New Waves
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TAMU Hosts Conference on Environmental Policy, Rhetoric

Whenever important decisions have to be made about the environment or other critical issues, often people say something like this: "Let's stop talking and do something!" Recently, researchers from universities throughout the United States and Canada gathered at Texas A&M University (TAMU) to take a different approach to these issues. They tried to analyze, interpret, and better understand what United States Presidents have said about the environment and how that relates to what they have done about it.

In March, TAMU hosted the Third Annual Conference on Presidential Rhetoric. The conference was sponsored by the TAMU Program in Presidential Rhetoric (a research component of the Center for Presidential Studies and the George Bush School of Government and Public Service). Cosponsors include the Speech Communication Department, and the Center for Science and Technology Policy and Ethics.

Tarla Rai Peterson stands outside the George Bush Presidential Library, now under construction at Texas A&M University.

The conference covered a wide range of issues including environmental policies voiced by presidents from Theodore Roosevelt to Bill Clinton. Speakers at the meeting discussed such issues as the historical roots, ethics and social implications of U.S. environmental policy, environmental policy of the Clinton White House; and environmental speeches given by leaders of the Reagan, Nixon, Theodore Roosevelt and Franklin Roosevelt administrations.

"This conference explored relationships between presidential rhetoric and U.S. environmental policy," says Tarla Rai Peterson of the TAMU Speech Communication Department. "Presidents and other political leaders often send out mixed messages, especially about controversial issues such as the environment. We wanted to explore the communication processes whereby political leaders and members of the public try to influence each other. We discussed how individuals and groups craft messages to

persuade each other to support particular policies, as well as how political leaders try to convince the public that the policies they favor will achieve publicly held goals."

Conference participants also discussed the political implications of limiting the role of nongovernmental groups in political decision making, and examined the ethical implications of scientific rhetoric on environmental policy.

A book containing the full text of all featured speakers at the conference is now being developed and will be published by TAMU next year. For details, contact Tarla Rai Peterson at (409) 845-5563 or tarla@unix.tamu.edu.

TAMU Scientists Study Transport, Survival of Viruses in Groundwater Systems

What is the chance that groundwater supplies could become contaminated by viruses from leaking sewer lines, malfunctioning septic tanks, and contamination from waste disposal sites?

That's the question being investigated by a team of Texas A&M University (TAMU) System researchers. Lead scientists include Yavuz Corapcioglu of the TAMU Civil Engineering Department, Clyde Munster of the TAMU Agricultural Engineering Department, and Suresh Pillai of the TAMU Agricultural Research Center at El Paso. Graduate students participating in the study included Scot Dowd, Jason Vogel, and Sookun Wang.

Clyde Munster has been studying interactions between surface and groundwater near the Brazos River.

The project was titled "Field experiments and modeling of viral transport in groundwater." The objective was to compare model predictions with the results of field experiments. "This project demonstrated to us that field conditions in the real world are much more complicated than we expected. This is especially true in aquifers which are not uniform and have multiple layers of clay and other materials," Corapcioglu says. "A major finding is that viruses may present threats to groundwater quality, even though these risks may be relatively small in duration or area."

"We were excited to do this research," Munster says. "We already had a unique facility in place that lets us examine groundwater and surface water interactions that was already equipped for research, thanks to grants from TWRI and other sources. The problem is fascinating scientifically because the transport of viruses in groundwater is poorly understood. We need to increase our knowledge of viral pollution to better estimate human health risks."

The field research was conducted from 1994 to 1996 at the Brazos River floodplain research site, which has been instrumented for groundwater studies. The site, which was utilized for previous agricultural chemical transport studies funded by TWRI, is equipped with 10 well nests, an injection well, and a pumping well. Each well nest contains four monitoring wells, which are screened so that water samples can be taken at various depths that represent distinct segments of the aquifer.

The soil profile at the site consists of a clay surface, a sand and gravel aquifer that extends to a depth of 38 feet, and an impermeable shale formation that underlies the aquifer. The water table is typically 18 feet below the soil surface.

One way to classify viruses is by the hosts which they infect. Basic types of viruses infect such hosts as plants, animals and bacteria. Bacterial viruses are called bacteriophages. If deadly viruses (polio or Hepatitis A virus) or other enteroviruses were used in field experiments to determine their transport through groundwater, scientists would have to demonstrate a high degree of control to mitigate possible health effects. Instead, researchers often use bacteriophages as indicators of virus transport. Bacteriophages have been proven to be totally benign and non-toxic to humans and animals. Two bacteriophages, MS-2 and PRD-1, have been utilized in many field studies. "That's because their behavior in the environment is thought to closely resemble that of enteric viruses and they are inexpensive to use in field studies," Pillai says. Because these organisms are so benign, it is less difficult to gain regulatory approval to release them into the environment.

The research consisted of the following steps. First, mixtures of groundwater and MS-2 and PRD-1 were injected into the aquifer under "natural" and "forced" gradient conditions and were monitored as they flowed through the system. The "forced gradient" conditions simulated scenarios in which an aquifer was being pumped, while the "natural" case study reflects an aquifer undisturbed by pumping. Parameters including pH, electrical conductivity, and temperature were tested in the field. Major components of the research included groundwater sampling, the use of groundwater simulation models to assess viral transport and contamination risks, laboratory column studies, and viral testing and analyses.

What does the research suggest?

The study shows that bacteriophage levels under natural conditions peaked after roughly 20 days and later declined to natural levels, probably due to die-off, soil adsorption and microbiological processes. When the aquifer was in a forced gradient mode, virus levels reached their peak after only eight days, although they too soon declined to background levels.

"This suggests that heavy pumping, which produces forced gradient conditions, may make an aquifer more vulnerable to contamination by viruses, in part because of increased groundwater velocities," Munster says. "It may be especially important to monitor groundwater systems that are characterized by high levels of pumping that are

near virus sources for potential viral threats." Pillai says, "the study also indicated that the viral isoelectric point and dimensions are critical factors that ultimately dictate whether and how far viruses will move and how long they will remain viable."

This research was funded by the U.S. Environmental Protection Agency and the National Water Research Institute (NWRI), a private group from California.

For details, contact Munster at (409) 845-8793 or munster@agen.tamu.edu, Corapcioglu at (409) 845-9782 or yavuz@zeus.tamu.edu">yavuz@zeus.tamu.edu, or Pillai at (915) 859-9111 or s-Pillai@tamu.edu. Information about the project can also be obtained from the NWRI World Wide Web site at http://www.ucaccess.org/wow/rip/corapcio.htm or call them at (714) 378-3278.

Developing a Spatial Water Balance for Texas

Researchers: Seann Reed, David Maidment, and Jerome Patoux, Center for Research in Water Resources, University of Texas at Austin, Austin, TX.

