divining rod

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Landscaping for Water Conservation

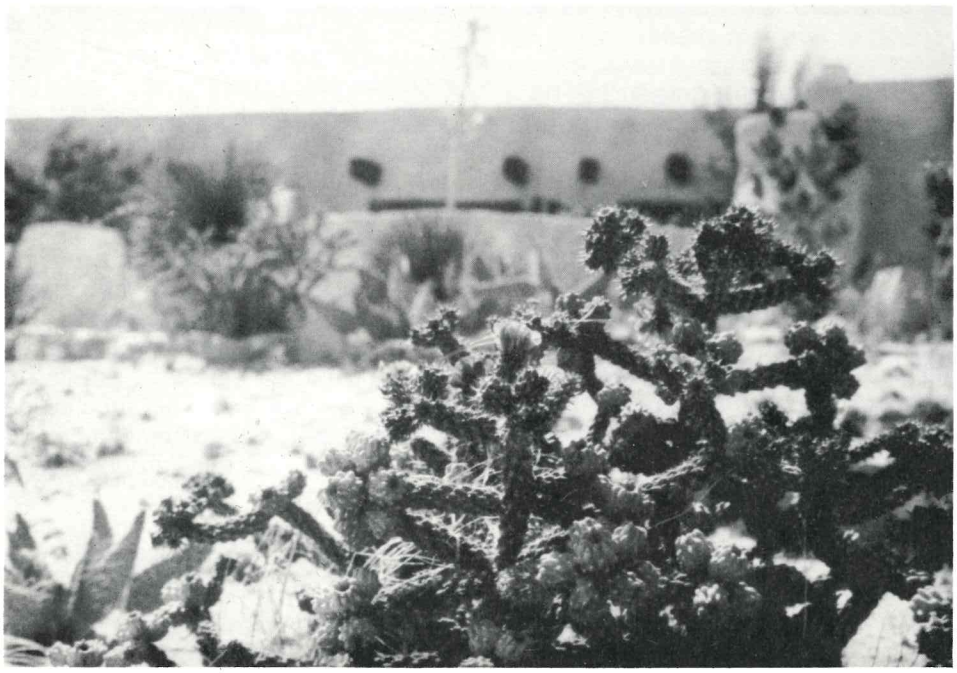
It's that time of year when thoughts turn to spring planting and to the insufficient moisture we received in New Mexico this past winter. The two are not incompatible, however. We can landscape for water conservation.

Xeriscaping is the conservation of water through landscaping. The term was coined during a project in Denver, Colorado in 1978. It comes from the Greek word Xeros meaning dry.

Norman Lownds, assistant professor in New Mexico State University's Agronomy and Horticulture Department stresses that xeriscaping is a comprehensive approach to landscaping--it means more than just planting water-saving plants.

There are seven principles to Xeriscaping, discussed below. "If you are serious about water conservation, follow the seven principles and you'll conserve a lot of water," says Lownds.

1. Use good planning and design. "A whole lot of people don't think about it," says Lownds. Creating a water-efficient landscape means considering your budget, your needs, the water requirements of plants, and the time you have to devote to maintenance. Consider some of the functions of landscape: for privacy, as a noise barrier, to reduce the effects of the summer heat, as a windbreak.



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2. Limit turf area.
You may not want to do away with turf entirely. It has a cooling function and you may have children or pets who will need a grassy area. You can reduce turf area through use of patios and decks, ground covers and mulched areas. In some areas of the state, native grasses such as buffalo grass or blue grama can be used. Not only are these grasses more drought tolerant than others, but they are not as vulnerable to insect and disease problems.

3. Adequately prepare soil.
Organic matter added to the soil of shrub and flower bed areas can increase the soil's ability to absorb water. Sandy soils may need a lot of peat moss or compost, while clay soils may need sand. Certain soils may need additional micronutrients, too.

