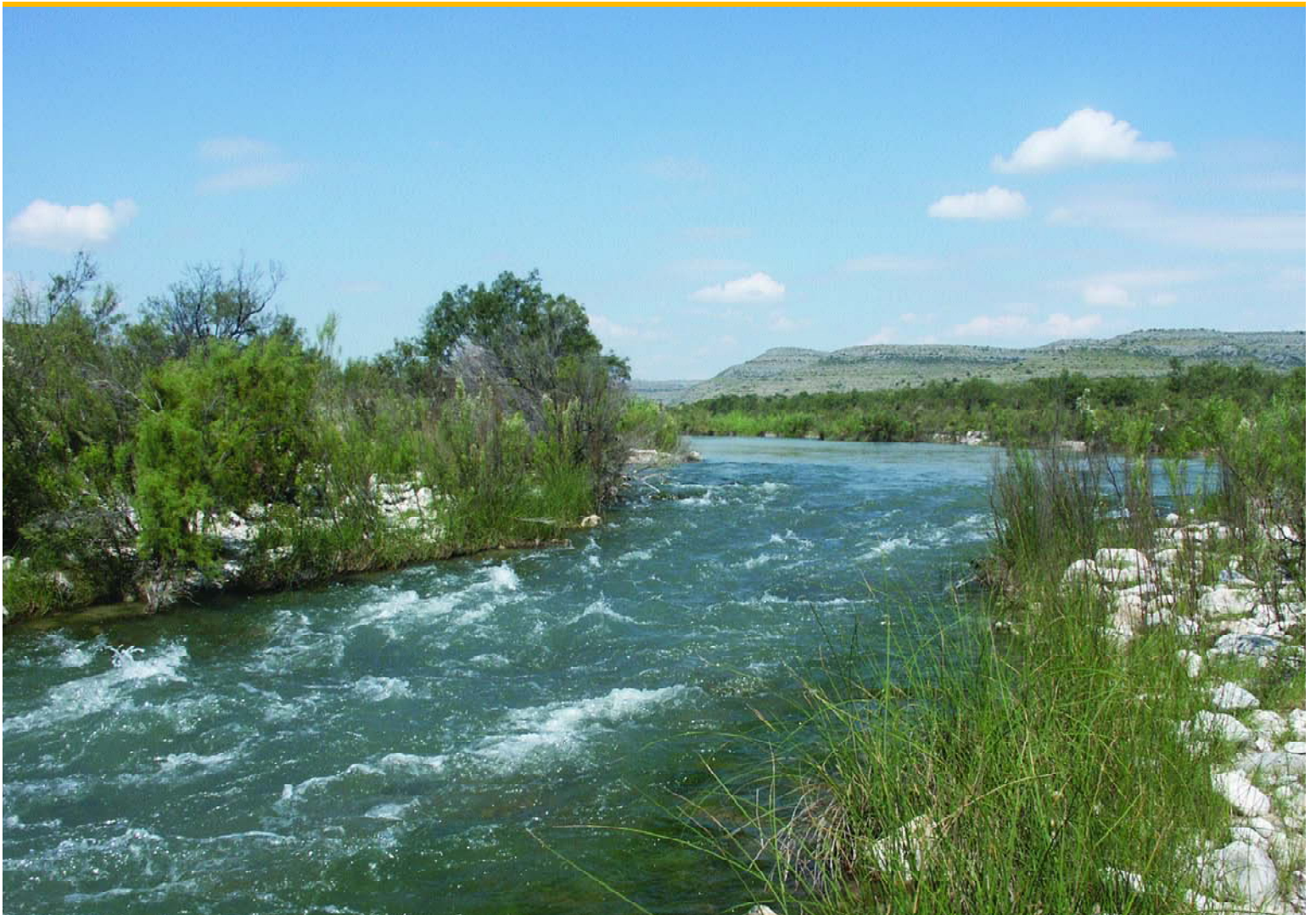


Rio Grande Basin Initiative

2005 Progress & Accomplishments



Rio Grande Basin Initiative

The Rio Grande Basin is one of the most productive agricultural areas in the United States, with irrigated agriculture claiming more than 85 percent of its water. Yet, population growth in the basin is expected to double in the next 50 years, also doubling urban water use.

In 2001, a team of researchers, Extension specialists, and county agents from The Texas A&M University System Agriculture Program and the New Mexico State University College of Agriculture and Home Economics began working with local irrigation districts, agricultural producers, homeowners, and other agencies to address these issues through the federally funded Rio Grande Basin Initiative.

Funded through the United States Department of Agriculture Cooperative State Research, Education, and Extension Service, the initiative focuses on efficient irrigation and water conservation. It is administered by the Texas Water Resources Institute and the New Mexico State University Water Task Force.