Problem: Water availability is a critical problem in Texas. The amount of rainfall varies dramatically from arid West Texas to the rainy and swamp-like portions of East Texas. Rainfall levels also influence nonpoint source pollution and runoff. Understanding the various components of the hydrologic cycle (rainfall, evaporation, runoff and groundwater recharge) is critically important to improve management of water supplies.

Objectives: 1) To develop an improved understanding of the atmospheric, soil, surface and ground water components of the hydrologic cycle, and 2) to develop a mass water balance for Texas.

Methodology: Three independent water balance models were constructed to model the atmospheric water balance, the soil-water balance, and the surface water balance. The models were constructed using a geographic information system. The atmospheric water balance was constructed by developing an imaginary column that is confined horizontally by the boundary of the state of the Texas and extending to the 300 millibar pressure level. The soil-water balance was developed by creating 0.5deg. cells with a depth equal to the plant-extractable water capacity of the soil. The surface water balance was developed by utilizing data from 166 gaged watersheds of varying sizes and shapes. The atmospheric and surface water balances are simply mass balances based on empirical data and do not simulate physical processes. The soil-water balance attempts to simulate evaporation from the soil using a soil-moisture extraction formula. The atmospheric and soil-water balance models are time-varying, while the surface water balance model is steady-state and uses an empirical relationship to estimate mean annual runoff and evaporation in ungaged watersheds. An independent rainfall-runoff curve was developed to estimate runoff in ungaged areas. This rainfall-runoff curve represents runoff that is expected in the absence of reservoir evaporation, urbanization, recharge, and springflows. Because three independent water balance models were developed, the models can be checked against each other for consistency.

Results: The surface water balance has the least uncertainty and the greatest spatial resolution. Current atmospheric data do not seem to support accurate calculations of net moisture influx at the scale of the state of Texas on a monthly time scale, as attempted in this effort. The soil-water balance method utilized in this study is limited by the use of monthly data because of its overly simplified representation of land surface hydrology. Despite their weaknesses, the atmospheric and soil-water balance methods do provide information and insights that cannot be gleaned from the surface water balance alone. The surface water balance provides usable runoff maps for engineering and planning. It can be used to generate maps of runoff and evaporation for Texas on a 500-meter grid. Maps of actual and expected runoff were created for Texas. These maps show where man's activities most strongly influence runoff in Texas. Other maps created in this project display trends in agricultural diversions, large springflows, and complexities in stream networks.

Reference: Reed, S., D. Maidment, and J. Patoux, *Spatial Water Balance for Texas*, CRWR, UT Austin, 1997.

NOTE: The maps in the report and the data used to create these maps can be obtained in digital form on CD-ROM disks from the UT CRWR at (512) 471-3131. The information is also on the World Wide Web at http://www.ce.utexas.edu/prof/maidment/GISHydro/seann/texas/wbtexas.htm.

Demographics of Water Conservationists

Researchers: Roger Durand and Richard Allison, Environmental Management Department, University of Houston-Clear Lake, Houston, TX.

Problem: Water conservation is increasingly recognized as an essential element of urban water management programs. In the Houston area, conservation has taken on an added importance as a way to combat land subsidence. If water conservation programs are to be successful, information is needed about such factors as which socioeconomic groups favor conservation, which people within certain demographic populations are likely to conserve water, and the strategies different groups typically utilize. Sociodemographic information can be especially useful in determining the public's willingness to adopt specific conservation measures, and in targeting educational and retrofit programs to audiences that are most likely to participate.

Objectives: 1) To identify socioeconomic and sociodemographic characteristics associated with groups that conserve water, and 2) to identify policy implications of these trends.

Methodology: In 1992, 572 Houston residents were sampled as part of a study to estimate water savings derived from installing and using water-conserving residential retrofit plumbing devices. In the study, information was also collected about the demographics of these residents, if they felt water conservation was important, and if individuals had participated in water conservation actions during the past month. Demographic information that was collected included if individuals were buying or

renting homes, the number of people in the household, household income, the length of time they had lived in the house, and education of survey respondents. Volunteers were selected who could participate in the study over several months. Survey results were analyzed using the "Statistical Package for the Social Sciences."

Results: Half the survey respondents reported that water conservation was of "high importance" to them. Nearly half of people responding to the survey (47%) said they had taken water conserving-actions during the past month. The most common conservation measures included reducing indoor water use (17%), installing a water conservation device (17%), reducing exterior water use (9%), and fixing leaks or replumbing (5%). Only two demographic characteristics, income and education, were significantly related to feelings about water savings. Surprisingly, those with higher household incomes and more education reported that water savings were less important to them. There was no significant relationship between individual demographic characteristics and people who had taken any water-saving action during the past month. However, there were significant relationships between demographic characteristics and the recent use of specific water conserving activities. For example, households with higher incomes were less likely to reduce interior water use, while lower income households were more likely to reduce water use. Larger households were more likely to fix plumbing and repair leaks than small households. Finally, reducing interior water use and installing water conservation devices was more commonly used to save water than reducing exterior water use, fixing leaks or repairing plumbing.

Reference: Durand, R. and R. Allison, "Who Are Citizen Water Conservationists? A Demographic Profile," in *Proceedings of the American Water Resources Association Symposium on Water Management in Urban Areas*, Houston, TX, 1995.

Water Quality in Small Reservoirs in Central Texas

Researchers: Anne McFarland and Larry Hauck, Texas Institute for Applied Environmental Research, Tarleton State University, Stephenville, TX.

Problem: In the 1950s and 1960s, many small flood control reservoirs with capacities of less than 200 acre-feet were built under Public Law 566 (PL-566). These reservoirs are an important source of water quality information in Central Texas. In the region, many streams are intermittent and flow only during or shortly following storm events. The 40 PL-566 reservoirs in the region are a more permanent archive of water quality data because they retain much of the runoff that flows into them. Monitoring and analyzing water quality in these reservoirs may yield important clues about pollution trends in the region.

Objectives: 1) To gather and assess water quality in 8 of the 40 PL-566 reservoirs in the upper North Bosque watershed, and 2) to identify potential contributing sources to water quality concerns in those reservoirs.

Methodology: Eight PL-566 reservoirs were monitored monthly between August 1993 and August 1995. Samples were collected for dissolved oxygen, water temperature,

conductivity, pH, Secchi depth, nitrate-nitrogen, nitrite-nitrogen, ammonia, total Kjeldahl nitrogen, orthophosphate phosphorus, total phosphorus, biochemical oxygen demand, total suspended solids, chemical oxygen demand, and chlorophyll-a. Routine grab samples were collected monthly at three depths within each reservoir (one foot below the surface, mid-depth, and bottom sediments). Water quality characteristics were evaluated for variations with depth and seasonal trends within and between the 8 reservoirs. Relationships between reservoir water quality and land use patterns in the watersheds above each PL-566 reservoir were evaluated using correlation and regression analysis.