4. Use effective and efficient watering methods.
Lownds suggests that you be aware of

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Landscape, continued

how much water you apply. Most lawns receive way too much water, too often. To create a deep, well-rooted lawn, which is more drought tolerant and water efficient, apply water infrequently, but thoroughly. Much of the water applied to lawns and gardens is never used by the plant. If applied too rapidly, water will be lost in the form of runoff. Some water will be lost as it evaporates from exposed, unmulched soil. If you have an irrigation system, make certain it is working properly and avoid irrigating on windy days.

5. Use mulches wherever possible. Mulch including bark, wood chips, gravel, and small rocks can reduce surface evaporation, weed growth, and soil temperature as well as prevent soil compaction.

6. Use low water-use plants. Some suggestions of well-adapted and native plants are given in the table to the right.

7. Properly maintain your landscape. Lownds says this is extremely important. "Low water use doesn't mean you don't need to do anything," he observes.

Although good design can decrease maintenance through reduced mowing, elimination of unadapted plants and more efficient watering, there is still pruning, annual mulching, weeding, fertilizing, and pest control to be taken care of.

Recommended reading

Southwestern Landscaping with Native Plants by Judith Phillips, published by Museum of New Mexico Press. This attractive book gives lots of good ideas for landscape design and plants to use. Phillips (sometimes humorously) discusses maintenance, propagation from cuttings and seeds and irrigation methods.

Southwestern Landscaping can be ordered from the Museum of New Mexico, P.O. Box 2087, Santa Fe, NM 87504-2807 for $27.95 (cloth) or $17.95 (paper). There is a $2.00 shipping charge for one book, $2.50 shipping charge for two books.

Some suggestions for landscaping

Dr. Norman Lownds from NMSU's Agronomy and Horticulture Department made a few suggestions for good plants to use in New Mexico landscapes. Some of these are native, others are considered well-adapted. Under the list of ground covers, the last seven plants were suggested in Judith Phillips's book, **Southwestern Landscaping with Native Plants**.

Trees
Desert willow
Honey locust
Chinese pistache
Mesquite
Mexican elder
Arizona cypress
Afghan pine

Shrubs
Fourwing saltbush or chamiso
Texas sage
Cherry sage
Bigleaf sage
Spanish broom
Yucca
Turpentine bush
Apache plume
Creosote
Bird of paradise

Ground Covers
Coyote bush
Rosemary
Verbenas
Blue flax
Blackfoot daisy
Blanketflower
Desert zinnia
Desert marigold
Woodbine or creeper
Globemallow

Bahr, Creel Honored

WRRI Director Tom Bahr and Assistant Director Bob Creel were among those honored at a ceremony at New Mexico State University on March 2. Bahr was recognized for ten years of service to the university and Creel for 20 years. Congratulations to them both.

AWRA Announces 1990 Officers

The American Water Resources Association, New Mexico Section, has announced its officers for 1990.

Steve Thompson, assistant professor of geography at the University of New Mexico and one of UNM's 1989 Faculty Scholars, is president and Doug Earp, geohydrologist with the Albuquerque Environmental Health Department is president-elect. Vice-president is Martin Steinpress, a consultant who is enrolled in Water Resources Administration masters degree program at UNM. Pat Stovall, a hydrologyst with Resource Technology, Inc. is secretary/treasurer and U.S. Geological Survey hydrologist Peter Frenzel is membership chairman.

The New Mexico section experienced a 60 percent growth in membership in 1989, when its membership rose to 102.

Arizona Conference Set

The Arizona Water Resources Research Center and the Udall Center for Studies in Public Policy at University of Arizona have planned a conference, "Taking the Arizona Groundwater Management Act Into the '90s," for September 6 and 7.

The conference will be held at the Holiday Inn in Casa Grande, Arizona and will feature panels of scholars, attorneys, legislators, and water managers. The program will attempt to answer such questions as: What were the goals of the act and what are its results? How well is the act functioning and can it be made to function better? Where does Arizona ground water policy go now?

