New Waves
The Research Newsletter of the Texas Water Resources Institute
Volume 14, Number 1, June 2001

TWRI Mills Program Funds 10 TAMU Graduate Students for 2001-2002

The Texas Water Resources Institute (TWRI) recently awarded 10 scholarships to assist graduate students at Texas A&M University.

The scholarships are funded by the W.C. Mills Scholarships, which were established by Mills Cox in 1967. The Mills Scholarships enhance water resources and hydrologic research at TAMU. Each scholarship provides $1,000 for the 2001–2002 academic year. The TWRI Mills Scholarship program can be used to recruit or retain outstanding graduate students who pursue water resources careers at TAMU.

"We feel very good about this year's Mills Program," said TWRI Director C. Allan Jones. "The TAMU faculty provided us with an excellent pool of graduate students from a wide range of disciplines including civil and agricultural engineering, soil and crop sciences, wildlife and fisheries sciences, geology and geosciences, and urban and regional planning."

The following students were selected for the Mills Scholarship Program for 2001-2002; TWRI has a page that contains up-to-date information on the work of the Mills recipients.

- Amanda Richmond, Soil and Crop Sciences Department. Richmond will evaluate on-site wastewater treatment systems that will produce secondary treated effluents that can be reused and recycled. Her chairman is Rick Weaver.
- Mary Bhuthimethee, Wildlife and Fisheries Sciences Department. Her research will focus on the use of sentinel fish species to determine how non-point pollutant sources affect how parasites attack fish. Work in the San Antonio River basin will examine if the presence of parasites on fish can provide insights into water quality issues. Her chairman is Norman Dronen.
- Matt Wagner, Urban and Regional Planning Department. Wagner is investigating the use of water marketing strategies to preserve riparian habitat and protect open spaces. His co-chairmen are Ron Kaiser of the Recreation, Parks, and Tourism Sciences Department and Jon Rodiek of the Landscape Architecture and Urban Planning Department.

- Christine Burgess, Wildlife and Fisheries Science. Burgess will be studying instream flow needs and fish assemblages at sites on the South Sulphur River where new reservoirs have been proposed. Her chairman is Fran Gelwick.
- Vance Weynand, Agricultural Engineering Department. Weynand will evaluate the long-term use and effectiveness of drip emitters to apply treated effluents from on-site wastewater treatment systems. His chairman is Bruce Lesikar.
- Graciela Lake, Geology and Geophysics. The emphasis of her studies will be to investigate the bioavailability and residence time of arsenic in the watersheds of the Nueces and San Antonio rivers. Her chairman is Bruce Herbert.
- Richard Hoffpauir, Civil Engineering Department. Hoffpauir is working to expand the capability of the Water Rights Analysis Program (WRAP) software to simulate how salinity affects water availability and reliability. His chairman is Ralph Wurbs.
- Raymond Li, Wildlife and Fisheries Sciences Department. His graduate work will focus on assessing the instream flow needs as well as fish assemblages in the Brazos River near the site of the proposed Allen's Creek Reservoir. His chairman is Fran Gelwick.
- Melissa Roberts, Geology and Geophysics Department. Her research will examine how arsenic and selenium are sequestered in the watersheds of the San Antonio and Nueces rivers, and whether organic arsenic species produced by microbes may affect the mobility and toxicity of arsenic. Her chairman is Bruce Herbert.
- Brooke Moore, Civil Engineering Department. Moore will study issues pertaining to the design of water and wastewater treatment plants. Her chairman is Timothy Kramer.
- F. John Hay, Soil and Crop Sciences Dept. TAMU Researcher/ Faculty member is Don Vietor, Soil and Crop Sciences Dept., TAMU

Hay recently earned a BS from the University of Nebraska. At TAMU, he is pursuing an MS in Soil and Crop Sciences. His research will focus on the fate of soil nutrients and carbon on largely agricultural watersheds. Hay will work with Vietor and Clyde Munster of the TAMU Ag Engineering Department in a comprehensive study to determine how growing sod and turfgrass from composted manure may improve water quality in impaired watersheds. The sod and turfgrass will be grown using composted dairy wastes from Central Texas. Later, the sod, turfgrass, and compost will be marketed to urban areas as landscape amendements.

The study will examine nitrogen and phosphorus runoff from landscapes that turfgrasses and landscape plants grown with composted manure, as well as related issues that may affect air quality. BTW, I have the printed form of his application letter, but not an elctronic version.

Increasing Agricultural Water Conservation in the Rio Grande is the Goal of TWRI, TAMU, NMSU Project

A $3 million grant to improve irrigation efficiency and agricultural and urban water conservation throughout the Rio Grande watershed is being coordinated by the Texas Water Resources Institute (TWRI).

The Congressionally-funded project involves research and extension professionals from the Texas A&M University (TAMU) System Agriculture Program and New Mexico State University. TAMUS Agricultural Program activities in this project will be coordinated by TWRI Executive Director Bill Harris. Other partners include the U.S. Bureau of Reclamation, the Texas Water Development Board, the U.S. Department of Agriculture Natural Resource Conservation Service, and local and county governments.

"In this area, which is perennially impacted by water shortages, it is essential that regional, state, and federal agencies work together with local groups to make the most efficient use of available water," Harris said.

TWRI Director C. Allan Jones said this project will provide strategies that can be used by all parties that rely on water resources in the region. "If we can develop a system that encourages agricultural and municipal water conservation in a coordinated manner, everyone will benefit."

The project, which began in June 2001 through 2004, involves nine major tasks. Working with irrigation district managers, project personnel will examine the water use efficiency of local agencies and provide education and training to their personnel. Institutional incentives for efficient water use will be explored. On-farm technologies to make irrigation systems more efficient will be tested. Opportunities to boost water conservation in urban landscapes will be identified. Other aspects of the project are to investigate environmental and ecological issues of area watersheds, to assess the potential use of saline and reused waters, and to model the hydrology of the region. TWRI will coordinate the work of this team to provide project oversight and responsibility and to communicate results of these efforts.

Lead TAMU researchers in this study include Ari Michelsen, Naomi Assadian, Seiichi Miyamoto, Zhuping Sheng and Howari Fares of the TAMU Agricultural Research and Extension Center at El Paso, and Bob Wiedenfeld, Paul Colaizzi, and John Robinson of the TAMU Agricultural Research and Extension Center at Weslaco. Other participants include John Ellis, Ron Lacewell, Ed Rister of the TAMU Agricultural Economics Department, Jim Gilley of the TAMU Agricultural Engineering Department, Richard White and Gene Taylor of the Soil and Crop Sciences Department, and Suresh Pillai of the Poultry Science Department. Other scientists located at agricultural research centers throughout Texas include Giovanni Piccinni and Keith Owens of the TAMU Agricultural Research and Extension Center at Uvalde, and Raul Cabrera of the TAMU Agricultural Research and Extension Center at Dallas, Raghavan Srinivasan of the Spatial Sciences

Laboratory, and Ranjan Muttiah of the Blackland Research and Extension Center at Temple.