Results: Typically, higher nutrient concentrations were found in the summer than in the winter. Water quality in many reservoirs varied with depth, and these changes were most noticeable in the summer. Non-regulatory screening levels set by the Texas Natural Resource Conservation Commission were exceeded for orthophosphate-phosphorus and chlorophyll-a concentrations during the summer and winter in four of the eight reservoirs. The existence of accelerated eutrophication in some of the reservoirs was confirmed using trophic state indexes that rely on chlorophyll-a, total phosphorus, and Secchi depth. Prominent land uses in the drainage areas included rangeland, woodlands, forage fields and dairy waste application fields. The percent dairy application fields and dairy cow density showed strong positive correlations with many water quality parameters. This suggests that the percent of land area used for dairy waste application increases the nutrient levels, particularly of phosphorus, in nearby downstream reservoirs.

Reference: McFarland, A. and L. Hauck, National Pilot Project Report on the Water Quality of Eight PL-566 Reservoirs in the Upper North Bosque Watershed, TIAER, Tarleton State University, 1997.

NOTE: This report is available from TIAER at (817) 968-9567.

Modeling Playa Bottom Infiltration at the Pantex Plant

Researchers: David Thompson and Ken Rainwater, Civil Engineering Department, Texas Tech University, Lubbock, TX.

Problem: The Pantex plant, located near Amarillo, is operated by the U.S. Department of Energy (DOE) as a site to construct and dispose of weapons systems. There is concern that contaminants generated by work at the plant may have run off from the surface through playa lake bottom sediments into aquifers in the region. Recently, a DOE contract with the State of Texas was completed to assess potential groundwater contamination.

Objectives: To develop and test a numerical model that would simulate infiltration through playa sediments to groundwater supplies in the region.

Model Background and Development: In the modeling effort, playa lakes were treated as two-dimensional surfaces. The principle of continuity (conservation of mass) was applied to the playa to account for distribution of inflows to the playa and outflows from the playas. Differences between inflows and outflows represent the change of storage in

the playa. Inflows are direct precipitation on the playa surface and runoff from contributing watersheds. Outflows include evaporation and infiltration through playa bed sediments. The simulated timescale used in this modeling scenario is one day. A FORTRAN program, "WaterBalance," was written to solve the mass balance equation. The program was written in using a style developed by Donald Knuth at Stanford University called "literate programming," in which both the source code and descriptive text is included in a single file. WaterBalance requires that users provide data on precipitation, watershed runoff, estimates of evaporation and infiltration capacity, the amount of inflows and diversions, and a curve that represents stages, storage, and area. WaterBalance uses these values to compute the components of the governing equation for each day in the simulation period. Generally, watershed runoff and inflows or diversions are known quantities and can be input directly and precipitation is reported on a depth of water basis. Two infiltration capacities were used in the model -- one for the area wetted at the end of the preceding day and another for areas within the playa lake depression that are wetted during the daily computational period. Watershed runoff is assumed to be subject to infiltration before reaching the wetted area. At the end of each day, the playa lake stage is updated according to whether water accumulated in or was depleted from the playa. In general, the model consists of the following steps: 1) read parameters and initial variables; 2) set the initial stage; 3) if rainfall occurs, compute direct precipitation and infiltration; 4) compute evaporation; 5) compute bottom infiltration; 6) compare evaporation and bottom infiltration with lake storage; and 7) compute changes in storage; and 8) compute end of day storage.

Methodology: WaterBalance was applied to two Pantex playa lakes. A rainfall-runoff model was calibrated to site-specific measurements and long-term simulation was run to determine historical inflows to the playas. The U. S. Army Corps of Engineers model, STORM, was used to compute runoff from playa watersheds. Daily precipitation data was taken from the National Weather Service at Amarillo. The Penman method was used to compute potential evapotranspiration. Infiltration capacities were estimated from flooding infiltrometer tests and computations were executed for 1952-91. Although a wide range of infiltration values was reported (0.01 to 74 inches per hour), a "likely" range of infiltration rates (0.1 to 16.1 inches per hour) was used in the simulations.

Results and Discussion: For the first playa lake that was modeled,

computed infiltration ranged from 116,000 to 301,000 acre-inches from 1952 to 1991. This corresponds to a range of 1,500 watershed inches to 2,800 watershed inches of infiltration. For the second playa, 150 to 220 feet infiltration occurred over the period of record, which corresponds to 3.2 to 5.6 feet per year during the study period. When the porosity of sediments above the saturated zone of the Ogallala Aquifer are considered, the research suggests that sufficient infiltration has occurred during the simulation period to reach the saturated portions of the Ogallala Aquifer.

Reference: Thompson, D., and K. Rainwater, "A Model of Playa Bottom Infiltration at the Pantex Plant," *Proceedings from the 24th Water for Texas Conference*, TWRI, 1995.

Effect of Winds on the Generation of Coastal Waves

Researchers: Jun Zhang, C.G. Wibner, and Charles Cinotto, Civil Engineering Department, Texas A&M University, College Station, TX.

Problem: Many structures like seawalls and revetments are designed to protect coasts from the heavy offshore waves and the erosion they may cause. Most computations now used to design these structures are based on empirical formulations or studies of physical models. They typically do not include the impact of strong on-shore winds often associated with severe storms that create many of the forceful waves likely to cause erosion. Incorporating the impact of winds into wave modeling could result in a more accurate depiction of coastal erosion processes and could lead to better designs for coastal engineering structures.

Objectives: To quantify the effects of on-shore coastal winds on wave run-up heights and overtopping rates by measuring wave run-up heights and overtopping rates on sloped revetments for various wind velocities in a two-dimensional wind-wave flume.

Methodology: Experiments were conducted for a wide range of wave conditions, revetments of various slopes (1: 1.5, 1:3, and 1:5), smooth and rough surfaces, numerous crest elevations, and wind speeds ranging from 0 to 16 meters per second (m/s). Wind advection was tested for various water droplet sizes and flow rates. Water droplets were produced using hypodermic needles. The effect of wind speeds on water droplet transport was studied using three wind velocities. A sharp-crested weir was centered on a flume to produce a vertically falling sheet of water into a test section of a wind-wave flume. Water released from the weir was collected into divided basins. Run-up and overtopping tests were carried out for a variety of mechanically generated regular waves of different time periods and amplitudes. Revetments constructed of impermeable plywood were used to investigate the effects of slopes on wave run-up and overtopping. Experiments were conducted in a two-dimensional glass-walled wave tank that is 108' long, 3' wide, and 2' deep that is located in the TAMU Hydrodynamics Laboratory. Wave generation was controlled by an IBM PC interfaced to the wavemaker. Water elevations were measured using wave gauges, consisting of stainless steel rods. Wind speeds were measured using a static tube connected to a manometer and a anemometer.

