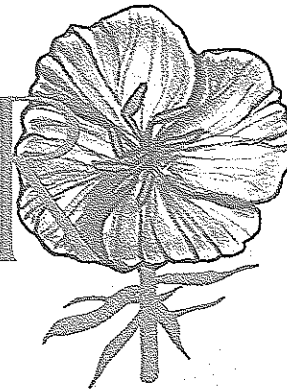


WILDFLOWER



A non-profit organization dedicated to researching and promoting wildflowers to further their economic, environmental, and aesthetic use.

Water: an eternal problem for plants

Drought. Flood. Drought. Flood. The availability of water often seems like a meteorological tug-of-war umpired by an indifferent Mother Nature. If you think animals (including humans) have a hard time coping, ponder the plight of plants.

Ever since ancestral aquatic plants first ventured onto land, maintaining adequate water supplies has been an ongoing struggle. To survive on land, plants evolved strategies and adaptations to collect and maintain water as long as possible, such as a waxy coating on their leaves to reduce water loss, and roots to extract moisture from the soil.

Water is essential to plant physiological processes such as photosynthesis and respiration. Structurally, it helps keep the plant cells taut so they can position their leaves to capture sunlight. The movement of water through conducting vessels distributes minerals throughout plant tissues. Water moves continuously from root to leaf to replace water lost by evaporation from leaf surfaces or through openings in the leaves and stem. This process, called transpiration, consumes about 98 percent of the water entering a plant. The rate of transpiration depends on environmental factors such as temperature, humidity, light intensity, wind, and soil moisture. Obviously, a plant will lose water more rapidly on a hot, sunny, dry day than on a cool, cloudy one.

To be useful to a plant, water must be drawn up from the soil through the roots. Most plants absorb little if any water through their leaves because of their impermeable surfaces. Water in the form of fog or dew benefits plants mainly by reducing their transpiration rates.

The intensity of rainfall is a key factor in the availability of water for plant use. Dense vegetation can intercept as much as 100 percent of the precipitation in a light shower. Conversely, a heavy downpour may saturate the soil quickly and run off before it is absorbed. A gentle, steady rain usually provides maximum water retention in the soil.

Most of the excess water after heavy rains quickly filters through the soil by means of gravity and becomes unavailable to plant roots after a few days. The residual water in the soil, unresponsive to the pull of gravity, is called the field or capillary capacity. Plants get the bulk of their water from this capillary water, which normally fills pores and coats particles in the soil. Thus, while evaporation dries out the upper surface of the soil, plant roots absorb most of the water from soil layers below about 12 inches.

The type and moisture content of

continued on page 4

Coastal dunes are an ever-changing ecosystem; each plant species plays a specific role in stabilizing a sand dune. Successful dune restoration requires establishment of dune vegetation. Mycorrhizal fungi, which facilitate plant growth and establishment by aiding in nutrient and water uptake, may be a necessary component of dune species establishment.

The Wildflower Center examined two dunes, one naturally established and one that has undergone restoration for two years, to determine whether mycorrhizal fungi were present at the two sites.

Botanists collected root samples from four species growing at both sites. Then they cleaned, stained, and examined the roots under a microscope to determine whether mycorrhizal fungi were present.

Comparing the two sites, it appears that plants in the natural site are more likely to be infected by mycorrhizae. The mycorrhizal association occurs slowly, and the restoration site initially is void of mycorrhizal fungi. Fungal spores eventually move into the restored site through wind, tidal action, and animal transport. Based on early results, a subsequent survey probably would reveal that more plants at the restored site are infected.

Inoculating plants with mycorrhizal fungi before planting might speed up plant establishment and growth in dune restoration sites.

RESEARCH U.P.D.A.T.E

PRESENCE OF MYCORRHIZAL FUNGI IN DUNE PLANTS SURVEYED

Species	Natural site	Restored site
<i>Panicum</i> sp.	yes	no
<i>Suaeda</i> sp.	no	no
<i>Ipomoea</i> sp.	yes	no
<i>Croton</i> sp.	yes	yes

BUY LOCAL

Call state highway departments and local municipal mowers with kudos when they mow at the correct time — after flowers have gone to seed.

GIFTS INSIDE

Research Director's Report

Urban island habitats: How big is big enough?

Approximately 40 percent of the world's population is urban, and that proportion is expected to grow to nearly one-half by the next century. Since just 1950 the world's urban population has almost tripled in numbers of individuals. This century's rapid urban growth created enormous social, economic, and environmental problems.