TAMU extension personnel who will play key roles in this project include Bruce Lesikar and Guy Fipps of the Agricultural Engineering Department, Mark McFarland and Monty Dozier of the Soil and Crop Sciences Department, Mike Masser and Neal Wilkins of Wildlife and Fisheries Sciences Department, and Janie Harris of the Family Development and Resource Management unit. Other participating Extension Service personnel include Charles Stichler of the TAMU Agricultural Research and Extension Center in Uvalde, and El Paso County agents Ruben Saldana , Ray Bader, and Daphne Richards.

Studying the Feasibility of Brush Management to Increase Water Yields in Eight Texas Watersheds

Researchers: J. Richard Conner, Texas A&M University (TAMU) Agricultural Economics Department, Joel Bach, TAMU Rangeland Ecology and Management Department, Ranjan Muttiah, Wes Rosenthal, and Bill Dugas, Texas Agricultural Experiment Station (TAES) Blackland Research and Extension Center (BREC), Temple, TX, Steven Bednarz and Tim Dybala, U.S. Department of Agriculture Natural Resource Conservation Service (USDA/ NRCS), Temple, TX, and Jeff Arnold, U.S. Department of Agricultural Research Service (USDA/ ARS), Temple, TX.

Problem: A growing statewide population, increased water demands, and the occurrence of frequent droughts have all prompted policy makers to consider measures to increase water supplies, including brush control. In 1999, the Texas Legislature funded research to study the extent to which brush control may increase water yields in eight Texas watersheds. Such studies would give policy makers more information to consider whether such brush control strategies may be feasible in specific regions or watersheds.

Objectives: 1) To predict the effect of brush control on water yields in eight Texas watersheds; 2) To prioritize sites within each watershed that may have the greatest potential to increase water yields; 3) To determine the benefits and costs of controlling brush in each of the eight watersheds; and 4) To assess the impact of brush control on wildlife habitat and livestock production in rangelands.

Methods: The river basins that were examined in this study cover the Canadian River, watersheds over the recharge zone of the Edwards Aquifer, the Frio River, the Main Concho River, the Nueces River, the Pedernales River, Twin Buttes Reservoir/ Lake Nasworthy, the Upper Colorado River, and the Wichita River. With the exception of the Canadian River watershed, the sites where brush control was simulated typically receive at least 18 inches of rainfall annually. The Soil Water Assessment Tool (SWAT) was used to predict the impact of climate and brush control on water yields in each watershed. The U.S. Geological Survey Digital Elevation Model (DEM) was employed to describe the surface topography of each basin. Daily precipitation totals and other meteorological data were obtained from the National Weather Service. Soils data were compiled mainly from two NRCS databases - the Computer Based Mapping System and the State Soil Geographic System. Land use and land cover were developed by classifying Landsat-7 satellite data. Landsat-7 carries an enhanced thematic mapper device that creates high resolution images of the Earth's surface. NRCS field staff collected field information for more than 1,100 control points on the ground. Using the ground control points and the satellite data, the research team classified sites within each watershed into the following land uses: heavy brush (species such as cedar, mesquite, and oak make up more than 30% of all vegetation when viewed from overhead), moderate brush (10 to 30%), light brush (less than 10%), open range, cropland, water resources, barren lands, and urban areas. Watersheds were divided into sub-basins and hydrologic units, based on the extent of uniform land uses and soil types. Inputs to SWAT were adjusted slightly until the predicted flow from the model matched the measured flow at the USGS stream gauges. Once input data had been developed, the researchers used the SWAT model to estimate surface runoff, the amount of water stored in shallow aquifers, water losses in stream channels, and the growth of range plants and grasses. Economic analyses were based on estimated costs of different brush control options, compared to estimated benefits that ranchers and landowners would receive. Brush control costs included initial and follow-up treatments required to reduce brush canopy to 3% to 8%, and maintain it at this level for 10 years. The state's cost-share was estimated by subtracting the present value of rancher benefits from the present value of the total cost of brush control programs. The total cost of creating additional water supplies was determined by dividing the total state cost-share (if all eligible acres were enrolled) by the total water estimated to result from brush control measures.

Results: Watersheds with the highest concentration of specific land uses include heavy brush (the Canadian River, 69%), light brush (Twin Buttes Reservoir/ Lake Nasworthy, 31%), open range (the Pedernales River, 16%), and cropland (the Main Concho River, 26%). The number of sub-basins in each basin varied greatly ranging from 312 in the Canadian River to five in the area where the Hondo River crosses the Edwards Aquifer recharge zone. Water yield is the sum of surface runoff and groundwater flow from the land surface before it enters the stream channel network. Increases in average annual water yield resulting from brush control ranged from 0.04 acre feet (AF) per treated acre in the Canadian River watershed to 0.5 AF per treated acre in the Medina River watershed. Annual gains in streamflows were estimated as low as 0.02 AF per treated acre in the Upper Colorado watershed to 0.5 AF per treated acre in the Medina River watershed. There was a high correlation between increases in streamflow and precipitation. Watersheds with higher average annual rainfall generally had greater streamflow increases. Economic analyses show that the present value of total brush control costs ranged from $33 to $159 per acre. Rancher benefits, based on the present value of the improved net returns to typical cattle, sheep, goat, and wildlife enterprises, ranged from $9 to $55 per acre. Present values of the state cost-share ranged from $21 to $138 per acre. The cost of added water for the eight watersheds ranged from $16 to $204 per acre-foot, when averaged between the eight watersheds.

Reference: Conner, J., J. Bach, S. Bednarz, T. Dybala, R. Muttiah, W. Rosenthal, B. Dugas, and J. Arnold. *Brush Management/ Water Yield Feasibility Studies for Eight Watersheds in Texas*, 2001. This report was co-published by the Texas Water Resources Institute as TR-181 and the BREC as Report 01-01.

Economic and Hydrologic Implications of Drought Management Measures for the Rio Grande Watershed

Researchers: Frank Ward, J. Phillip King, and J. Thomas McGuckin, Agricultural Economics Department, New Mexico State University; Robert Young and Marshall Frasier, Agriculture and Resource Economics Department, Colorado State University; Ronald Lacewell and John Ellis, Agricultural Economics Department, Texas A&M University; Raghavan Srinivasan, Texas Agricultural Experiment Station; Charles DuMars, University of New Mexico Law School; and James Booker, the Natural Resources Law Center, University of Colorado.

Problem: The portion of the Rio Grande Basin that extends from its headwaters in Colorado into New Mexico and Texas is governed by a 1938 compact. The region is often arid and faces increasing demands for water resulting from population and economic growth and environmental water needs. It is likely, if not inevitable, that a severe drought will affect this region and cause significant economic damage. Coordinated management strategies are needed to deal with droughts that affect substantial portions of the Rio Grande watershed and that may affect Texas, New Mexico, and Colorado.

Objectives: 1) To test whether new interstate institutions that coordinate surface water withdrawals and reservoir operations could reduce economic losses from droughts; 2) To identify hydrologic and economic impacts of possible changes in management institutions that cope with droughts.