Results: When winds were included in the simulations, significant increases in wave run-up and overtopping were observed for high wind speeds. Increases in wave run-up and overtopping were most significant at high wind speeds. For revetments with low crest-to-wave height ratios, overtopping is caused by waves that run up and overtop the structure. In this scenario, wave overtopping rates under the influence of strong winds can be 30% more than they would be if there were no winds. For revetments with high crest-to-wave height ratios, overtopping is mainly due to the advection of water droplets and wind-driven spray. In this case, overtopping rates under the influence of strong winds can be several orders of magnitude larger than if winds were absent. When wind speeds are constant, revetments with gentle slopes showed the least adverse effects from wave run-up and overtopping. This finding may be important when designing jetties and other revetments. The research suggests that gentle sloped revetments may be better able to

withstand increases in wave run-up and overtopping from strong on-shore and off-shore winds.

Reference: Zhang, J., C. Wibner, and C. Cinotto, *Experimental Studies of Wind Effects on Wave Run-Up and Overtopping of Revetments*, Texas Engineering Experiment Station, TAMU, College Station, TX, 1996.

BRA, Blackland Research Center Establish Water Quality Lab at Central Texas College

The Brazos River Authority (BRA) and the Texas Agricultural Experiment Station's Blackland Research Center (BRC) have signed a memorandum of understanding to establish a water quality laboratory at Central Texas College in Killeen.

The laboratory will serve as a teaching facility for CTC students. BRA contributed funds to help buy equipment for the laboratory. CTC will contribute space for the laboratory and BRC personnel will operate it.

BRA funds were used to help purchase an ion chromatograph to analyze water chemistry and other laboratory equipment, including fecal coliform analytical equipment, computer systems and software.

BRC, in addition to providing employees to operate the lab, plans to use the lab to analyze samples collected as part of its water quality projects in the area. BRC scientists are currently studying agricultural and military land management practices and their impact on water quality.

For details, contact Chip May of BRA at (817) 776-1441 or cmay@brazos.org, Bill Dugas of the BRC at (817) 770-6600 or dugas@brcsun0.tamu.edu.

Lamar Geologist Studies Fossils Along Ancient Texas Coast

A geologist at Lamar University is investigating paleontological sites throughout Texas and elsewhere to determine the extent of the prehistoric Texas coast and to identify animals and plants that were likely to have lived there. Jim Westgate of the Lamar Geology Department is the lead scientist in the project. Since 1984, he has taken many samples of fossils found in soils from the Lower Rio Grande Valley to East Texas.

Westgate has uncovered substantial evidence about coastal vertebrate species that lived along the prehistoric Texas coast roughly 35 to 45 million years ago. At that time, Westgate says the coastline would have stretched from Laredo to Crockett TX, and on to Memphis, TN, Jackson, MS, and Macon, GA. About 40 million years ago, sea levels suddenly dropped. When they rose again 1 million years later, the temperature of the Gulf declined by about 5deg. C , introducing great white sharks and abundant whale populations into the region. He is now trying to link this observed decline in Gulf temperatures with the onset of the glaciation of Antarctica which occurred in the same period.

Two of the most fruitful sites Westgate has investigated include Lake Casa Blanca, near Laredo, and the Brazos River, near Texas A&M University. At the sites, he has recovered ancient flora (spores, pollen, and leaves) and such fauna as turtles, oysters, crocodiles, lizards, and many others.

An article about his research at Lake Casa Blanca, "Eocene Forest Swamp," was published in the October 1994 issue of *National Geographic Research and Exploration*. For details, contact Westgate at (409) 880-8236 or westgate@aol.com.

Students from Lamar University collect paleontological samples near the Brazos River and Highway 21 in Brazos County.

West Texas A&M Studies Dryland Corn, Sorghum Production

Typically, grain sorghum is the crop most farmers in the Texas High Plains choose once they've decided to not irrigate and to utilize dryland farming methods. Recently, researchers at the Dryland Agriculture Institute at West Texas A&M University (WTAMU) used a computer simulation model to investigate whether corn may be a better dryland crop in parts of the region.

The project was conducted by Bobby Stewart, who directs the institute, WTAMU student Muhammad Akbar, and Clay Salisbury of the Texas A&M University Agricultural Research and Extension Center in Amarillo. The study was needed, Stewart says, because there has recently been substantial interest in producing corn under dryland methods. Little research has been conducted to study dryland corn yields in the region, so potential growers wanted more information.

The study used a computer simulation model, the Erosion Productivity Impact Calculator (EPIC), to simulate dryland sorghum and corn yields at sites throughout the southern High Plains. Study sites included Dimitt and Bushland, TX; Boise City, OK; Tribune, KS, and Akron, CO. Planting dates used in the simulations included April-May for corn and June for sorghum. It was assumed that soil moisture levels were 50% of the maximum possible.

Stewart says the results are revealing. For example, average sorghum yields were higher in the south, while average corn yields were higher in the north. Since grain sorghum is often planted later, it benefits from later rains that typically occur in the southern plains but are not common further north. Perhaps the most important part of the study concerns greater risks associated with growing corn at all sites. Grain sorghum produced higher yields than corn at all sites during dry years when total water use (seasonal rainfall plus

stored soil water) was less than 17 inches per year. Simulated corn yields were greater than grain sorghum yields when total water use was more than 17 inches per year.

For details, contact Stewart at (806) 656-2299 or bstewart@wtamu.edu.

Rice U. "Texas Survey" Shows Environmental Concerns Rise

Environmental pollution concerns among Texans rose dramatically during the past two years, and there is a consensus about the need to protect the global environment, according to the 1996 Texas Environmental Survey, which was conducted by Rice University.

"The proportion of Texans believing that pollution is `not much of a problem' in their area declined from 61% in 1994 to 54% in 1996," said Stephen Klineberg of the Sociology Department, who has conducted the biennial survey since 1990. "The respondents in the latest survey were consistently more likely than in 1994 to be concerned about air and water pollution, and about the management of hazardous wastes and exposure to dangerous substances, both in their own communities and in the state of Texas. The data clearly indicate that generalized concerns about environmental pollution have increased substantially in Texas during the past two years."

Survey interviews were conducted in Spanish and English from November to December 1996. A representative sample of 1,001 Texans from across the state participated in the interviews. The questions focused on a wide variety of issues relating both to environmental concerns and political issues.