For more information, contact Mary G. Wallace at 602-621-7607.

A new use for our 15 billion acre-feet of saline ground water?

Algae-Based Oil May Be in Your Future

In the future that Cadillac you are driving could be running on algae. The ubiquitous, lowly algae, which it seems is being studied for just about everything from use as a food source to cleaning up waste waters, is now being looked at to produce a substitute for oil. Growing algae for oil production may be one of the most economically promising uses for New Mexico's 15 billion acre-feet of saline ground water.

Dr. Peter Herman of New Mexico State University's Biology Department says that U.S. Department of Energy (DOE) began studying the possibility of using algae as an alternative source of hydrocarbon fuel in 1979. DOE studies estimate lipids found in algae could be extracted and converted to gasoline and diesel-like fuel for a cost of $1.60-$2.00 per gallon by the year 2010. Herman acknowledges, "While the current depressed state of the oil and gas industry makes this price range seem unrealistically high, the finite nature of fossil fuel reserves will undoubtedly bring the price back up at some future time."

The DOE studies also indicate southeastern New Mexico would be an ideal location to produce oil from algae. Currently the DOE is sponsoring a pilot-scale project for growing algae in saline water at the Roswell Test Facility. Herman also reports Roswell is probably the first place the algae-based oil production would occur. Not only does that area have a high level of solar energy and abundant saline water, but he says, "there is already a whole petroleum infrastructure there." For example, he observes that algae's growth can be boosted by adding carbon dioxide to the water. "If they [those growing the algae] decide to go with carbon dioxide, the pipeline is already there because the petroleum industry uses carbon dioxide in recovery processes."

"We know from the chemical end how to convert biological lipids into fuels. The basic engineering is there, although specific engineering hasn't been tailored for the process," relates Herman. "The setting is right, so the next question is can you do it economically?" That is where he comes in.

Through a project sponsored by the Water Resources Research Institute, Herman is working on a low-tech way to optimize algae growth and the amount of lipids found in algae. "We can get algae by the bucket-loads using high tech methods, but that is energy-expensive," he reports.

Although Herman and his graduate students grow some algae in a controlled laboratory environment, they primarily grow algae in outdoor tanks which look like small stock tanks. The tanks contain submersible pumps which keep the algal cells moving through the water to help maximize growth. If the cells are too dense, and light doesn't reach the cells, they don't grow as well. In the lab, algae are grown in large flasks, placed under special lights, kept at a certain temperature, and agitated to keep the cells moving.

Another aspect of Herman's project is to chemically analyze types and amounts of lipids found in different algae varieties. Herman says it appears algae producers could break-even selling the lipids extracted from algae for oil production, but to turn a profit, they will have to market what's left of the algae. Much research supports using algae for livestock feed and some algae produce lipids found in the highly touted Omega-3 fatty acids.

Herman predicts future algae producers will face "low tech farming with sophisticated decision-making." Questions they will face are: do you stress the algae to increase lipid production, which simultaneously curtails growth and therefore possibly limits your secondary product? Or do you fertilize and increase yield for plenty of secondary product although the lipid for oil production might decrease?

"With low-tech, you have to make do with what the environment gives you," says Herman. This may mean growing different types of algae during different seasons to deal with New Mexico's wide temperature variations and not stressing the algae to increase lipid production.

Herman hopes his research will help solve some of these problems. For example, he's found that diatoms, single-cell algae whose valve-like cell walls contain silica, produce the most lipids for oil production. These can withstand a wide range of temperatures, but are not so good for cattle feed, however, because of the grainy silica. Blue-green algae, which like very warm temperatures, would be ideal for summer growing, but they don't produce many lipids and sometimes have toxic by-products. Green algae tend to be better adapted to cold temperatures.

Because raising algae for oil production will require commitment on the part of agricultural producers, such as building a pond and drilling a well for saline water, the next step in moving toward algae-based oil production is a demonstration-level project to get agricultural producers interested in raising algae, according to Herman. Until then, he can be found growing low tech algae and analyzing it in a high-tech way to find the best algae for producers to grow for oil production at a maximum profit.