Methods: A mathematical model was developed to keep track of economic benefits, subject to hydrologic and institutional constraints. The modeling approach reflects the highly variable and stochastic supplies of the Rio Grande as well as fluctuating water demands. The project incorporated the hydrologic connection between groundwater pumping and flows of the Rio Grande into the model. The 1938 Rio Grande Compact was built into the model to ensure that institutional constraints were included in the simulations. The model was solved with General Algebraic Modeling System optimization software. Water supplies and flows in the watershed were represented in a yearly time-step over a 44-year planning horizon. Agricultural water uses were identified, including those in the El Paso Irrigation District. Municipal water demands in El Paso were represented. Total economic benefits were calculated for long-run normal inflows and a sequence of droughts, based on historical inflows from 1942 to 1985. Total drought damages were computed as the reduction in future economic benefits that would occur if flows dropped from average levels of 1.57 million acre-feet (MAF) per year to 1.4 MAF in drought years. Three water development and management scenarios were evaluated: 1) Increasing carryover storage at Elephant Butte Reservoir in New Mexico by reducing releases to downstream areas, 2) Investments in irrigation efficiency in the Middle Rio Grande Conservancy District in New Mexico, and 3) Constructing an additional 10,000 acre-feet (AF) of reservoir storage in northern New Mexico above Cochiti Lake.

Results: Long-term annual average drought damages were estimated at $8 million for Texas, $5.8 million for Colorado, and $3.4 million for New Mexico (about $101 per AF reductions in water supplies). Increasing reservoir storage at Elephant Butte created a $433,000 annual loss for Texas and a $200,000 annual deficit for New Mexico. Improving irrigation efficiency in the Middle Rio Grande District resulted in a $15,000 annual benefit for Texas and a projected $7,000 annual gain for New Mexico. The cost of implementing improved irrigation technologies would have to be very low to justify these investments economically. Creating additional reservoir storage at Cochiti Lake would create an annual benefit of $685,000 for Texas and an estimated gain of $134,000 per year for New Mexico. This project demonstrates how optimization models can be utilized to evaluate the hydrologic and economic implications of multi-state water management measures. The report suggests this type of model may be especially useful, if it can be expanded to include a mass surface water balance for the region, can better simulate groundwater pumping and return flows, and can include refined estimates of environmental needs and water use.

Reference: Ward, F., R. Young, R. Lacewell, J. King, M. Frasier, J. *McGuckin, C. DuMars, J. Booker, J. Ellis, and R. Srinivasan, Institutional Adjustments for Coping with Prolonged and Severe Drought in the Rio Grande Basin*, New Mexico Water Resources Research Institute (NMWRRI) technical report (TR) 317, February 2001.

Relationships Between Dryland Farming Practices and Hay and Sorghum Quality and Yields

Researchers: Curtis P. Walton and Bobby Stewart, Dryland Agriculture Institute, West Texas AA&Mamp;M University (WTAMU), and Norbert Chirase, WTAMU and the Texas Agricultural Experiment Station.

Problem: Throughout much of the Texas High Plains, water levels in the Ogallala Aquifer are declining. As a result, farmers in several parts of the region are considering growing crops under dryland or rainfed conditions. One strategy that is receiving particular attention is growing grain sorghum for forage or silage - not grain. When growing sorghum for silage, farmers are less dependent on stored soil water or late-season rains in order to fill the grain. More research is needed on specific practical strategies farmers in the High Plains can use to grow sorghum for silage.

Objectives: 1) To determine the yield and quality of grain sorghum and forage sorghum as a function of growth stage; and 2) To assess the consequences of dryland farming strategies on water use in these crops.

Methods: The research was conducted near the WTAMU campus at Canyon. It consisted of four fields planted to forage or silage sorghum and three fields of grain sorghum. Some of the fields had been left fallow while others were continuously cropped. From 38 to 120 days after planting, the yield, above-ground biomass, crude protein percentage, and soluble fiber of grain sorghum were measured. Similar measurements were made of forage sorghum between 53 and 100 days after planting. Water use and soil moisture levels were measured throughout the project.

Results and Discussion: In general terms, there is a definite tradeoff between forage quality and yield. Harvesting the crop too soon results in a high quality crop with poor yields. In contrast, delaying the harvest will produce maximum yields of poor quality silage. The research also shows that forage yield is closely related to water use. When growing sorghum for forage, a high population of plants grown in narrowly-spaced rows will best exploit soil moisture. If enough water is available, this should result in a fairly high yield and good quality silage, since the plants will use the available water before forming a head. Farmers should also consider planting sorghum for silage at a later date than they would start grain sorghum production. Later planting dates may allow farmers to take advantage of early summer rains that can replenish supplies of water stored in the soil. Harvest dates can be largely determined by when plants have utilized stored water in the soil to a depth of 4 feet.

Reference: Walton, C.P., B.A. Stewart, and N. Chirase, *Yield and Quality of Dryland Sorghum Silage or Hay as a Function of Growth Stage*, Research Report 99-1, Dryland Agriculture Institute, WTAMU, 1999.

Note: For more information, contact the WTAMU Dryland Agriculture Institute at http://www.wtamu.edu/research/dryland/ or (806) 651-2299, or Stewart at Bstewart@mail.wtamu.edu.

Monitoring Pollution Fluxes During Storm Events in a Fort Worth Watershed

Researchers: Attila Lazar and Michael Slattery, Geology Department, Texas Christian University (TCU), Fort Worth, TX.

Problem: Many regulatory entities, including the U.S. Environmental Protection Agency (EPA), have urged that additional monitoring of river and stream water quality needs to be undertaken. The need is especially great in rural areas where few monitoring sites now exist. Water quality monitoring efforts, especially those that capture data during storm events, can provide significant insights into how various land uses contribute to nonpoint source pollution.

Objectives: 1) To compare the pollutant load of two headwater streams to determine the effects of land use on contaminant fluxes; 2) To quantify pollutant loads and exports from these streams; and 3) To determine the temporal and spatial variability of these pollutant loads during storm events and periods with little runoff.

Methods: A 6-month field study was conducted in the headwaters of Sycamore Creek, which is a small tributary of the Trinity River. The Creek is located south of downtown Fort Worth near the TCU campus. One tributary of Sycamore Creek drains urban lands, while another contributing stream flows through agricultural grazing and pasture lands. The research site covers an area of 24 square miles. Stream gaging stations were established on each tributary slightly upstream of their confluence with Sycamore Creek. Automated water samplers were installed at each station and were programmed to collect data only during storm events. Flow data were also collected automatically and were used to plot the hydrology of the site. Rainfall data were obtained through the use of a tipping bucket. Spatial samples were manually gathered at nine other sites throughout the basin during storm events and periods of low flow. Water quality data were collected for such parameters as pH, dissolved oxygen, water temperature, specific conductivity, and phosphorus. Turbidity data were obtained with the use of a multiprobe, and were used to estimate suspended solids levels throughout the watershed. Water quality samples were analyzed at a TCU lab for ammonia nitrogen, nitrate plus nitrite, and total dissolved phosphorus.