Some other highlights of the 1996 survey include the following: 1) Only 44% of respondents in this year's survey were prepared to pay $200 more each year for things they buy if price increases were the result of new pollution controls. That figure was 54% in 1994 and 63% in 1990. 2) Texans are more reluctant than ever to support any increase in taxes to pay for greater pollution controls. The majority of respondents in the 1996 survey are no longer in favor, as they were in previous surveys, of new taxes on coal and oil consumption in order to reduce emissions thought to cause global warming. 3) 65% agreed that "environmental improvements will create more jobs and help the economy."

"Most striking," Klineberg said, "is that Texans today are more concerned than ever before about threats to the global environment." Only 39% in the 1996 survey (down from 43 percent in 1994) agree that "people worry too much about threats to the global environment." By a margin of 60 percent to 34 percent, Texans today reject the claim that "plants and animals exist primarily to be used by humans."

Copies of the survey are available by contacting Phil Montgomery of the Rice University News Office at (713) 831-4795 or at pmontgom@ruf.rice.edu. Klineberg can be contacted at 713-527-8101 or slk@rice.edu.

Texas Tech Studies New Applications for Doppler Radar

Dark clouds forming an anvil shape on the horizon could be a harbinger for a potentially dangerous tornado, meteorologists know. But what damage could the severe weather cause? Accurately predicting the impact of such storms is one goal of researchers in the Institute for Disaster Research at Texas Tech University (TTU).

Doug Smith of the Civil Engineering Department at TTU, is developing a model that will allow weather watchers to predict potential damage to property before a storm arrives. This program should be completed within two years. Texas Tech researchers use recordings from Doppler radar systems and correlate them with damage observed from the storm models.

The new computerized system will give emergency managers and insurance companies and other private sectors a way to simulate a severe storm like Hurricane Andrew and be able to predict the damage the storm might cause. Representatives of such groups could then have an appropriate emergency management plan in place as a storm approaches.

Doppler radar allows meteorologists to obtain a three-dimensional view of a storm from the inside out. It provides a more complete weather outlook and aids forecasters in issuing more precise severe weather warnings.

For details, Smith at (806) 742-3476 or fmdas@ttacs.ttu.edu. This research was recently featured on the World Wide Web site operated by the TTU News and Information Office. The URL is http://www.ttu.edu/newspubs/doppler.htm.

TAMU Plans Strategy to Revitalize Texas Rice Industry

Facing unprecedented challenges to its viability, the Texas rice industry used February's Texas Agricultural and Natural Resources Rice Summit to adopt an action plan for dealing with its most critical issues.

The summit met in February in Houston and quickly focused on developing action plans. Speakers described several challenges, including declining rice acreage in Texas, potential loss of milling and refining infrastructure, limited future water supplies, and legislation that encourages some landowners to take rice land out of production.

Texas had 249,000 acres of rice land in 1996, down from more than 600,000 acres in the 1980s, said Steve Balas, a member of the Texas Rice Producers Board and the summit's co-chair.

After the morning's speakers, four breakout groups focused on such issues as markets and marketing; production efficiency; tenant, landlord and infrastructure issues; and water, wildlife and environmental issues.

Some of the suggested actions that resulted from the meeting included developing a Texas rice office to aid in market information and education dissemination, increasing Texas rice yields while maintaining high quality, reducing production costs, reducing the

need for pesticide applications, maximizing the benefits of water, wildlife and the environment to the rice industry, and determining the impacts of rice production on the environment.

For more information about the Rice Summit or rice irrigation, contact Jim Stansel of the Texas A&M University Agricultural Research and Extension Center at Beaumont at (409) 752-2741.

Rice U. Proceedings Focuses on Sustainability

A proceedings that focuses on many issues relating to sustainable development has recently been published by Rice University. The proceedings, *Sustainable Development -- Managing the Transition*, contains papers presented at an international conference that met at Rice U. March 3-5, 1997. The proceedings was published by Environmental and Energy Systems Institute (EESI) at Rice University, which is led by Hanadi Rifai.

Broad subject areas covered in the proceedings describe 21st Century challenges, achieving ethical and equitable leadership, scientific issues and uncertainty in decision making, market tools to achieve sustainability, stakeholder empowerment, dispute resolution, and how institutions and individuals can provide leadership to development environmentally sustainable policies.

To obtain a copy of the proceedings or for more information, contact EESI at Rice U. at 713/ 527-4700 or eesi@rice.edu.

Texas A&M Scientist Writes Book on Agricultural Ethics

A book about agricultural ethics has been written by a Texas A&M University researcher.

The book, *The Spirit of the Soil: Agriculture and Environmental Ethics*, was written by Paul Thompson, who is Director of the Center for Biotechnology, Policy and Ethics, and a researcher in the Philosophy, Humanities, and Agricultural Economics departments at Texas A & M University. He has taught and written extensively on agricultural and environmental ethics.

The book examines environmental problems in industrial agriculture and challenges environmentalists to think more deeply about the ethical dimensions of agriculture's impact on the environment. It considers such problems as the use of chemical pesticides and biotechnology from an ethical perspective. Chapters of the book cover such topics as the ethics of the soil, environmental critics of agriculture, the productionist paradigm, agricultural stewardship and the good farmer, calculating the true cost of food, the holistic alternative, and sustainable agriculture.

You can contact Thompson at (409) 845-5434 p-thompson@tamu.edu. or The book can be ordered from Rutledge Press at (800) 865-5840.

Irrigation Water Quality Handbook Available from TWRI

A new handbook with information on irrigation water quality standards and salinity management strategies for agricultural production has been published by the Texas Agricultural Extension Service (TAEX).

The handbook, *Irrigation Water Quality Standards and Salinity Management Strategies* (B-1667), was written by Guy Fipps, an irrigation specialist with the TAEX. It was published by TAEX.

The report describes such issues as water analysis, types of salinity problems, how to classify irrigation water and salt-affected soils, water quality effects on plants and crop yield, leaching for salinity management, subsurface drainage, seed placement, and other salinity management techniques. Also included are 15 tables that describe the kinds of salts normally found in irrigation waters, recommended limits for salts in reclaimed water, soil salinity levels for different crops and many other issues.

Individual copies of the report are available free from TWRI while supplies last at twri@tamu.edu or 409/ 845-1851. Fipps can be contacted at (409) 845-3977 or g-fipps@tamu.edu.

TAES Scientist Writes Book Chapter on Salt-Tolerant Plants

A new book on plants that grow in the saline conditions called halophytes includes a chapter by a Texas Agricultural Experiment Station scientist. The book, *Halophytes and Biosaline Agriculture*, was edited by Redouane Choukr-Allah, Clive Malcolm and Atef Hamdy. It includes comprehensive information on the biology, biogeography, ecophysiology, productivity, and utilization of halophytes.