Peter Herman checks on algae he has growing in his laboratory.

Small-Scale RBC Studied for Septic Effluent Treatment

Rotating biological contactor--the name conjures up images of something robotic or technically sophisticated. It's not. The simple RBC treats the most mundane of problems--sewage.

Although RBC technology has been used in large sewage treatment plants, for the first time it is being tested for residential use with a septic tank. In a WRRI-sponsored project, NMSU Civil Engineering Professor Ricardo Jacquez and graduate student Firoj Bhai Vora are studying the feasibility of using RBC technology to provide extensive treatment of septic tank effluent.

They have designed and implemented a small RBC unit. It is providing intermediary treatment of sewage from three mobile homes after the sewage has passed through a septic tank. The RBC reduces the pollutants in the sewage before it reaches the leach field, minimizing its impact on ground water quality. Most cases of ground water contamination in New Mexico are caused by septic tanks, according to the Environmental Improvement Division.

The unit consists of a series of rotating plastic disks which are partially immersed in a tank that is about four feet long and a foot deep. The wastewater from the septic tank is pumped out of the tank and circulated over the disks. Microorganisms growing on the disks help in the process of cleansing the wastewater. The longer the system runs, the more efficient it becomes due to increased bacterial growth.

The main contamination problem with septic tanks is from nitrates. Sewage contains a large amount of ammonia. As it passes over the soil, the ammonia oxidizes in the soil and converts to a nitrate. With the RBC, the ammonia converts into nitrates before the sewage reaches the soil.

Nitrification occurs as the RBC's disks rotate, alternating exposure to the oxygen in the air and to the wastewater. Then, by increasing the depth the disks are submerged into the tank, an environment suitable for denitrification occurs. The nitrates are converted to N_2 gas, meaning the wastewater going to the soil has been through a denitrification process, helping to reduce nitrate contamination. Jacquez says the tricky part of the project has been to balance the nitrification and denitrification process.

The RBC also cleanses the wastewater of organic chemicals. The same process which causes nitrification causes oxidation of organic pollutants. The system has reduced organics by 85-90% which Jacquez says is consistent with the large RBC units.

The researchers believe the RBC will prove to be a cost-effective way to treat wastewater. They estimated a unit would cost homeowners $500-$700 to install and about $60 per year to operate. The unit needs only minor maintenance--inspection and lubrication.

When the unit was first installed, there was a problem with odor as the wastewater was pumped out of the septic tank. After sufficient bacteria grew on the disks, the odor ceased to be a problem.

Looking to the future, it is possible in the arid Southwest that an evapotranspiration method could be used to dispose of the wastewater after it is treated by the RBC. Little effluent would then be released to the soil, further lessening any ground water contamination.

The small rotating biological contactor above was built by NMSU's Civil, Agricultural and Geological Engineering Department and is now being used to treat the septic tank effluent from three mobile homes.

Below Average Water Supply Plagues NM

The Soil Conservation Service reports water supply conditions across the state, except for the Canadian River Basin, remain in the "much below average" range. The worst conditions are in the west central mountains that provide runoff to the Zuni River drainage and the Bluewater Creek drainage.

Below average precipitation over most of the state has left the soil moisture conditions in poor to very poor condition, which will reduce snowpack runoff even more.

Laboratory Planning Help Available

In the past there has been no standardized approach to laboratory design and planning which reflects the unique demands of water quality analysis. Agencies such as the Environmental Protection Agency and the General Accounting Office have criticized the inadequacy of current water and wastewater laboratories. To compound the problem of laboratory design, during the past decade tremendous advances have been made in water and wastewater analysis equipment and procedures.

According to Albuquerque laboratory consultant Douglas Clark, a well-planned laboratory can better enable personnel to achieve the federal and state water quality standards for which they are responsible.