Results and Discussion: The pollution dynamics of these two subwatersheds were distinctly different during the study period. The tributary that received urban runoff carried as much as 50% more suspended sediments than the watershed that drained agricultural lands. Higher sediment rates within the urban watershed appear to have resulted from the existence of highly erodible sites, such as construction areas and unstable stream channel banks. The urban tributary exhibited high ammonium levels during storm events, as well as elevated levels of nitrate plus nitrite in low-flow periods. In the rural subwatershed, orthophosphate levels were higher than those in the urbanized watershed during storm events. Throughout the watershed, pollutants seemed to be generated in response to sporadic, localized inputs. Research results suggest that best management practices (BMPs) may have to be implemented at large landscaped areas such as public parks in the urbanized subwatershed in order to treat nitrogen, phosphorus, and suspended solids. In the rural watershed, BMPs may be needed near subdivisions.

Reference: Lazar, A., *Storm Based Monitoring of Pollutant Fluxes on Upper Sycamore Creek*, Fort Worth, Texas, M.S. Thesis, TCU, 1999.

Note: For more information, contact Slattery at (817) 257-7506 or m.slattery@tcu.edu.

Evaluating Drip Irrigation Systems Used for On-Site Wastewater Treatment Along the Texas Gulf Coast

Researchers: Andrew Ernest, Krishna Pavananadan, and Alondra Barnes, Environmental Engineering Department, and Duane Gardiner, Agronomy and Resource Sciences Department, Texas AA&Mamp;M University-Kingsville (TAMUK). Kingsville, TX.

Problem: Typically, septic tanks and drainfields are used for on-site wastewater treatment. However, these conventional systems often fail when placed in challenging environments, especially those sites with heavy clay soils. Drip irrigation has been proposed as an alternate disposal method for sites where conventional systems will not function properly. However, much more needs to be done to investigate the actual field performance of these systems, especially at sites along the Texas Gulf Coast and other areas that are plagued by heavy clay soils that shrink and swell.

Objectives: 1) To evaluate the performance of on-site wastewater systems (OSSFs) along the Texas Gulf Coast that utilize drip irrigation to dispose of effluents in clay soils; 2) To analyze reasons these systems may fail; 3) To recommend improvements to these systems; and 4) To identify specific areas where future research is needed.

Methods: A total of 18 sites were selected for this study, based on soil types, geographical features, and effluent characteristics. The sites were located in Orange, Tyler, Hardin, Fort Bend, Shelby, and Jasper counties. Most of the systems (15 sites) treated domestic wastewater, although systems serving a post office and service station were also studied. Landowners and county health officials were interviewed to develop background information on these systems. Soils at each site were analyzed for clay content, texture, shrink-swell tendencies, bulk density, and soil moisture. Effluents were obtained through the use of lysimeters, and were tested for chemical oxygen demand (COD), five-day biochemical oxygen demand (BOD-5), pH, total phosphorus, total Kjeldahl nitrogen (TKN), nitrate, total suspended solids (TSS), and fecal coliform populations. Wastewater flows were estimated based on the total number of occupants or bedrooms. Permeability tests were used to determine the hydraulic conductivity of soils at different sites. Multiple regression analyses were carried out to determine the relationships between system failures, loading rates, and soil features.

Results and Discussion: The clay content of soils ranged from 5% to 40%, while the shrink-swell capacity of soils varied from 0 to 11%. Measured pH levels ranged from 6.2 to 7.8. OSSF systems at these sites removed 23% to 79% of COD, 0 to 68% of BOD-5, 62% to 88% of total phosphorus, and 77% to 100% of TKN. Reductions in nitrate levels ranged from 60% to 100%, fecal coliforms were reduced 14% to 94%, and TSS levels were lessened 90% to 100%. The research suggests that the quality of treated effluent is more dependent on COD loading rates than the clay content or shrink-swell characteristics of soils. There was also a correlation between increased clay content of soils and improved OSSF treatment. The researchers suggest that OSSF treatment by drip irrigation systems in clay soils can be improved by adding filters for pretreatment to existing systems. They also recommend that existing systems should be inspected every four or five years to ensure they are still operating properly, and that education should be increased to help homeowners better manage their systems.

Reference: Ernest, A., D. Gardiner, K. Pavananadan, and A. Barnes, *Evaluation of Existing Subsurface Drip Irrigation Systems in the Texas Coastal Plains*, 2000. This report was submitted to the Texas On-Site Wastewater Treatment Research Council (TOWTRC). Ernest can be contacted at (361) 593-3041 or a-ernest@tamu.edu.

Research by TAES ,USDA,Suggests that High Temperatures May Influence Herbicide Efficiency

Research on the Texas High Plains suggests that it may be critically important for farmers to check the thermometer before applying certain herbicides. Lead scientists in this effort are James Mahan, a researcher with the U.S. Department of Agriculture Research Service at Lubbock, and Peter Dotray, who holds a joint appointment with the Texas Tech University Plant and Soil Science Department and the Texas Agricultural Experiment Station.

During the past two years, Mahan and Dotray studied whether the effectiveness of a pesticide, Staple, may be influenced by the temperature at the time the herbicide was applied. Staple is a herbicide applied to cotton to control a number of annual broadleaf weeds, including pigweed. In basic terms, Staple stresses pigweed by inhibiting an enzyme which produces amino acids. If the amino acid production can be minimized, the pigweed becomes stressed and dies.

The research suggests that Staple performs best when it is applied at temperatures ranging from 68 and 93 degrees F. On the other hand, spraying weeds with Staple when temperatures are too hot or cold is like throwing the chemical away. "There's a zero gain, or no positive effect, when you apply Staple when the temperature is too high," Mahan says. "The pesticide is likely not to work when it is applied when environmental conditions are not right." Additionally, if the initial pesticide application fails, it is probable that the weeds will have grown to the point that Staple can no longer control them. In this situation, application of another herbicide may be needed in order to achieve weed control. Thus, a farmer might needlessly incur higher input costs and perhaps introducing a greater volume of potential contaminants into the environment.

Mahan suggests that agricultural producers would be wise to check the short-term weather forecast before applying Staple to see which days will likely have the optimal temperatures. They may also want to consider applying the herbicide early in the morning, before temperatures increase. Currently, the researchers are also evaluating other pesticides to see if their efficiency may also be related to temperatures.

For details, contact Mahan at (806) 749-5560 or jmahan@lbk.ars.usda.gov, or Dotray at (806) 742-1634 or P-dotray@tamu.edu.

Texas Tech Researchers Work to Lessen Foul Odors from High Plains Hog Farms

Researchers in the Texas Tech University (TTU) College of Agricultural Sciences and Natural Resources are developing a way to eliminate the stink surrounding the hog industry. Literally. Texas Tech animal science department researchers are raising pigs in what is called a "Sustainable Pork" production system. The animals are reared under conditions that are more friendly to the environment, the community, the workers and the animals. The system may allow small and mid-size pork producers to participate more successfully in the industry.

