Evelyn-Veere of Rain Bird says the golf course superintendent remains the expert, despite new technology.

The system only operates under optimum flow and pressure conditions, Scott says. If conditions necessitate it, the computer will prioritize areas to be irrigated: greens first, then tees and so on.

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

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. . . TO THE LAST DROP *from page 22*

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.

A non-watered, non-mowed roadway corridor in Orange County, Calif. is safer, more attractive and more water-efficient.

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

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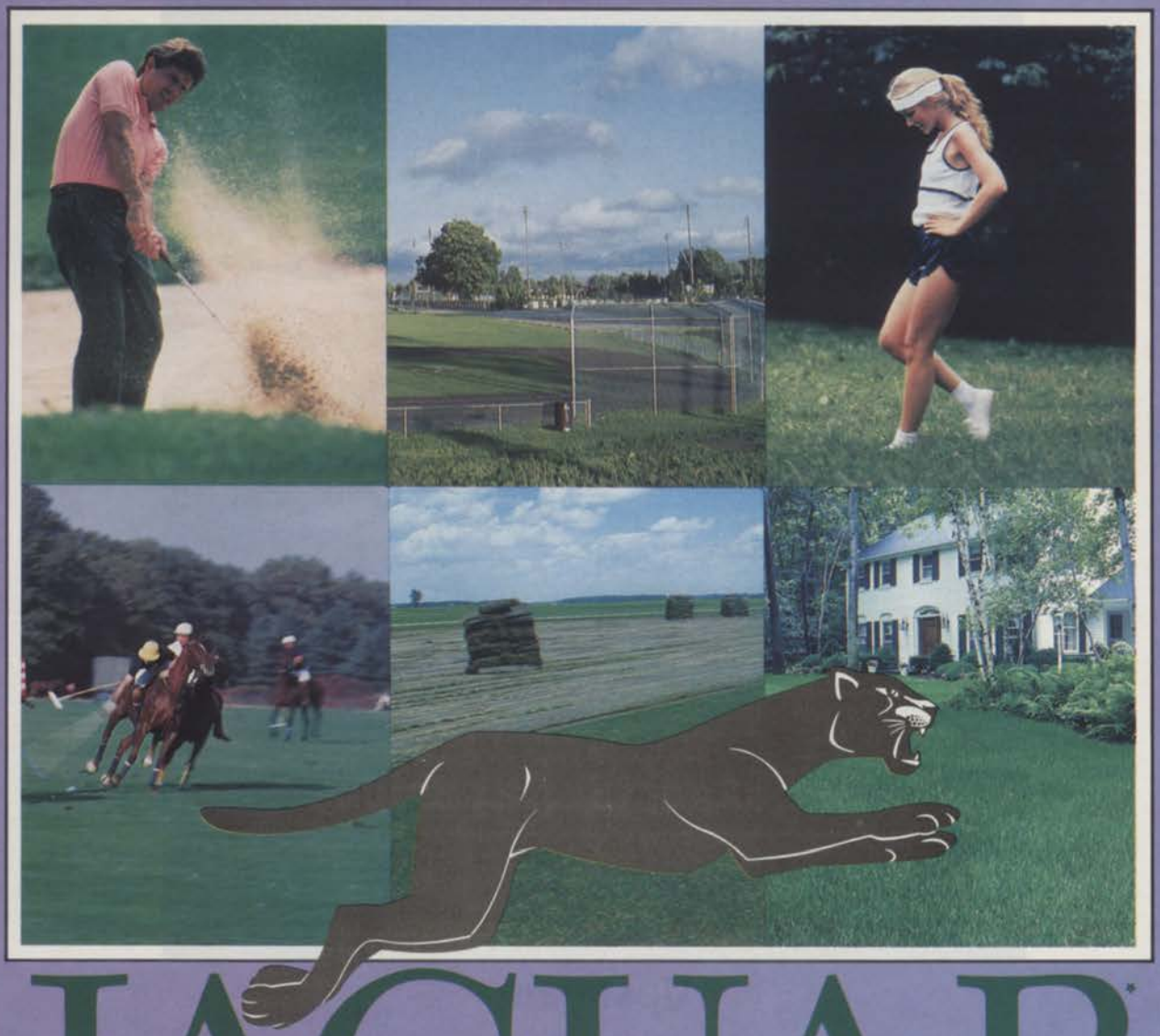
Excellent Overall Performance