We probably are more aware of the socio-economic consequences of urbanization and environmental issues related to water and air quality in our cities than we are of the effects of fragmented, highly disrupted habitats and the resulting loss in overall biodiversity in urban areas. However, the impact is well documented and immense.

The National Wildflower Research Center, from its early origins, has promoted the concept of replacing, where it has been lost, some of our natural heritage of native plants. We also promote initial conservation and enhancement of natural and seminatural areas. All of these efforts, in addition to preserving plant species, enhance wildlife habitat by providing food and nesting sites for animals that often are adapted specifically to particular native plant species or plant communities.

A number of cities have establish-

ed what are known as greenbelts, natural or semi-natural areas in and around the metropolitan area. These typically were established before expansion related to urban sprawl and represent steep slopes and canyons, or perhaps inland waterways that could not be built on. A number of cities now are attempting to establish such areas in a more systematic fashion for the purpose of habitat preservation, but how large they should be is a continuing question.

In the last several years, interest has developed in an area of study known as island biogeography and its relation to conservation biology. On a number of islands a smaller number of species is found than in a comparable, adjacent continental area. It's been noted that on these islands there are constant local extinctions, reintroductions, and new colonizations, the rates of which are related to the size of the island and its distance from the source of colonization. On small islands, extinction rates are higher and recolonization and new colonization rates are lower. At some point, the extinction rate and colonization rate reach equilibrium and the number of species remains relatively constant, although there is some flux in the individual species that make up that number.

How does this relate to conservation biology? Essentially all of our natural biological diversity—especially that in the urban regions of the world—is being maintained as "islands" of various-sized greenbelts and preserves in a sea of agricultural and urban development. Questions about the necessary minimum size of a reserve intended to preserve the biological resources of an area, and how closely spaced such preserves should be, remain unresolved.

Clearly, we must continue setting aside greenbelts and natural area preserves, and they must contain as large a representation of local plant diversity as possible. Further, we must practice sound land-management techniques that maximize the ecological stability of the preserves. As continued research focuses on these issues, the appropriate size, number, and relative proximities of such urban preserves can be more precisely determined.



John E. Averett, Ph.D., is director of research of the National Wildflower Research Center.

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Executive Director: *David K. Northington, Ph.D.*

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WILDFLOWER CENTER NEWS

The Center's Midwest Regional Office and the University of Wisconsin at Madison co-sponsored a one-day forum in March for individuals involved in native plant research. Midwestern faculties, agencies, and plant industry representatives were invited to discuss ongoing research and future trends. Participants discussed using wildflowers and native plants in projects such as mining reclamation, roadside plantings, erosion control, propagation, restoration, and alternative lawn establishment.

The Center's Board of Trustees has chosen Overland Partners, a San Antonio architectural firm, to design the Center's new headquarters, which will be built on a 37-acre site southwest of Austin. Opening for the new site tentatively is planned to open in 1994.

The Wildflower Center will celebrate its tenth anniversary Oct. 3 at the LBJ Ranch in Stonewall, Texas. Ticket prices for the gala will be announced soon, and proceeds will support the Center's education and research

programs. The party will feature a gourmet country-style buffet and live music. For more information, please contact the Development Department.

Board of Trustee members from across the country gathered in Austin the first weekend in May for the annual spring meeting. Topics discussed included the Capital Campaign, which is raising construction funds for the Center's new facility.

Dr. John Averett, director of research at the Wildflower Center, spoke to the Southwest Park and Recreation Training Institute in Kingston, Oklahoma, in February, on landscaping with wildflowers.

The Center and its grounds continue to be open to visitors from 10 a.m. to 4 p.m. Saturdays and Sundays through May 10, in addition to our year-round hours of 9 a.m. to 4 p.m. Monday through Friday. Please visit!

GROWTH CHAMBER SPROUTS NATIVE PLANT INFORMATION

How much heat or cold does a seed need to experience before it will germinate? How much light or darkness does a plant need to experience before it will flower?

The Wildflower Center's growth chamber helps unravel these mysteries. The growth chamber resembles a giant refrigerator with light and temperature controls. Inside the chamber, shelves hold plants or seed-filled petri dishes.

Temperatures in the growth chamber can range from 40 to 110 degrees Fahrenheit, and light intensity can range from darkness to a bright sunny day, depending on what settings staff Research Horticulturist Elinor Crank chooses for her studies.

Seeds are placed on petri dishes and placed in the growth chamber; then Elinor programs the chamber to provide light and dark and chilling or warming temperatures for a certain amount of time each day, simulating natural conditions. She takes the seeds out of the dishes when they germinate, making note of when they sprouted, because a germinated seedling takes up more space than an ungerminated seed. Removing the seedlings also helps keep the dishes free of mold.