The project brings together production technology, environmental stewardship and training to alleviate some of the problems faced by the pork industry. According to researcher John McGlone, who is the director of the TTU Pork Industry Institute, the major complaint that conventional hog farms face is that these sites smell bad. "Secondly, traditional pig farms have a certain low risk of polluting rivers, streams, and lakes," McGlone said. "If the pigs are at a health risk, they will require more antibiotics."

TTU researchers have found solutions in raising pigs outdoors. Unlike conventional American pig farms, which are usually comprised of a system of large indoor buildings that house the animals, waste lagoons, poor air quality and polluting runoff, the Sustainable Pork system works as an environmentally friendly cyclical system. "A properly run outdoor unit has the advantage of being environmentally friendly because it will have animal populations that are low enough to allow growth of native or planted vegetation. When vegetation can grow during operations, the site will not have an offensive odor or a runoff of manure," McGlone said. "The future growth of the industry will be in a manner that is friendly to the environment - both air and water, the animals and the local communities."

The acreage is divided into sections, called "radials." The radial design makes sow movement and farm worker efforts more efficient. There are separate radials for breeding, gestation, birthing, and new plant growth. Each radial contains an arc-shaped hut in which the pigs sleep and find shelter from inclement weather. Because the pigs are moved from radial to radial, the waste products are spread around the land naturally. The nutrients then return to the soil, and the natural grass renews itself, creating more forage for the next cycle.

The comparative simplicity and cost of the initial set up for "Sustainable Pork" production may also allow more small, mid-size and younger producers to enter into the hog farming industry. McGlone says the initial cost of getting into the outdoor production business is one-third that of starting a conventional indoor hog farm.

"With the proper topography and climate, which we have here on the South Plains, farmers can realize the ability to develop a major pork market niche that can make them competitive in both the national and international pork markets," said McGlone.

To learn more, contact McGlone at (806) 742-2826 or access the institute's website at http://www.pii.ttu.edu.

Using Membrane Filters Along the Border to Treat Drinking Water is Aim of UH Research

In several small communities along the Rio Grande on the Texas-Mexico border, there is no guarantee there will always be adequate drinking water. In these communities, there often are not enough resources to economically provide safe drinking water, wastewater treatment, and electricity to area residents. In emergencies, providing safe drinking water can be a major challenge.

Providing small towns along the border with safe drinking water is the goal of an investigation by Dennis Clifford and Shankar Chellam of the University of Houston (UH) Civil Engineering Department. The researchers are working to evaluate and develop membrane-based drinking water treatment systems that could be especially useful for rural areas along the Rio Grande.

"A goal of this project is to provide a way for communities along the Texas-Mexico border to provide emergency drinking water using alternate energy sources," Chellam says. "The project aims to protect public health from acute risks associated with exposure to a variety of pathogens and bacteria, including E. coli, Giardia, and Cryptosporidium," he said.

The membrane technologies being evaluated in this study include microfilitration (MF), ultrafiltration (UF), and nanofiltration (NF). Microfilters remove particulates larger than 0.1 micron in diameter, while ultrafilters trap particles bigger than 0.01 micron in diameter. Meanwhile, nanofilters can treat even smaller particles that are only 0.001 micron in diameter.

Clifford and Chellam are currently testing the performance of each type of filter to see how well they remove pathogens and contaminants from water, as well as how fast they become clogged or foul. They are also researching if fouling impacts water quality treated by these systems, and how to best regenerate filters that have been fouled.

The research on the membrane systems will determine which type of filter may work best in settings where limited amounts of power are available, or where electricity supplies are unreliable.

During the first phase of this project, Clifford and Chellam collected water samples from typical sources of drinking water in these communities. This includes the Rio Grande, ponds, and shallow aquifers. These samples will be tested to see how well membrane filtration removes particles of various sizes, turbidity, bacteria, viruses, and virus surrogates.

In the near future, the researchers want to develop and test larger pilot- and full-scale membrane systems. They also want to work with industrial partners to find a portable power supply to run and field test this technology.

Note: This project is funded by the Texas Higher Education Coordinating Board Advanced Technology Program. For more information, contact Chellam at (713)-743-4265 or chellam@uh.edu, or Clifford at (713) 743-4266 or DAClifford@uh.edu.

UT Austin Researchers Develop Digitized Maps;May Speed Response to Future Floods

Work at the Center for Research in Water Resources (CRWR) at the University of Texas at Austin (UT) may help speed evacuation efforts and better determine flood risk areas in future flash floods. David Maidment and Francisco Olivera of CRWR are working with the U.S. Army Corps of Engineers to better estimate extreme flood discharges for the Missouri and Mississippi Rivers after their tragic floods in 1993. Currently, they are creating similar water flow maps for Texas.

Maidment's research provides a way to translate maps of rainfall and storm data to display the hydrology of rivers. This could be used to improve flood forecasting systems. "Currently most flood forecasting systems used throughout Texas and elsewhere depend on precipitation data measured by rain gauges," Maidment said. "In contrast, the more highly sophisticated NEXRAD radar stations are used to create the storm rainfall maps seen on television. We want to use NEXRAD to get accurate rainfall measurements at any location, not just the limited sites monitored by rain gauges."

The U.S. Army Corps of Engineers hired Maidment's laboratory to produce a NEXRAD-based flood forecasting model for the Addicks and Barker reservoirs on the west side of Houston. The same technology could be applied statewide to improve flood warning systems. The procedure of translating rainfall maps into water flows is aided by a vast effort being undertaken by the state of Texas and the city of Austin to produce a digital description of the landscape, Maidment said.

"Texas will be the first state nationwide to have a seamless digitized terrain map," said Maidment. "The city of Austin and the Capital Area Council are creating a more refined terrain map of Austin and 10 surrounding counties. By tracing the movement of water cell to cell in this mesh, the effect of storm rainfall anywhere in the landscape can be translated into flood flow estimates in streams." The Center for Research in Water Resources has produced a computer program called CRWR-PrePro that prepares the terrain and precipitation data for a new flood forecasting program from the U.S. Army Corps of Engineers Hydrologic Engineering Center. The digital terrain base can also be used to assess the likely impact of droughts throughout Texas.

To learn more, contact Maidment at (512) 471-4620 or maidment@mail.utexas.edu, or visit the CRWR WWW site at http://www.ce.utexas.edu/centers/crwr/.

TIAER Publishes New Reports on Water Quality, CAFO Regulations

Several new reports about water quality and water policy issues are available from the Texas Institute for Applied Environmental Research at Tarleton State University (TIAER).