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213-589-6331

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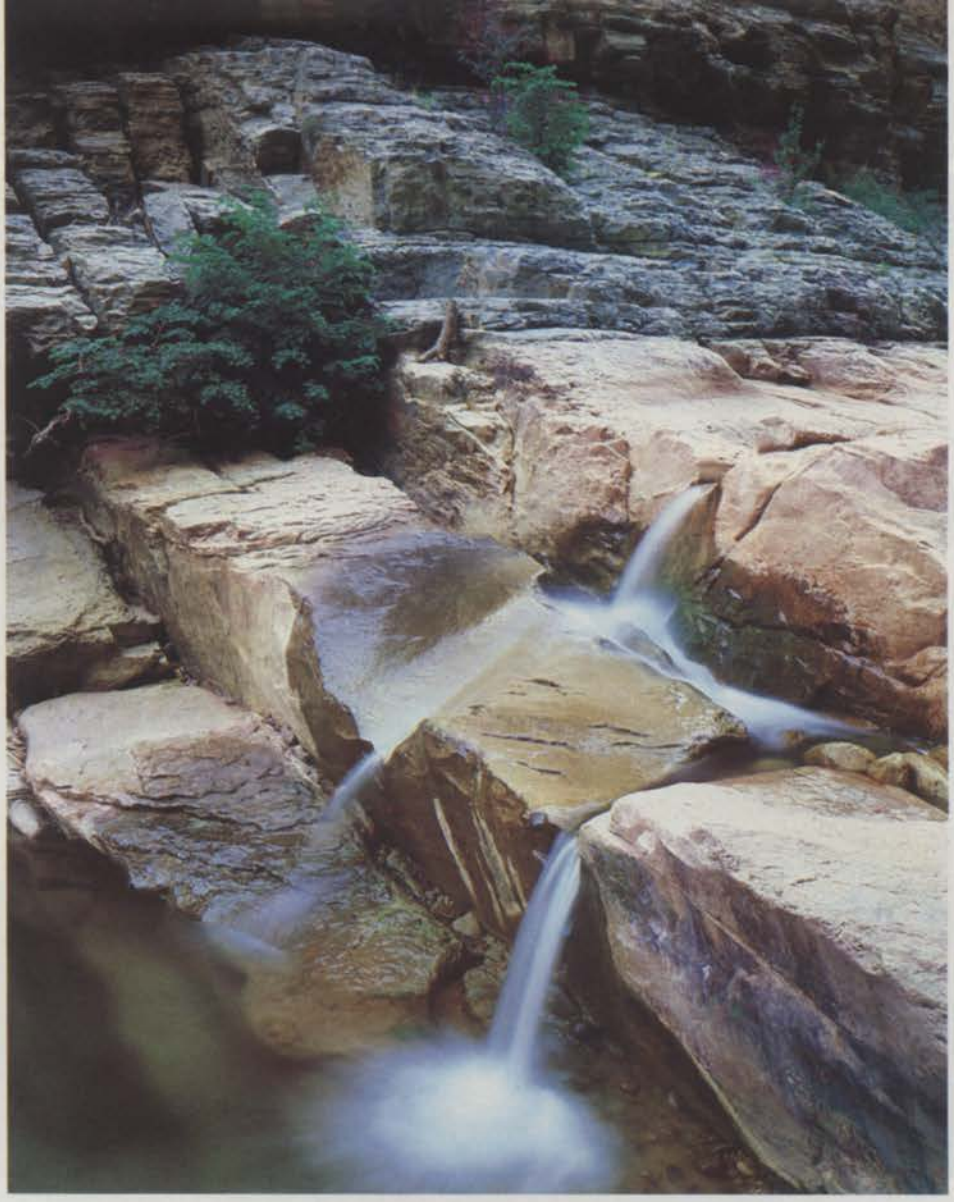

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A DRY IDEA, *from page 24*

to choose alternatives other than buffalograss. She says that one-third of her clients choose xeriscaping.

Native plants are always recommended for new xeriscapes and conversions to xeriscapes. They are naturally adapted to the soil and environmental conditions and require less maintenance and irrigation. But as with all new plants, natives need to be watered sufficiently until proper root development has occurred.

As for irrigating lawns, Borland says, "so much of it is what they (customers) expect. How little water can we use and still get by with a good-looking lawn?" The key is to find a balance between giving the customer the lawn desired while also giving them the maintenance desired, she adds.