Chapters of the book cover such topics as the biology and ecophysiology of halophytes, agromanagement of halophytes, irrigation of halophytes, national studies, and economic aspects. Seiichi Miyamoto, a scientist who was studied salinity problems in agriculture for many years and who works for TAES in El Paso, wrote a chapter titled "Salt Tolerance, Water Use, and Potential Irrigation Scheduling of Halophytes."

The book can be purchased from Marcel Dekker, Inc., by calling (800) 228-1160. You can contact Miyamoto at (915) 859-9111 or s-miyamoto@tamu.edu.

TAMU Scientists Co-Author Book on Paleoclimatology

Two Texas A&M University (TAMU) scientists have co-authored a new book on paleoclimatology. The book, *Paleoclimatology*, was co-authored by Thomas Crowley of the TAMU Oceanography Department and Gerald North of the Meteorology Department.

Book chapters cover include an introduction to climate models, quaternary climates, pre-quaternary climates, and a summary and synthesis. The book provides perspectives on such issues as greenhouse warming, reconstructing and modeling the climate of the last 20,000 years, and historical climate fluctuations.

The book was published as an Oxford Monograph on Geology and Geophysics (#18). It can be purchased by calling (800) 451-7556. You can contact North at (409) 845-8083 or northead@ariel.tamu.edu.

TNRCC Publishes Reports on Water Rights, Groundwater

The Texas Natural Resources Conservation Commission (TNRCC) has published many new reports on such topics as water rights, groundwater protection, and other issues.

Surface Water Rights in Texas -- How They Work and What to Do When They Don't describes the legal framework for determining a priority of water use during a drought, and describes the types of surface water rights, the permit process, and the TNRCC Watermaster program. This report is available on-line at http://www.tnrcc.state.tx.us/admin/topdoc/gi/228/.

The Texas Groundwater Program Directory was published by the TNRCC in October 1996. It contains information on general hydrologic principles that affect groundwater, the Texas Groundwater Protection Committee, and summaries of groundwater programs of the TNRCC and other agencies. The Groundwater Yellow Pages provide key contacts for many topics pertaining to groundwater including agricultural chemicals, aquaculture, and nitrate contamination. Appendices provide contacts at various agencies, maps of major and minor Texas aquifers, the Texas groundwater protection policy, and internet addresses for state and federal agencies.

For more details on these or other publications, contact the TNRCC Publications Office at (512) 239-0028 or puborder@tnrcc.state.tx.us.

Extensive Texas Water Data Available in New USGS Reports

Extensive data on Texas' water resources and other reports have recently been published by the U.S. Geological Survey (USGS).

Water Resources Data, Texas, Water Year 1996 is a four-volume set that includes comprehensive data on flows, peak discharges, floods, and groundwater levels from many Texas sites. Volumes 1 - 3 describe surface water conditions, while Volume 4 contains groundwater data. The reports were compiled by S. Gandara, W. Gibbons, F. Andrews, R. Jones, and D. Barbie.

Some of the other reports published recently by the USGS Texas District include the following: *Geologic Framework and Hydrogeologic Characteristics of the Edwards Aquifer Outcrop (Barton Springs Segment), Northeastern Hays and Southwestern Travis Counties, Texas,* by T. Small, J. Hanson, and N. Hauwert (WRIR 96-4306); *Hydrogeologic Factors that Affect the Flowpath of Water in Selected Zones of the Edwards Aquifer, San Antonio Region, Texas,* by G. Groshen (WRIR 96-4046); and *Simulation of Storm Peaks and Volumes for Selected Subbasins in the West Fork Trinity River Basin Above Lake Worth, Texas,* by T. Raines (WRIR 96-4110).

For more information about these or other USGS reports, contact the USGS Texas District at (512) 873-3064.

UTMSI Book Examines Reproduction, Physiology of Fish

A new book on factors influencing fish reproduction has recently been published by the University of Texas Marine Science Institute (MSI) at Port Aransas.

The book, *Reproductive Physiology of Fis*h, was edited by F.W. Goetz and Peter Thomas of UTMSI. It contains papers that were presented at Fifth International Symposium on Reproductive Physiology of Fish that met at UTMSI in 1995. Major sections of the book deal with such topics as environmental influences on reproduction, aquaculture, reproductive life history, behavior, gonadal physiology, and other topics.

The book can be purchased from UTMSI at (512) 749-6723 or ruth@utmsi.zo.utexas.edu.

TAMUK Geologist Develops Hands-On Education Tools for K-12 Students

A Texas A&M University-Kingsville (TAMUK) researcher has created a popular series of geoscience lesson plans for 3-12 grade earth science teachers and an easily understood "soda bottle hydrology" demonstration technique for classrooms use. The projects were developed by Thomas McGehee of the TAMUK Geosciences Department and Terrence and Catherine Cavanaugh of the U.S. Department of Energy (DOE).

Tom McGehee demonstrates groundwater protection to South Texas students.

"School children can actually see groundwater and contaminants infiltrating the soil with this simple hands-on activity," said McGehee. "The exercise helps children understand how dumping used auto oil in the backyard can seep into groundwaters and pollute water resources."

For the past five years, McGehee and TAMUK graduate and undergraduate students have traveled to Oak Ridge, TN each summer to work on DOE environmental cleanup projects. The summer work gives students hands-on experience that amplifies classroom lectures and spawned new case histories about environmental cleanup that McGehee incorporated into his courses at TAMUK.

While at Oak Ridge, McGehee also initiated evening classes in hydrogeology and groundwater modeling for students, faculty, and DOE professionals collaborating on the cleanup projects. An environmental education brochure that resulted from McGehee's work describes how to conduct the classroom demonstration and is available through the DOE Environmental Management (EM) Information Office.

The soda bottle hydrology exercise is accessible on the Internet at http://www.coedu.usf.edu/~tcavanau/sodabottle/bottle.htm. For more information, contact McGehee at (512) 593-3795 or kftlm00@tamuk.edu.