Some of these reports include the following:

- *Semiannual Water Quality Report for the Bosque River Watershed,* July 1 1998 - June 30 2000, by Todd Adams and Anne McFarland (TR0103).
- *Nutrient Balance Analysis for Duck Creek Watershed, Texas,* by Keith Keplinger (TR0102). This study estimates nitrogen and phosphorus balances for the Duck Creek watershed.
- *Fate and Transportation of Soluble Reactive Phosphorus in the North Bosque River of Central Texas,* by Anne McFarland (TR0101). This report describes how phosphorus was sampled at sites along the North Bosque River.
- *Regulatory Status of the Broiler Industry in Texas (Duck Creek),* by Keith Keplinger (RR0101). This report provides an overview of current regulations for Concentrated Animal Feeding Operations (CAFO), and
- *Historical Data Review, Clear Fork of the Trinity River (Stream Segments 0831 and 0833),* by Larry Hauck and Alex Tanter (MS 0102). This report summarizes relevant existing water quality and hydrologic data.

To order any of these reports, contact TIAER at (254)-968-9567, or visit their WWW site at http://tiaer.tarleton.edu.

Sea Grant Program Publishes Guide to Texas Wetlands

The Texas Sea Grant College Program recently published the Texas Coastal Wetlands Guidebook. The book was written by Daniel Moulton of the Texas Parks and Wildlife Department, and John Jacob, who works for the Texas Sea Grant College Program and the Texas Agricultural Extension Service.

The guidebook provides information on what coastal wetlands are, why we should care about them, and how Texas Gulf Coast wetlands came to be. It identifies major wetland types for the Texas Gulf Coast, including systems sited along the estuarine or tidal fringe, interior of barrier islands. Other wetlands types described in the book include prairie potholes marshes, systems in riverine forests, coastal flatwoods, and sites in riparian areas along the lower Texas coast. The Guidebook also discusses the location, geology, soils, hydrology, vegetation, and ecological functions associated with these unique coastal wetland systems. Human values, as well as threats, associated with these ecoregions are also presented.

The Guidebook also features descriptions of wetlands sites as well as maps of wetlands along the upper, middle, and lower Texas coast. The book includes colored photographs, charts, and graphs, as well as an appendix with the scientific names of all the wetland plants mentioned in the book.

For more details or to order the book, contact the Sea Grant Program at (979) 862-3786, or e-mail egraham@unix.tamu.edu.

Texas A &M University Press Publishes Personal Accounts of Tragedies Associated with the Great Galveston Flood

A new book by the Texas AA&Mamp;M University (TAMU) Press, Through a Night of Horrors, recounts the tragedy of the great Galveston Flood of 1900. The book is written by Casey Greene and Shelley Kelly of the Rosenberg Library in Galveston.

The hurricane winds that lashed over Galveston Island the night of September 8, 1900, unleashed a horror that no survivor would ever forget and that more than six thousand people would not survive. Galveston's Rosenberg Library, noted for its fine archives of local and early Texas history, holds many accounts of the storm. The letters and memoirs included in this book provided catharsis to their writers as well as important documentation about these events for future generations. Oral history recordings made in the 1960s and 1970s provided accounts given by survivors as they approached the end of their lives. Readers can imagine in these stark yet poignant stories a mother's despair, or the last painful memory of a sister who perished after handing over her youngest child. Their vivid descriptions stand as moving testimony to the enormity of the worst natural disaster Americans have ever experienced.

To order, contact the TAMU Press at (800) 826-8911, or visit them on the WWW at http://www.tamu.edu/upress/.

TAMU Researchers Test If Adding Vitamins to Diets of Bass Makes them More Disease-Resistant

Can adding vitamins and elements to the diets of fish raised in aquaculture operations make them more resistant to diseases? That's the question being asked by researcher Delbert Gatlin and graduate student Wendy Sealey of the Texas AA&Mamp;M University (TAMU) Wildlife and Fisheries Sciences Department. They want to determine if dietary supplements, such as vitamin C, vitamin E, selenium, and beta-1.3 glucans can help increase hybrid bass' immunity.

"The hybrid striped bass industry is one of the fastest growing sectors in aquaculture in the United States, with roughly 10 million pounds of farm-raised hybrid striped bass sold in 1999. There are two major aquaculture facilities that produce hybrid striped bass in Texas," Gatlin said. Yet inadequate control of infectious diseases decrease the profitability of aquaculture. Instead of working for disease prevention, farmers are currently dependent on disease treatment as means to rid fish of pathogens.

The hybrid striped bass (*Monrone chrysops x M. saxatilis*) is the subject of this study. The fish are fed diets that are supplemented with nutrients. Afterwards, the bass are given a controlled, standardized lethal dose, of the bacteria *Streptococcus iniae* to measure disease resistance. The bacteria are administered through an injection. In the future, the researchers hope to use a bath immersion as a non-specific means to expose the fish to the pathogen. *Streptococcus iniae* is a major bacterial pathogen encountered in the aquaculture production of these fish.

"Survival against the disease exposure will be monitored, and various aspects of the fish's immune system will be investigated, " said Gatlin. A series of four separate 12-week feeding trials will expose 1,500 to 2,000 striped bass to several different dietary regimes. Roughly 300 fish will be used for each treatment. One trial will study the effects of deficient, required, and megadose levels of vitamin C and vitamin E on immune responses, while another will study the effects of graded levels of selenium and beta 1.3-glucans on immune responses. The third and fourth feeding trials will evaluate the most effective dietary levels of each compound, based on results from the previous two trials.

Gatlin and Sealey have currently completed the first trial involving vitamins C and E and are about to start trial two. The preliminary findings suggest that vitamin C and vitamin E at megadose levels do improve specific immune responses of hybrid striped bass, but not survival when challenged with the pathogenic bacteria.

The results of the research will hopefully prevent outbreaks and produce the maximum protection against virulent diseases. "The results of this project should be potentially transferable to other fish raised in aquaculture settings, such as channel catfish and redfish," said Gatlin. "We also hope to be able to recommend specific diet modifications and feeding strategies to prevent and control diseases. Some of these diet modifications may be implemented at times of stress to the fish, such as when they are handled."

The project was funded by the Texas Higher Education Coordinating Board. For details, contact Gatlin at d-gatlin@tamu.edu or (979) 845-9333.

UT Researchers Develop 'High Tech ' Parallel Computing Resources to Better Simulate Water Problems

Researchers at the University of Texas at Austin (UT) are developing computer simulation tools that utilize high tech computing technology to learn more about the flow and transport of water within river systems and aquifers.

The research is led by Mary Wheeler and Graham Carey of the Texas Institute for Computational Mechanics and Applied Mathematics, which is part of the UT College of Engineering.

"We are developing the underlying mathematics, numerical methodology, and parallel algorithms to solve complex flow and transport problems in environmental applications," Carey said.

The project focuses on making computer simulation more cost-effective by providing modeling results more quickly. Dedicated clusters of personal computers (PCs) are tightly networked to permit parallel computation of groundwater simulations. The simulation work is divided among the PCs in the cluster using what Carey calls a "divide and conquer" approach. "We think this will dramatically reduce the time to solve modeling problems, while exploiting the cost-effectiveness of commodity processors mass produced for general use," Carey said.

According to Carey, using PC clusters in this way allows scientists to compute problems facing many regions simultaneously. For example, the use of parallel computing may allow you to model all the waters in a watershed at the same time.