When Elinor knows nothing of a specific species' germination requirements, she tries to ascertain what the conditions are like in the area where it grows naturally. Then she programs the growth chamber to match those conditions. For example, a shade-



At right: Elinor Crank examines a petri dish containing seeds undergoing a germination test in the growth chamber. Above: Seeds in the petri dishes are germinating.



loving plant might not germinate with light, or might need only a few hours of light. Elinor can set the growth chamber to have light for only a few hours and change the temperature from warm to cool.

The growth chamber also can be used to help determine whether seeds actually are alive by performing a tetrazolium (TZ) test. In a TZ test, the seed coat is excised from the seed itself. Then the seed is placed in a staining solution and placed in the growth chamber at 90 degrees Fahrenheit for several hours. If the seed is alive and could germinate, it will soak up the stain and turn red. If the seed is dead, it won't soak up the stain.

Elinor says the TZ test can help save time.

"If the germination of a batch of seeds was low, it could be because the seeds have some dormancy that is preventing germination. The seeds might be viable, but might not be germinating because their dormancy needs to be broken."

The TZ test tells whether there are more viable seeds than the germination test indicated. Having this information allows researchers to then proceed through various dormancy breaking procedures such as heat- or cold-treatments.

The Wildflower Center bought the growth chamber two years ago with a matching grant from the Texas Department of Agriculture. The chamber was first used in crop production research on Indian paintbrush (*Castilleja indivisa*).

Later, the chamber was used in a study to determine the germination requirements of ashy dogweed (*Thymophylla tephroleuca*), an endangered species.

"One of the greatest achievements we've had was in determining how to break the dormancy of ashy dogweed," Elinor says. "We increased germination rates by giving the seeds a heat-treatment. The more knowledge you have about a species, especially an endangered one, the greater the chances of saving it."

RESEARCH INTERN COUNTING ON EXPERIENCE

1 As part of her research internship at the National Wildflower Research Center, Flo Oxley has been counting the number of *Sophora secundiflora* (Texas mountain laurel) roots that show evidence of mycorrhizal fungi.

Although it can be tedious to look at hundreds of root sections and estimate the percentage of them that have been colonized by mycorrhizal fungi, Flo says the work can be interesting.

"I enjoy the lab work," she says, "especially when I can also do field research."

Mycorrhizal fungi form a symbiotic relationship with host plants, and can help the plant roots take up more water and offer some protection from plant pathogens, Flo says.

Flo's root counting is the continuation of a research project started last year by the Wildflower Center's research horticulturist, Elinor Crank, and former sabbatical researcher Dr. Mike Dana of Purdue University.

The project examines the relationship of fertilizer rates, rhizobium, and mycorrhizal development.

Flo Oxley, research intern, has been examining Texas mountain laurel roots for evidence of mycorrhizal fungi.



2 Researchers want to know what the optimum fertilization rate is for inducing the mycorrhizal association with *Sophora*.

The research internship program at the Wildflower Center was made possible through generous response to a special appeal to the membership last August.

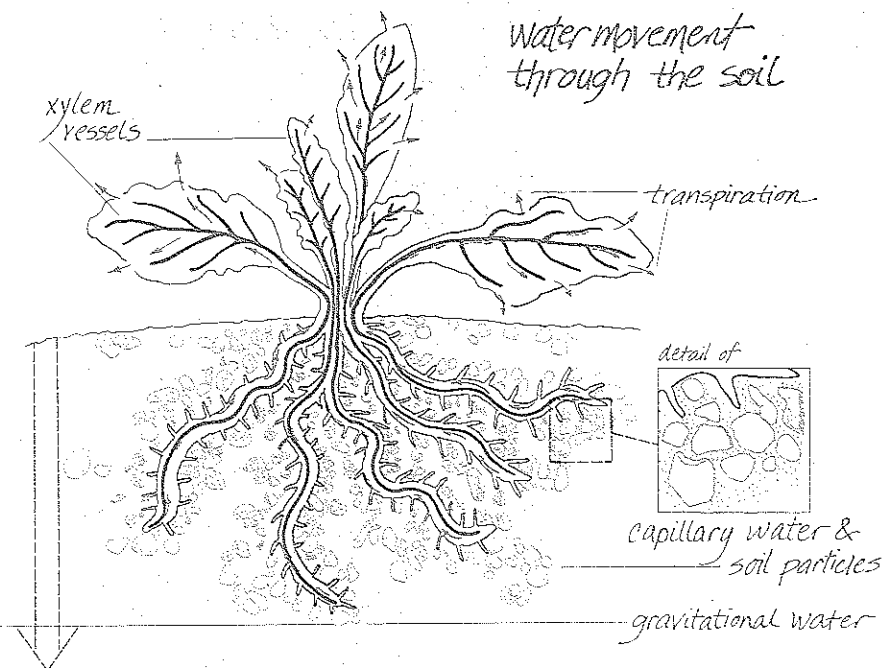
"This request for funds was the most successful project appeal ever made to the Wildflower Center's membership," says Mae Daniller, director of development. "We're very pleased that our members believe in our projects so strongly."