The management principles naturally apply to arid areas where natural rainfall cannot keep up with public consumption, though xeriscaping can be used anywhere. "Inquiries are coming in on a global basis," says Ken Ball of the Denver Water Department. Ball is also secretary of the National Xeriscaping Council.

And xeriscaping is effective, often cutting down on water use outside the home by 40 percent or more.

Becky Garber of Colorado Landscape Enterprises, Arvada, Colo., says her company worked with a group of Aurora homeowners to implement xeriscaping and general water conservation practices on a 6½-acre property called Sunstone. She says the program reduced water bills by $15,000 in one year.

A study was conducted among 548 townhouses in Marin and Sonoma counties in California. Xeriscaped townhouses averaged about an $85 savings compared to conventional landscaping over the eight-and-a-half month test period. More importantly, water use was cut by 30,000 gallons per townhouse, a 54 percent reduction.

Xeriscaping councils exist in seven states (see list for contacts), with an eighth, New Mexico, expected this summer.

To help promote xeriscaping, many community xeriscaping councils have established exhibition gardens to give people a visual idea of what to expect.

"They show plants and how xeriscaping can be pulled off," explains Ball. "If there's something a person can go and wiggle their toes in and sit down with, it's more effective."

—Jeff Sobul

SLIDING AWAY

A valuable resource not given enough thought is soil. Topsoil is frequently lost from runoff due to heavy rainfall or improper irrigation.

While irrigation rates can be adjusted to correct a problem, rainfall can't. The impact of falling water on surface soil can destroy the structure of surface soil, cause surface to settle and seal, decreasing infiltration and increasing runoff, says Penn State's Tom Watschke, Ph.D. Therefore, it becomes necessary to protect the soil from eroding away.

The four basic types of erosion are:

- splash erosion when raindrops strike the soil surface an break soil aggregates into fine particles which can be carried away;
- sheet erosion when water moves across the soil surface and removes thin sheets of soil;
- rill erosion when water moves across the soil surface and cuts small ditches a few inches across; and
- gully erosion when water flows across one spot long enough to cut large gullies.

The best method of erosion control is establishing a good stand of turf. Under good conditions, and without stringent time requirements, reseeding can do the job.

But if the problem is severe, and immediate, Watschke notes it is better to use sod. The sod is more dense, and with bluegrass sod, "it's an instant fix. The day you lay it, the effect on runoff and erosion is immediate," he says.

The slow-establishing seed is less dense and subject to runoff. The problem with sod is a purely economic one. It costs more. Notes Watschke, it comes down to a cost vs. benefit decision.

But other methods are often more economical. They involve using geotextiles, either natural or synthetic.

On reseeded soil, says Watschke, putting a mulch/straw mix on top reduces the impact of rainfall. "The structure of the soil remains, the runoff decreases. Once the plants establish, they will take care of the runoff."

Other natural geotextiles come in blanket form, such as North American Green's straw and/or coconut fiber blankets. According to the company, the blankets are designed to reduce moisture loss while allowing