"We hope to develop the concept and provide a prototype that will allow fast and affordable simulations of water problems, using improved methods and algorithms. We want to show that these ideas, together with the software and technology, can be adopted and enhanced by the State of Texas and industries in the state to meet their modeling needs, " said Carey.

A possible environmental application for this project would use in crisis management, Carey says. For example, contaminant leaks, spills, and pipeline ruptures could be simulated through parallel computing networks. These methods could also be helpful in developing effective containment and remediation strategies.

The research is funded by the Texas Higher Education Coordinating Board Advanced Technology Program, the U.S. Department of Defense High Performance Computing Modernization Program, the National Aeronautics and Space Administration NASA Grand Challenge Project, and the National Science Foundation. For details, contact Carey at carey@cfdlab.ae.utexas.edu or at (512) 471-4207.

SWT Geographer Examines Build-up of DDT, Other Pesticides, Throughout the Texas ÐMexico Border

It has been 28 years since the pesticide DDT was banned, yet it still continues to affect the environment. DDT does not rapidly biodegrade into less toxic substances, and it persists in the environment for lengthy time periods.

Recently, geographer John Tiefenbacher, of Southwest Texas State University (SWT) examined the US-Mexico border to assess the current and future impacts of toxic materials in the region. Tiefenbacher conducted a comprehensive literature review about the use of persistent toxic substances in the region, using published research in academic journals, technical reports, and governmental data sets. He then identified activities that were carried out in specific watersheds along the border, as well as the biological and toxicological evidence of persistent contaminants. Later, Tiefenbacher created maps that illustrate trends associated with the ecological buildup of toxic substances.

One of the more significant findings is that several sites in the Lower Rio Grande Valley (stretching from Mission to the Laguna Madre) may face problems associated with persistent pollutants like DDT. Tiefenbacher's research suggests that there tend to be concentrations of persistent pollutants in agricultural areas. "There is no direct proof of connection to environmental contaminants, but the Rio Grande Valley used to be a very biologically diverse region. Now there are many threatened and endangered species there. Species such as the jaguarundi and ocelot are endangered, and this could be due to the long term effects of contaminants like DDT or due to the changes in land use," Tiefenbacher said. "Part of the problem may be that agricultural activities in the early part of the 1900s used first-generation synthetic pesticides that had a low toxicity, but were long-lasting. The fact that water from the Rio Grande was used for irrigation and that this arid region suffers from rapid evaporation makes the problems more difficult."

Tiefenbacher's analysis shows that several sites along the border may be suffering from the effects of persistent toxic chemicals. Near El Paso, the mining of the heavy metals in New Mexico and the leaching of naturally occurring mercury and cadmium form the soils in this region. In the Laguna Madre and South Padre Island, Tiefenbacher found evidence that suggests industrial chemical mining, and heavy metal industries, may have resulted in contamination by persistently toxic pollutants and may be harming falcons and shorebirds. Consumption of fish from some parts of the Laguna Madre has been restricted because of high levels of DDT-related contamination. In 1994, soil, water, and fish caught at eight surface water stations in the Lower Rio Grande Valley were sampled for contaminants. Results show that 17 of the 26 toxic chemicals that were detected were present at levels that constitute moderate environmental threats.

"The most pressing need is to conduct intensive, coordinated, and systematic environmental assessments to evaluate the environment to assess these threats," Tiefenbacher said. "This will require stronger efforts to store and manage the data, as well as the use of geographic information systems so the spatial effects can be evaluated."

For more information, contact Tiefenbacher at (512) 245-8327 or jt04@swt.edu.

TAMUCC Project Will Examine Cycling of Trace Metals in Lake Corpus Christi

As part of her master's thesis, Jill Brandenberger of Texas AA&Mamp;M University-Corpus Christi (TAMUCC), recently began a project which examines the cycling of trace metals in Lake Corpus Christi. Brandenberger's project, "Arsenic Concentrations in Water Resources of the Choke Canyon/Lake Corpus Christi Reservoir System: Surface and Ground Waters," is one of 11 projects awarded grant funding by the Texas Water Resources Institute (TWRI) in 2001.

Branderberger's work will be supervised by researcher Patrick Louchouarn, an environmental scientist who works in the TAMUCC Conrad Blucher Institute for Surveying and Science. In this project, Brandenberger will collect water samples from Lake Corpus Christi to study the behavior of dissolved and particulate trace metals under changing oxygen conditions within the water column. She plans to take water samples during summer and winter months to further evaluate any effect of seasonality on metal cycling in surface waters in the region.

The rationale behind this project is that changes in oxygen levels may cause redox-sensitive trace metals, such as arsenic, to flux into and be retained by sediments or to be released from these into the water column.

So far, Brandenberger has already obtained water samples taken from Lake Corpus Christi, the Nueces River and its tributaries, and tap water from the city of Corpus Christi. Her preliminary results show that arsenic concentrations are often above background values (usually around 1 part per billion, or ppb), and have often ranged from 6 to 16 ppb. The study is especially timely since Congress is now debating whether the current regulatory standard of 50 ppb of arsenic in drinking water is adequate, or if it needs to be lowered to better protect human health.

"Although the levels we are seeing in our surface waters are elevated above ambient concentrations, they do not constitute an immediate danger to life and human health," Brandenberger said. "But the literature suggests that long-term exposure to drinking water with elevated arsenic concentrations may increase cancer risks."

In addition to investigating arsenic levels in surface waters, Brandenberger and Louchouarn are also studying concentrations of this contaminant in the region's groundwaters. Available data for aquifers in this area show that arsenic levels may be as high as 100 to 900 ppb at some sites. In rural areas where alternative water sources are not available and the residents depend on groundwater, this could pose a serious and recognized health risk. "We felt the need to extend our work from only surface waters to also include ground waters," Brandenberger said. We want to better understand arsenic levels in South Texas aquifers," she said.

The study will also include evaluating potential non-point sources of arsenic and trace metals in surface and ground waters in the region. They want to learn if such activities as old uranium-mining (which were active in the region from the late 1960s to the 1980s), pesticide use, acid rain, and the geological features of the area may be responsible for nonpoint loadings of heavy metals in the area. "If we can identify nonpoint sources, it will help us better understand the water quality of Lake Corpus Christi and help us develop strategies to protect it," Brandenberger said.

Since comprehensive information about how heavy metals may be affecting the area's waters is lacking, Brandenberger hopes her research may ultimately help play a part in developing a comprehensive watershed study for the region. "This project may help advise scientists and policy makers in the region about temporal cycling of heavy metals," Brandenberger said. "Maybe it can help protect drinking water quality."

Note: To learn more, contact Brandenberger at (361) 825-3088 or Jill.Brandenberger@mail.tamucc.edu, or Louchouarn at (361) 825-3254 or loup@cbi.tamucc.edu.