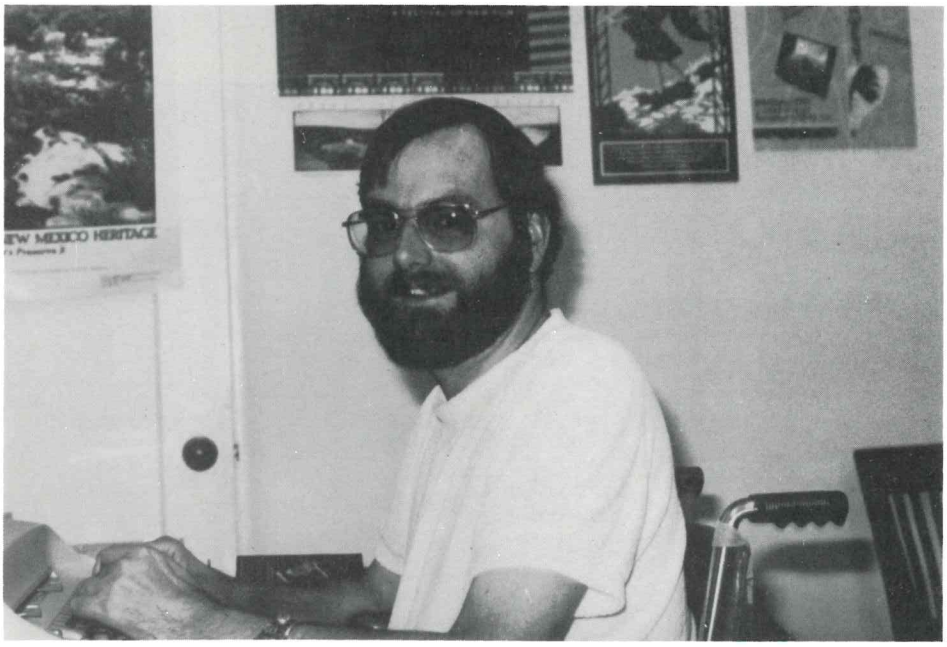
Clark's latest publication, **Laboratory Planning for Water and Wastewater Analysis**, presents comprehensive, standardized guidelines for water and wastewater treatment facilities. It is the third in a series of laboratory handbooks written by Clark and published by the New Mexico Water Resources Research Institute.

The handbook is useful for water and wastewater operations which must upgrade or extend the life of existing laboratory and treatment facilities.

Clark observes, "Many such facilities are reaching the limits of their original design lifetimes, but cannot be replaced in the foreseeable future due to a shortage of funds for new construction, particularly from the federal level. Application of the guidelines presented in this manual will help ensure that existing laboratories are used to their fullest advantage."

Laboratory Planning covers the analytical capabilities, staffing levels, facility size, design and construction, furnishings, and utilities necessary for an efficient laboratory. It also includes design applications for laboratories of four different sizes.

Copies of the manual can be purchased for $19.50 plus $2.50 for postage and handling from WRRI, Box 30001-Dept. 3167, Las Cruces, NM 88003. Bulk order discounts are available as follows: 13-24 copies $17.50 each; 25 or more copies, $16 each.



*Laboratory consultant Doug Clark is the author of three laboratory manuals: **Basic Laboratory Skills; Microbiological Skills for Water and Wastewater Analysis;** and **Laboratory Planning for Water and Wastewater Analysis.** Clark is president of Laboratory Consultants, based in Albuquerque, and the former editor of "The Bench Sheet."*

Symposium Planned by Southwest Consortium on Plant Genetics and Water Resources

The Southwest Consortium on Plant Genetics and Water Resources has announced its fifth annual symposium to be held April 22-24 at the Holy Cross Retreat south of Las Cruces. Seventeen scientific talks will be presented including a keynote address given by Dr. Theodore Hsiao, University of California-Davis. Hsiao, an expert in plant water stress and water-use efficiency, will talk about differential growth of roots and shoots under water stress.