3 In addition to the mycorrhizal research, Flo is helping compile a list of coastal and dune plants for the Gulf states. The new recommended species list will be useful for dune restoration and coastal landscaping.

Flo earned her bachelor's in biology from Southwest Texas State University in San Marcos and expects to receive her master's in biology there this month. She has worked as a botany laboratory instructor at the school for several years, and hopes to embark on a research career when she graduates.

Water

(continued from page 1)



soils directly affect their water-holding capacity. While large amounts of water move readily through coarse-textured soils, clay soils tend to become saturated quickly with minimal water, forming an impervious layer. Dry soils absorb more water at a faster rate than moist soils.

Saturated soils inhibit root development in most plants, not necessarily due to excess water, but because of the lack of oxygen. Some species, however, can survive in water-logged soil for several months with only minimal effects, such as reduced growth. Other species may start to lose branches or die after being submerged a couple of weeks. In many climates, plants must adjust to conditions ranging from abundant rainfall to drought on a seasonal basis. Plants growing in well-drained, alluvial soils usually survive flooding better than those found in shallow, fine-textured soils.

Beth Anderson
Resource Botanist
National Wildflower Research Center

FROM THE F.I.E.L.D.

Statewide Wildflower Conference, May 1-2, Lawton, OK. Co-sponsored by the Oklahoma State Garden Clubs and the Oklahoma Dept. of Transportation. Contact: Oklahoma DOT Beautification Office, 200 NE 21st, Oklahoma City, OK 73105, (405) 521-4037.

Interface Between Ecology and Land Development in California, May 1-2, Los Angeles. Contact: Dr. Jon Keeley, Dept. of Biology, Occidental College, Los Angeles, CA 90041.

Florida Native Plant Society Spring Conference, May 1-3, St. Petersburg Beach, FL. Contact: Judith Buhrman, Pinellas Chapter, 4362-80th Ave. N, Pinellas Park, FL 34665, (813) 546-7661.

California Native Grass Association Educational Conference, May 2, Elkhorn Ranch, CA. Contact: Patricia Gouvya, CNGA, P.O. Box 566, Dixon, CA 95620.

Rare Day III, May 7, Rhode Island. Contact: Rhode Island Wild Plant Society, 12 Sanderson Rd., Smithfield, RI 02917-2606, (401) 949-0195.

Fourth Annual Wildflower Pilgrimage, May 14-16, The Ridges Sanctuary, Baileys Harbor, WI. Contact: P.O. Box 152, Baileys Harbor, WI 54202, (414) 839-2370.

Spring Conference on Coastal Prairies, May 22-23, Houston. Co-sponsored by the Gulf Coastal Prairies Foundation and the Native Prairies Association of Texas. Contact: George Levandoski, (713) 364-1090 or (713) 895-0700.

1992 Earth Day Summit (United Nations Conference on Environment and

Development), June 1-12, Rio de Janeiro. Contact: U.S. UNCED Coordination Center, 722 Jackson Pl. NW, Washington, DC 20503, (202) 399-3110.

Seventh Annual Wildflower Festival, June 14, Storrs, CT. Contact: Connecticut State Museum of Natural History, 75 N. Eagleville Rd., Storrs, CT. 06269-3023, (203) 486-4460.

Native Plants in the Landscape, June 25-27, Millersville, PA. Contact: Grace Evans, Continuing Education, 104 Dilworth Hall, Millersville University, Millersville, PA 17551, (717) 872-3030.

Crested Butte Wildflower Festival, July 6-13, Crested Butte, CO. Contact: CBWF, P.O. Box 216, Crested Butte, CO 81224, (800) 545-4505.

Send calendar information to the Editor, at address on back page.

WILDFLOWER OUTLOOK

The Wildflower Center's Texas Wildflower Hotline operates until May 31. The hotline, updated weekly, is a 5-minute recording detailing wildflower hot spots in the state. To access the hotline via a touch-tone telephone, call (512) 370-0000, and punch in 9500 after a short message.