Texas Tech Study Assesses How Depletion of the Ogallala Aquifer May Impact Farmers,Counties in the High Plains

The Ogallala Aquifer - a vast groundwater system that ranges from the Texas High Plains to South Dakota - is considered by most experts to be a largely nonrenewable resource. The basic fact is that pumping rates often exceed the amount of recharge the system receives. As the aquifer is depleted, the farmers who rely on the Ogallala for irrigation will likely be forced to consider other ways of growing crops with less or no irrigation.

To answer what the economic effect of changes in the water supply of the southern portion of the Ogallala may mean to communities in the Texas High Plains region, TWRI recently funded a research project at Texas Tech University (TTU). The project, "Regional Economic Impacts of Aquifer Decline in the Southern High Plains of Texas," will be conducted by graduate student Jeffrey Johnson under the supervision of researcher Phillip Johnson of the Agricultural and Applied Economics Department.

So far, the project is in the initial planning stages. Currently, Johnson has developed the conceptual framework that will define his project throughout the coming year. In this study, Johnson will evaluate the anticipated total water use over time in each of the region's 21 counties.

"We want to develop a model that will evaluate the economic impact on individual counties as water levels in the Ogallala decline," Johnson said. "Once we have estimated the economic impact on counties, we will look at various policy tools that may restrict water use and perhaps prolong the water supplies in the aquifer. We also want to assess the effects of water management strategies on the economies of the counties."

By comparing different methods of water restriction, Johnson hopes to compose suggestions for local policy makers that will aide in future water legislation. "This project will give policymakers an understanding of the effects of potential water policy tools," Johnson said. "They can use the results of this study in the decision-making process as they develop policies that will impact this region."

Johnson's project is funded by the Texas Water Resources Institute (TWRI), as well as the College of Agricultural Sciences and Natural Resources at Texas Tech University.

For more details, contact Jeff Johnson at (806) 742-2852 or Jeff.Johnson@ttu.edu, or Phillip Johnson at (806) 742-2821 or uypnj@ttacs.ttu.edu.

UT Study will Examine Middle East Groundwater Conflicts to Gain Insights for Texas ÐMexico Aquifer Management

Can lessons from the Middle East help policy makers in Texas and Mexico develop strategies to jointly manage shared groundwater supplies? Answering that question will be the aim of a University of Texas at Austin graduate student, in a research project funded by TWRI.

Daniel Stein, a graduate student in the UT Lyndon B. Johnson School of Public Affairs (LBJ School), will conduct this study, which is titled "Texas Groundwater Management and Global Applications." In this project, Stein will gather information about transboundary groundwaters managed by Israel and the Palestinian Authority. Later, he will use these observations to reevaluate the future of transboundary aquifer management between Texas and Mexico. The work will be done under the direction of researcher David Eaton of the LBJ School.

Both Israel and the Palestinian Authority depend largely on groundwaters for water supplies in the region, because the Jordan River contributes relatively little water to the drinking water supplies of both Israel and the Palestinian Authority. This scarcity of water, combined with the ongoing political conflicts between both parties, has made it necessary to craft extensive agreements to allocate groundwater.

In this project, Stein will learn how water resources managers in the Middle East define "equitable allocation," and he will discuss what this implies for groundwater management between the Israelis and Palestinians. Stein will apply these findings to evaluate possible groundwater management measures that can be used by Texas and Mexico.

According to Stein, both Texas and Mexico are currently using shared or transboundary groundwater supplies very quickly, without any joint or binational regulations or monitoring programs. So far, no major disputes have occurred between Texas and Mexico concerning shared groundwater resources, largely because the Rio Grande has provided sufficient surface water. However, Stein feels that binational groundwater contracts may be necessary to discourage aquifer depletion. Without a formal allocation agreement, both sides may continue to extract groundwaters until they are exhausted. Water quality may also deteriorate and health problems may worsen as groundwater levels decrease.

Stein also hopes to examine the extent to which water conservation and reuse are a key component of groundwater management in the Middle East. "Conservation may be a valuable strategy to control groundwater use, especially in areas where aquifers may not receive significant recharge," Stein said.

A key topic involved in this project lies in the absence and creation of public policy to manage transboundary groundwater supplies along the Texas-Mexico border. "Both conservation and health are at the center of the issue, but this project also has to do with law," Stein says. "As of yet, there is no law covering groundwater use. If we have institutions that equitably divide the Rio Grande, shouldn't we also have institutions that manage the equitable division of groundwater supplies?"

Stein hopes his research may help create solutions Texas and Mexico can use to share joint groundwater supplies. Eaton may use Stein's findings in a drought simulation exercise tentatively scheduled for fall 2001 at the UT campus. This simulation "game" will test how well water management strategies may function when water quality and quantity emergencies are simulated.

For more information on this project, contact Stein at drs_73@hotmail.com, or Eaton at (512) 232-4012 or eaton@mail.utexas.edu.

TAMU Researchers to Evaluate How Brush Control May Affect Ecosystems,Aquatic and Terrestrial Life

Recently, a team of Texas AA&Mamp;M University (TAMU) System researchers evaluated the potential of brush control to increase water yields in eight Texas river basins (for details, see the Abstracts section of this newsletter). Now, several of these scientists, and others, are engaged in a new project to investigate the implications of brush management on aquatic ecosystems and aquatic and terrestrial life.

The investigation, "Ecosystem and Wildlife Implications of Brush Management Systems Designed to Improve Water Runoff and Percolation," is funded by the U.S. Army Corps of Engineers. The project began in April 2001 and runs through August 2002.

Lead TAMU scientists in this effort are Richard Conner of the Agricultural Economics Department, and Neal Wilkins, Sallie Hejl, and Kirk Winemiller of the Wildlife and Fisheries Sciences Department. Other project leaders include Wesley Rosenthal and Ranjan Muttiah of the TAMUS Blackland Research and Extension Center at Temple, and Steve Bednarz and Tim Dybala of the U.S. Department of Agriculture Natural Resource Conservation Service (USDA/ NRCS). The project will be administered by the Texas Water Resources Institute (TWRI).

The purpose of this study is to evaluate the changes in populations of aquatic and terrestrial wildlife, as well as flows, that are likely to result from brush clearing activities. The project will involve an integrated analysis of how fish, aquatic invertebrates, and birds - and the ecosystems they depend on - may be affected when brush is removed to boost water yields.

Two watersheds will be analyzed - the Twin Buttes region, which includes the Middle and South Concho River, Spring Creek, and Dove Creek, and sites where the Medina, Hondo, Seco, Sabinal, and Frio rivers cross the Edwards Aquifer Recharge Zone. Initially, the research team will develop baseline conditions about the structure and composition of streams, riparian areas, and upland habitats. Selected aquatic invertebrates and fish will be used as key indicator species that may represent broader environmental effects. Later, the impacts of brush control on these species and ecosystems will be assessed. The project will also develop a geographic information system (GIS) to model and display potential changes that may be brought about by brush management throughout the watershed.

To learn more, contact TWRI at (979) 845-1851 or twri@tamu.edu, or Conner at (979) 845-2336 or jrc@tamu.edu.