UNT Studies Impact of Chloride Control on Lake Texoma

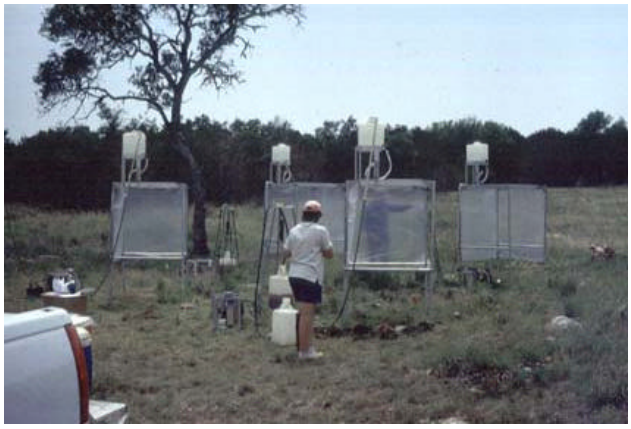
How will the Red River Chloride Control Project, which is being proposed by the U.S. Army Corps of Engineers, affect water quality in Lake Texoma? That's the focus of studies now being conducted at the University of North Texas.

The research is being conducted through the UNT Institute of Applied Sciences (IAS), which is directed by Ken Dickson. Lead scientists in the study include Tom Waller and Sam Atkinson and graduate students Gerald Clyde, Jessica Franks, and David Rolbiecki.

The research consists of two phases. Water quality at many sites in the lake, which straddles the Texas-Oklahoma border, is being monitored to determine if the project could adversely affect natural resources and aquatic species at the lake. Water quality information is being gathered on a suite of physical, chemical, and biological parameters to develop baseline information. A focus of this effort involves measuring the spatial and temporal variation of chlorides and sulfates in the lake. In the future, these baseline data can be compared to changes in water quality that occur after the project is implemented. Studies are also underway to determine the spatial and temporal variation of phytoplankton and zooplankton in the lake. Zooplankton samples are being collected monthly from 16 sites at 5 zones throughout the lake. The relationships between phytoplankton and zooplankton populations and physical/ chemical data are being assessed.

For details, contact Dickson at (817) 565-2694 or dickson@cas.unt.edu.

TAMU Investigates Environmental Effects of Brush Control



For many years, water managers have realized the importance of brush control as a means to increase water yields. The benefits of removing such nuisance brush species as mesquite and juniper are obvious -- clearing brush frees up water supplies needed by more efficient grasses and forage plants, and will likely increase the amount of water that runs off these sites and replenishes streams and groundwater supplies. Relatively little is known about the water quality impacts of brush control practices. A project now being conducted by researchers in the Rangeland Ecology and Management Department at Texas A&M University (TAMU) is evaluating the impact of commonly used brush clearing techniques on chemical and sediment yields.

Bob Knight of TAMU is the lead scientist on the project. The study, which is being conducted on field plots in Blanco and Llano counties, is sponsored by the Lower Colorado River Authority and the Texas State Soil and Water Conservation Board. Other cooperating agencies include the U.S. Department of Agriculture/ Natural Resource Conservation Service, and the U.S. Environmental Protection Agency.

Several methods will be used to remove nuisance brush species from plots in the region, including slashing, bulldozing, and piling as well as the use of agricultural chemicals like picloram. The amount of runoff that results from the use of these methods will be measured in the field through the use of rainfall simulators. The amount and quality of runoff will also be monitored off-site. Knight says the project will be useful to scientists, policy makers, and range managers. "Everyone wants to control brush and make rangelands more productive," he says, "but no one wants to risk environmental damage when doing so."

For details, contact Knight at (409) 845-5557 or rknight@rlem.tamu.edu.

UT LBJ School Evaluates Economics of Rice Irrigation

Policy analysts at the University of Texas at Austin (UT) recently completed a comprehensive study to determine water demands for rice irrigation in two water districts in the lower Colorado River.

The study, titled "Estimation of derived demand for surface water on two rice irrigation districts in the Lower Colorado River basin," was led by Martin Schultz of the UT Lyndon B. Johnson School of Public Affairs. Participants include David Eaton of the LBJ School, Peter Wilcoxen of the UT Economics Department, and Quentin Martin and Jobaid Kabir of the Lower Colorado River Authority.

Phases of the project included developing and utilizing statistical methods to determine the value of water for rice irrigation, developing extensive background information on rice irrigation districts in the region, and examining irrigation efficiency in Texas rice fields. The researchers also developed a linear programming model to estimate derived demands for rice irrigation. They calculated the value of water to rice irrigation districts, the value of indirect subsidies to farmers, the potential savings that could be accomplished through average cost pricing, and the price elasticity of irrigation water demands.

The study estimates the potential benefit of alternative water conservation practices in rice irrigation. While some farming operations are efficient, others could become more efficient by adopting better technologies. Investments in technology and on-farm water conservation can reduce basin-wide costs that arise from the current assignment of water rights.

A report describing this project was recently published by the UT LBJ School and can be purchased by contacting the publications office at (512)-471-4218 or pubsinfo@uts.cc.utexas.edu. For details about the project, call Schultz or Eaton at (512)

471-4962 or e-mail Schultz at lpje152@bongo.cc.utexas.edu or Eaton at eaton@mail.utexas.edu.

Rice University Scientists Investigate Ways to Control Scaling, Corrosion in Water, Wastewater Pipelines

When harmful deposits of naturally occurring radioactive materials (NORMs) build up inside mains and pipelines used for water and wastewater distribution, they can slow the volume of fluids moving in these systems to a mere trickle. Innovative research at Rice University is investigating a variety of methods to detect the accumulation of these materials and to remove them. The project leaders are researchers Mason Tomson, Amy Kan, Shiliang He, and Lynn Frostman of the Environmental Science and Engineering Department.

Lynn Frostman and Shiliang He display NORM build-up in this pipe.

In Texas, NORMs that commonly that build up in pipes include barium sulfate, strontium sulfate, and trace amounts of precipitated radium. NORMs are a problem in many pipelines, including those used for oil and gas production as well as public works. The thrust of the studies is to investigate and test chemicals that will inhibit the build-up of materials that cause scaling, to construct mathematical equations that predict what effect inhibitors will have on scale formation, and to develop user friendly computer software that people can use to decide which inhibitor is best for their situation.

Tomson says this ongoing research project has resulted in many useful management strategies and products to control the accumulation of NORMs. For example, chemical inhibitors including phosphonates, polyacrylates, and co-polymers have shown promise in keeping pipes relatively clear and flowing. A computer package developed by Tomson, "ScaleSoft," is commercially available. It allows users to predict scaling potentials, design efficient treatments, and predict the efficiency and ultimate fate of chemical inhibitors.

The work is sponsored by the Rice University Brine Chemistry Consortium. For details, contact Tomson at (713) 527-6048 or mtomson@rice.edu.

UT SPH Studies Lower Rio Grande Valley Birth Defects

There may be no easy answer as to why some babies are born on the Texas-Mexico border with a fatal birth defect, but Irina Cech, a researcher of environmental sciences at the University of Texas-Houston School of Public Health, hopes to find solutions.