The Red Butte Gardens in Utah operates its state hotline from April 1 to Oct. 31 each year. From April to September, the recording tells where to find wildflowers. From September to October, it tells where to find the best autumn leaf displays. Call (801) 581-5322.

The Theodore Payne Foundation in California operates its hotline until June 30. The recorded message, updated weekly, tells callers where the best wildflowers are located, within a day's drive of Los Angeles. Call (818) 768-3533.

(If we omitted your hotline, please contact the editor. We want to include you next year!)

tive trees, shrubs, wildflowers, and grasses that otherwise would be lost when land is cleared for development. The rescued plants find new homes in city parks, reducing the city's landscaping bill.

The American Gardener reports that Kane County, Ill., has passed a landscaping ordinance requiring developers to plant or restore "at least three native trees, shrubs, or vines of a caliber sufficient to assure survival and from a species appropriate to the existing edaphic and hydrological site conditions."

Sand dunes and their accompanying beach grasses in Ocean City, Md., are being restored thanks to a project by state, local, and federal agencies.

The sand dunes in Ocean City were destroyed by development 20 years ago so hotels and condominiums could be built — leaving the area vulnerable to severe Atlantic storms.

Sand was dredged from an offshore site and placed on the shore, creating 11.3 kilometers of dunes

that were planted with grasses to stabilize them.

Ecological Restoration and Management, Inc., of Towson, Md., planted the "new" dunes with American beachgrass (*Ammophila breviligulata*) and Atlantic coastal panic grass (*Panicum amarum* var. *amarulum*).

Center membership: A gift that keeps giving!

As a member of the National Wildflower Research Center, you enjoy many benefits, including:

- Six issues of this newsletter, plus two issues of our scientific publication, *Wildflower Journal*.
- Priority handling of information requests to our Clearinghouse.
- Free or reduced admission to more than 80 botanic gardens and arboreta across the nation.

Why not share all these benefits — and more — with a friend? Send your friend's name, your name, and \$25 to: Membership, NWRC, 2600 FM 973 N, Austin, TX 78725-4201.

The Arlington, Texas, Parks and Recreation Dept. has a plant rescue program to retrieve and replant na-

The Native Beauty of America Photo Contest

SPONSORED BY THE
NATIONAL WILDFLOWER RESEARCH CENTER

Winners of this exciting new photo contest will collect prize money—plus the First Place photo in each category will be featured in the Wildflower Center's traveling exhibit. Enter now!

PHOTO CONTEST RULES:

- 1 The photo contest has two categories: (1) Home or Commercial Native Plant Landscapes, and (2) Wildflower Vistas.
- 2 Slides must predominantly feature native plants, and the predominant plants in the photos must be identified.
- 3 Photos will be judged on technical quality (sharpness, correct exposure), composition, originality, and relevance to the "Native Beauty" theme. Photos will be judged by Wildflower Center staff members and a panel of photography experts. The decisions of the Wildflower Center and judges are final.
- 4 Entries must be submitted on duplicate 35 mm slides or duplicate slides from 35 mm prints. All entries must be postmarked no later than June 15, 1992.
- 5 Contestants may enter as many times as they wish, but must pay an entry fee for each entry submitted. Entry fee for current members is \$10; entry fee for non-members is \$15.
- 6 Prizes will be awarded for first, second, and third places in both categories. First Prize winners will receive \$250, Second Prize winners will receive \$150, and Third Prize winners will receive \$75. Winners will be notified by mail. To qualify to receive a prize, winners must sign an affidavit of eligibility and release. Employees and families of the National Wildflower Research Center and its judges are not eligible to enter.
- 7 All slides become the property of the National Wildflower Research Center, which may use the slides in its publications, educational programs, publicity efforts, and slide library. Contestants must know the names and addresses of any identifiable persons featured in the slides, who must also sign an affidavit of release without compensation. No slides will be returned. The National Wildflower Research Center cannot be responsible for lost, late, misdirected, damaged, or postage-due mail.
- 8 Mail your 35mm slide submission(s), fully completed entry blank, and a check or money order for the total entry fee (made payable to the National Wildflower Research Center) to: The Native Beauty of America Photo Contest, National Wildflower Research Center, 2600 FM 973 North, Austin, TX 78725-4201.

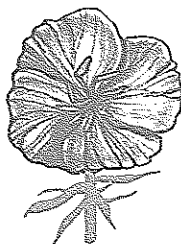
NAME: _____	DAYTIME PHONE NUMBER: (____) _____
ADDRESS: _____	
CITY: _____	STATE: _____ ZIP: _____
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NUMBER OF ENTRIES SUBMITTED: _____	TOTAL ENTRY FEE: _____

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