Other presentations include:

- A Combined Approach to Improve Cotton for Dryland Agriculture
- Study of Key Biosynthetic Enzymes in Plant Abiotic Stress Tolerances
- Genetics and Environmental Control of Water Use Efficiency in Sorghum and Cowpeas
- Biochemical Differences in Carbon Assimilation Enzymes as CAM and CAM-Idling are Induced during Salt/Water Stress
- Physiological Criteria of Drought Tolerance and Water Use Efficiency in Alfalfa
- Isolation and Characterization of Putative Salt Tolerance Genes from Distichilus spicata.

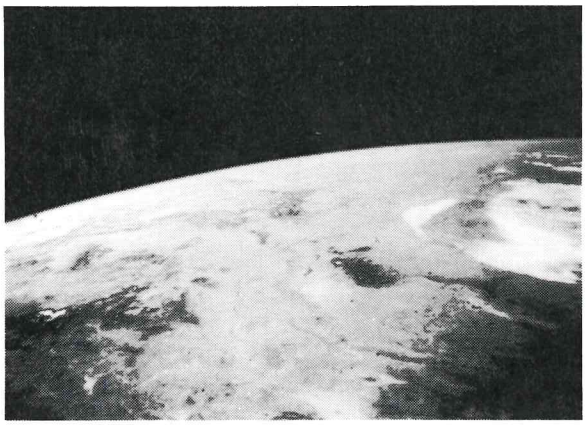
The registration is $30 for out-of-town participants who will be staying at the retreat and $15 for participants who do not require lodging. For more information, contact Mindy McAbee at the Plant Genetics Engineering Laboratory at NMSU, 646-5453.

Since we went to press, the site for the climate conference has been changed to the Ramada Inn Classic in Albuquerque.

Focus on the Rio Grande Basin

Global Climate Change and Variability Co

The Water Resources Research Institute is participating in an inter-institutional conference on potential impacts of global climate change in the Rio Grande Basin, scheduled for June 1-2, 1990 at the Four Seasons Hotel in Albuquerque.



The conference will have two major parts, one of which will be open to the public.

The first portion of the conference will begin on Friday, June 1. It will include workshop sessions for representatives from various institutions. Participants will work to build a consortium of institutions to 1) perform and coordinate the research needed to develop a quantitative understanding of the basin's response to possible climate changes and 2) consolidate the research results and present them in a way which would be useful to environmental resource managers.

Workshop participants will also develop the concept of the Rio Grande Basin as a field laboraory for measuring the effects of climate change on man's environment and discuss possible administrative and funding mechanisms for future work.

On Saturday, June 2 the conference will be open to the public. The goal of the session is to increase awareness and understanding of possible impacts of climate change and variability on the Rio Grande Basin. Four speakers will discuss global climate change predictions and potential impacts of climate change on water resources, ecological systems and political, social and economic institutions.

The idea for the conference was conceived by the 1989 UNM Faculty Scholars, who have named themselves the "Rio Grande Basin Interdisciplinary Group." Members of the group include Jim Gosz, Biology Department; Chuck DuMars, School of Law; Chris Nunn, Economics Department; Bruce Thomson, Engineering Department; and Steve Thompson, Geography Department. UNM's Faculty Scholars program releases outstanding researchers from teaching responsibilities for one semester, allowing them to conduct an interdisciplinary research project.

The University of New Mexico, New Mexico Tech, New Mexico State University, the City of Albuquerque, Sandia National Laboratory, and Los Alamos National Laboratory are among the institutions participating in the conference. Several other state and federal agencies will be participating also.

All of those on the **Divining Rod** mailing list will receive a conference flyer by early May.

Tom Bahr, director, New Mexico Water Resources Research Institute
Leslie Blair, editor

the divining rod
New Mexico Water Resources Research Institute
Box 30001 - Dept. 3167 NMSU
Las Cruces, NM 88003
(Address correction requested)

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