Cech has been awarded a grant by the Agency for Toxic Substances and Disease Registry to research the number of babies born near the Texas-Mexico border with anencephaly. The number of such births is much greater than the national average. Anencephaly is a neural tube defect (NTD) characterized by an underdeveloped brain and incomplete formation of the skull. Most infants with anencephaly are stillborn or survive only a few hours after birth.

Until recently, anencephaly was quite rare in the U.S., but from 1986-91 an anencephaly rate of 13 per 10,000 live births was reported in Cameron County by the Texas Department of Health. That rate was four times greater than the national average. During 1990-91 the rate increased to 19.7 per 10,000 births, and other southwest Texas border counties have recorded increases.

"We are going on the assumption that one thing is not to blame for this increase in neural tube defects," Cech says. ""We are probing the possibility that exposure to chemicals, such as those found near hazardous waste sites, are one of many risk factors for NTDs," she said. Parents of children born with NTDs will be asked to complete a survey in which they will answer questions about environmental, occupational and genetic factors that may have contributed to the development of anencephaly. The research team will collect air, water and soil samples at the sites where the affected families lived during the first trimester of pregnancy.

For more information, contact Cech at (713) 500-9227 or cech@utsph.sph.uth.tmc.edu.

USGS Texas District Uses WWW to Distribute Water Resources Information

The U.S. Geological Survey (USGS) Texas District is working to make a variety of water-related resources available to the public through the World Wide Web (WWW).

Many of the USGS efforts are led by James Bisese, who is the webmaster for the district, and USGS hydrologist Marshall Jennings.

Some of the most useful products available at the USGS WWW site include on-line hydrologic databases about such topics as current hydrologic conditions (updated daily), data on peak discharges, water quality data for South Texas, and the 1995 surface and ground water data reports. The site contains abstracts for USGS reports about Texas since 1994, a bibliography of the Edwards Aquifer, and special publications on such topics as the geology and hydrology of the Barton Springs segment of the Edwards Aquifer, a fact sheet describing the 1996 drought, and descriptions of flood frequency in Texas watersheds and recent floods in the Nueces River watershed.

Both Jennings and Bisese made presentations at the Texas WWW Water Users Group which met in December at Texas A&M University. The URL for the USGS WWW site is http://txwww.cr.usgs.gov/. For more information, call the USGS Austin office at (512) 873-3002 or e-mail Bisese at jabisese@usgs.gov.

TAMU Entomologist Creates Digital Dragonflies

A World Wide Web site created by an entomologist at the Texas A&M University Agricultural Research and Extension Center in Stephenville is attracting attention from scientists who study aquatic insects, people who love artistic color photographs, and water quality professionals.

The site, "Digital Dragonflies," was developed by Forrest Mitchell of TAMU-Stephenville. Mitchell says the idea for the site originated when he recognized the difficulties and limitations of collecting physical specimens of dragonflies. Typically, when dragonflies are dried and stored they lose their distinctive colorings and become fragile, brittle, and difficult to work with.

This dragonfly is a skimmer from the family Libellulidae.

As an alternative, Mitchell created an innovative method in which dragonflies are collected and then stored live in refrigerators at temperatures that prevent them from becoming overly active and flying away. Mitchell then removes them from the refrigerated environment, places the dragonflies on a flatbed scanner, and creates a rich, 24-bit color image using commercially available photography editing software. Later, the images are placed on the WWW site.

Mitchell says there are many advantages to this new method of cataloging these insects. "The biggest advantage is that dragonflies are full of distinctive color patterns and markings when they are first collected. You can take advantage of the colorations to identify individual species if you have reference photographs to compare your specimen to." Other unexpected benefits have also resulted from the project. For example, Mitchell says some scientists are using the digital photos to measure the width and length of many species. He often gets e-mail from individuals who know nothing about insects, but who adore the great looking photographs.

Mitchell has worked for several years to study relationships between aquatic insects and water quality. The most important part of the project for water managers may be that you can tell a lot about the water quality in a stream or creek by identifying if pollution-tolerant dragonflies are found there. He is also developing an on-line library that will contain comprehensive information on life histories, ranges, and water quality tolerances of many species as well as color photographs.

Digital dragonflies is on the WWW at http://www.our-town.com/dragonfly/Welcome.html. For more information, contact Mitchell at (817) 968-4144 or f-mitchell@tamu.edu.

UT Scientist Incorporates Research, Teaching into WWW

A scientist at the University of Texas at Austin is actively working to incorporate many aspects of his water-related research and teaching activities into the World Wide Web (WWW).

David Maidment is a researcher in the UT Civil Engineering Department. One of his projects involved creating and posting a variety of course materials and tutorials designed specifically for the WWW. He also encourages his students to publish the results of class projects and graduate theses and dissertations on the WWW.

Recently, he's published many research reports on his WWW site in both HTML and Adobe Acrobat format. Some of the research projects on the WWW site include the spatial water balance of Texas (mentioned in the abstracts section of this newsletter), spatial hydrologic data for the City of Austin, agrichemical transport in the Midwestern United States, and a water balance of Africa.

Maidment presented information on these projects at a Texas WWW Water Users Group meeting at Texas A&M University in December 1996. The URL for Maidment's home page is http://www.ce.utexas.edu/prof/maidment/GISHydro/. For details, contact Maidment at (512) 471-4620 or maidment@crwr.utexas.edu.

Sabine River Authority Puts Interactive Maps on the WWW

The Sabine River Authority (SRA) is working with a private vendor of geographic information systems (GIS) in a pilot project that allows users to access and make queries of interactive maps showing watersheds in much of East Texas.

The project leader is SRA webmaster Jim Brown. The work is being done in cooperation with the Environmental Systems Research Institute, Inc., which develops GIS software packages like ArcInfo, ArcView, and the MapObjects Internet Map Server.

Demonstration areas on the SRA World Wide Web (WWW) site include maps of the Sabine River basin, Orange County, and remotely sensed images for many East Texas sites. The sites were programmed with a WWW software package "MacCafe," which is a "Java applet." The site lets users select key features within watersheds such as streams,

lakes, and county boundaries, zoom in and zoom out, and print and download items of interest.

"We think this project is a great idea," Brown says, "because this technology combines the access of the WWW with the searchable and interactive nature of GIS. We want to assess whether new software packages like MapObjects may be a better way for us to share information from large data sets about hydrology and orthoimagery on the WWW." In the future, SRA hopes to add many additional interactive features to the WWW site.

This project was presented at the 1997 Texas Clean Rivers Program State of the Basins meeting in San Antonio on April 10, 1997.

For more information, you can access the SRA WWW site at http://www.sra.dst.tx.us/ or contact Brown at jbrown@sra.dst.tx.us.