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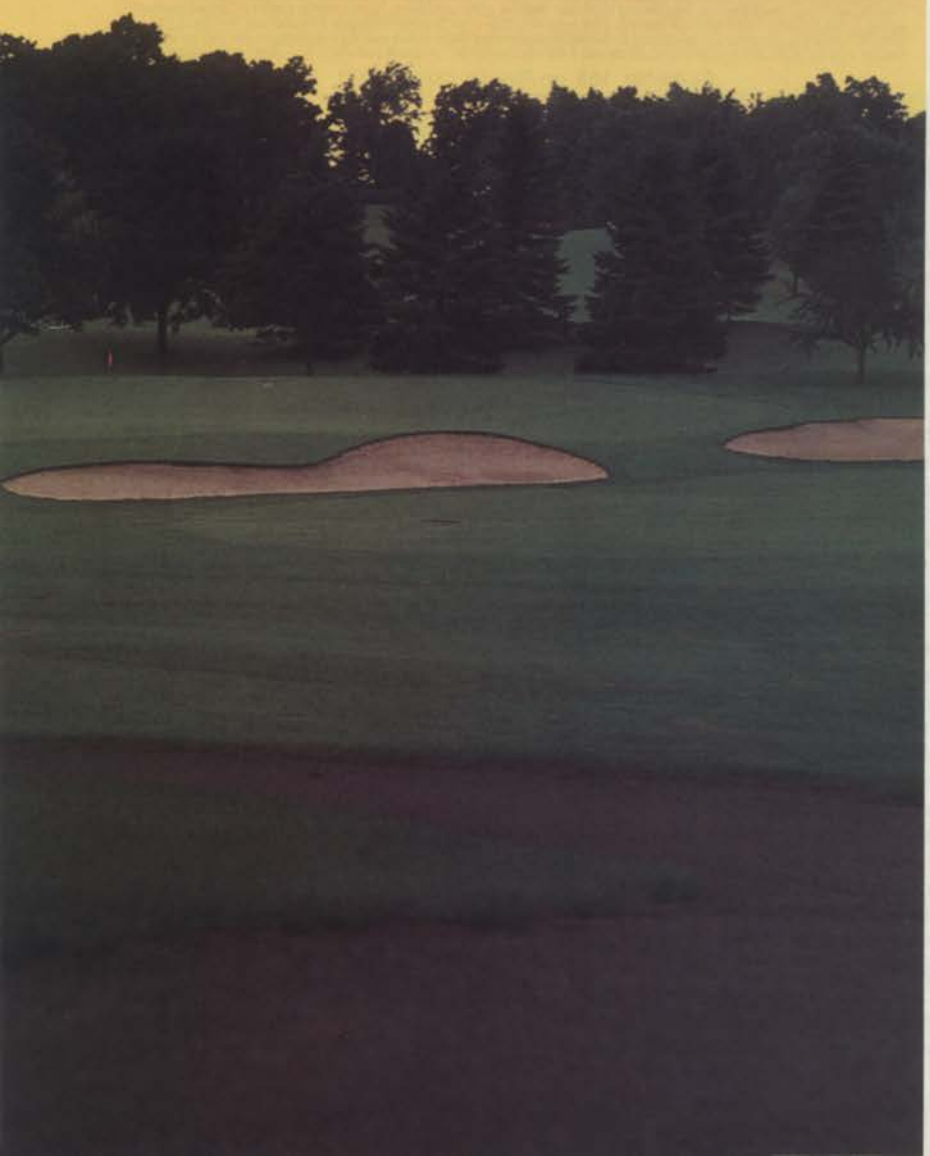

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SLIDING AWAY *from page 27*

moisture to infiltrate, and also to keep seed warm to facilitate germination. In time, the blankets brake down to provide a mulch covering.

Synthetic geotextiles come in a number of materials though they generally serve the same purpose as natural. American Enka's Enkamat, actually considered a geomatrix rather than a geotextile, is contructed of nylon monofilaments fused into a three dimensional form which leaves 90 percent of its area open. This area can be filled in with soil, gravel, etc. This stabilizes the soil, allowing seed to germinate. When the turf is established, the material continues to stabilize the soil substrate.

Geotextiles like the polyesters from Warren's and polypropylene Typar from Du Pont control erosion and also prevent weeds from growing. They can be used on flat areas as well as slopes such as river and lake banks, road and rail cuts, etc.

In the end, though, there is only one way to stop erosion, and that is to treat different parcels of land according to the individual needs and capabilities.

—Jeff Sobul

Local xeriscaping councils

A number of councils exist as part of the National Xeriscape Program Network. The following is a list by state and city with a contact included.

*indicates the program has a xeriscape demonstration garden.

National Xeriscape Council, Inc., c/o Highlands True Value Hardware & Nursery, 8080 S. Holly, Littleton, CO 80122; (303)779-8822. Contact: Jim Grabow, president, NXCI.

ARIZONA

Flagstaff, (602) 774-5281. Contact: Frank Abeyta, Jim Clevenger or Vicki France.

Phoenix, Arizona Municipal Water Users Assn., (602) 256-0999. Contact: Robin Stinette.

Tucson*, Southern Arizona Water Resources Assn., (602) 881-3939. Contact: Marybeth Carlile.

CALIFORNIA

So. California Xeriscape*, Santa Ana, (714) 973-1023. Contact: Mary Cooper

State of California, Department of Water Resources, Office of Water Conservation, Sacramento, (916) 445-4403. Contact: Suzanne Butterfield.

Contra Costa, Contra Costa Water District, Concord, (415) 674-8000. Contact: Debora Maxon.

Fresno, Water Division, (209) 488-1408. Contact: Dave Todd.

Oakland*, Alamo, (415) 820-6600. Contact: Richard Bennett.

San Diego*, San Diego County Water Authority, Cuyamaca College Office of Public Information, (619) 297-3218. Contact: Pete Rios.

COLORADO

Arvada*, Parks Department/Utilities Division, (303) 420-0984/431-3035. Contact: Mike Lee or Sterling Schultz.

Aurora, City of Aurora Utilities, Water Conservation Dept., (303) 695-7387. Contact: Kim Hout.

Boulder, Planning Department, (303) 441-3270. Contact: Peter Pollock, Ron Donahue or Stan Zemler.

Denver*, Denver Water Department, (303) 628-6329. Contact: Ken Ball

Ft. Collins*, Water Utilities Department, (303) 221-6681. Contact: Molly Nortier.

Genesee Estates*, Homeowners Assn., E. Golden, (303) 526-1339. Contact: Muff Mackey.

Greeley, Ext. Svc. Weld County, (303) 356-4000 x.4465. Contact: Donna Liess

Lakewood, Parks & Recreation, (303) 987-7800. Contact: Bill Jewell.

Longmont*, Municipal Utilities, (303) 776-6050. Contact: Kathy Faatz.

Wheat Ridge, Parks Dept., (303) 237-6944 x.283. Contact: Bill Cassel.

FLORIDA

Southern Fla., S. Florida Water Mgmt. District, West Palm Beach, (356) 686-8800 x.391. Contact: Bruce Adams.

NEVADA

Reno*, Great Basin Xeriscape, Inc., (702) 329-4329. Contact: Tom Stille.

Sierra Pacific Power Company*, Reno, (702) 689-4116. Contact: John M. Metcalf.

TEXAS

Abilene, Water Administration, (915) 676-6000. Contact: Cynthia Manning.

Arlington, Utilities Dept., (817) 275-3271. Contact: John Kubala.

Austin*, City of Austin Xeriscape Program, Resource Management Dept., (512) 462-6265. Contact: Martha Latta.

Brownsville*, Public Utilities Board, (512) 544-3800. Contact: Pamela Gross Downing.

Corpus Christi*, Corpus Christi Botanical Society, (512) 992-5337. Contact: Dr. Sue Gardner.

Denton, Operations & Energy Mgmt., (817) 566-8448. Contact: Lisa Tindel.

Ft. Worth*, Ft. Worth Water Department, (817) 870-8220. Contact: Cari Hyden.

McKinney, Heard Natural Science Museum and Wildlife Sanctuary, (214) 542-5566. Contact: Marcia Coale.

San Antonio*, South Central Texas Xeriscape Program, c/o Bexar County Extension Service, (512) 220-2776; Contact also: Doug Welsh, Texas A&M College Station, (409) 845-7341.

WATER USE BY TURFGRASS PLANTS

Three California researchers discuss why turfgrass needs that water you're giving it, and what happens when it gets too much or too little.

By Matt Leonard, Steve Cockerham and Vic Gibeault

This automatic weather station reports local evapotranspiration information as part of a statewide system in California.

Increasing leisure time and a greater awareness of the health benefits of physical exercise have led more people of all ages to become active participants in a wide range of sports and recreational pursuits. As a result, turfgrass acreage in the United States is continuing to grow.

Still, the most persistent force behind the increasing use of turf is population growth. More people translates into more homes, schools, parks and commercial centers, all of which means more turf. As the area under turf increases, there is an increased demand on available water resources. Since it has been demonstrated that turfgrass irrigation is not a high priority when water is allocated, turf managers must become aware of available water-saving options.

The cost of water for irrigation is having an even greater impact on conservation than local supply problems. Fundamental to the water conservation effort is an understanding of how the turfgrass plant uses water.

Matt Leonard is a research scientist, Steve Cockerham superintendent of agricultural operations and Vic Gibeault extension turfgrass specialist. All work at the University of California in Riverside.

Water in grass

Water entering the root from the soil contains plant nutrients as dissolved mineral salts. As water moves up through the root to the stem and leaves, these mineral nutrients are carried along, available for absorption by cells that need them. Water enters the roots and moves through the plant along a continuum of potential gradients. This is the process of moving from a high concentration of water toward a lower concentration. Where water concentration is high, dissolved salt concentration is low and vice versa. This is an important principle as it explains how water moves and carries nutrients throughout a plant, even to the top of the tallest trees.

Light and water

Water is also used in photosynthesis, which is the process of using light en