2005 Partners:

- > Cooperative State Research, Education, and Extension Service
- > Texas Agricultural Experiment Station
- > Texas Cooperative Extension
- > Texas Water Resources Institute
- > New Mexico State University Agricultural Experiment Station
- > New Mexico State University Cooperative Extension Service
- > New Mexico State University Water Task Force

On the cover:

This beautiful and remote section of the southern Pecos River, between the northern Val Verde County line and Pandale, Texas, is in stark contrast to the river's northern stretches. Texas Cooperative Extension is working to control the spread of saltcedar along the riverbanks, to conserve water and save this natural habitat. Photo courtesy of Charles Hart

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2005 Task Areas

Extension



Task 01 Extension

Irrigation District Studies



> Irrigation demonstration initiative program promises water savings

Texas Cooperative Extension has teamed with the Texas Water Development Board in a 10-year irrigation demonstration initiative program. The \$3.7 million project focuses on maximizing on-farm efficiencies through proper canal management in the Harlingen and Delta Lake Irrigation Districts. Examples of similar projects include the United Irrigation District, which has saved 362 acre-feet (120 million gallons) of water per year due to a pipeline replacement and 72 acre-feet (23 million gallons) per year with post-pipeline construction leak testing. A total of 505 acre-feet (160 million gallons) per year of water have been saved in the Brownsville Irrigation District after pipeline replacement.

> Engineers complete maps of irrigation districts

Texas Cooperative Extension engineers have completed mapping of each Texas irrigation district along the Rio Grande. These maps, along with GIS maps for the El Paso, Elephant Butte (Texas portion), and Redford Irrigation Districts, will provide an indispensable tool for district modernization, regional water resource analysis, planning efforts, and rehabilitation planning.

> New Mexico workshop demonstrates use of soil moisture meters

A team with New Mexico Cooperative Extension conducted an agricultural water management practices workshop on the use of soil moisture meters and flumes in March 2004. Local and state agencies, agricultural specialists, and farmers took part in the workshop, which demonstrated advances in portable and stationary soil moisture meters as well as methods for inexpensively measuring and applying water with portable flumes.

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Task 02 Extension

Irrigation Education and Training



> Program reduces water application for urban specialty crops

A project called User Friendly Drip Irrigation and Mulch Systems for Urban Specialty Crop Production aimed at increasing the use of drip irrigation and mulch systems for urban specialty crops has helped New Mexico Master Gardener cooperators to reduce water application by 29.3 percent. Approximately 246 New Mexico master gardeners in 10 county programs were trained in drip irrigation and water conservation techniques. Through nine garden club programs, Extension specialists showed urban gardeners the benefits of using drip irrigation and mulching techniques to conserve water and enhance growth of specialty crops. The success of this program led to a collaboration with the Arizona master gardener program in which the New Mexico team conducted drip training in Keyenta, Arizona.

> Floriculture research provides opportunity in water conservation

NMSU students learned about water conservation through a hands-on study in floriculture. The study addressed a major deficit in the scientific floriculture literature, namely determining water and fertilizer-N requirements of poinsettias under greenhouse cultivation. Students wrote research reports as part of their lab grade and sold the crop to make money for future research and teaching projects in floriculture. Approximately 150 students from three area high schools were given a tour of the greenhouse project, with the prospect of encouraging New Mexico students to consider a career in floriculture.

> Irrigation system designs completed in San Antonio

Texas Cooperative Extension engineers have teamed with the San Antonio Water System and the Texas Turf Irrigation Association to complete a detailed irrigation system design. The design will be used as part of an Irrigation Technology Center public service project to rehabilitate the irrigation systems of the San Antonio Botanical Gardens. Another irrigation design in San Antonio was completed for a new turf evapotranspiration (ET) facility to determine specific irrigation requirements for turf and other groundcovers. The rate of linear and sprinkler water systems will be varied to determine the appropriate amount of water for the facility's 180 plots.

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Task 03 Extension

Institutional Incentives for Efficient Water Use



> GIS and data management integrated to modernize water resources tools

Database Recommendation for Irrigation Districts reports are now available from Texas Cooperative Extension, which offers irrigation districts suggestions for better GIS and data management integration. This upgrading of databases will allow for easy incorporation with software tools and facilitate the use of data to make management and operational decisions.

> Brownsville receives technical assistance

A team of engineers with Texas Cooperative Extension assisted the City of Brownsville with justification of an on-farm water metering program that will result in an estimated water savings of 1,100 acre-feet (360 million gallons) per year. Technical assistance such as this has saved districts \$1.8 million in the cost of hiring consultants.

> Meetings coordinated with Elephant Butte Irrigation District

A team with New Mexico Cooperative Extension coordinated growers meetings with the Elephant Butte Irrigation District to assist users in distribution and conservation of water with Elephant Butte irrigators. The water measurement program helped irrigators evaluate the cost benefit of a water metering program for producers and form a community ditch association for smaller irrigators.

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Task 04 Extension

On-Farm Irrigation System Management



> Irrigation scheduling conserves water in corn and cotton crops

Irrigation scheduling with the use of soil moisture sensors has allowed Lower Rio Grande farmers to conserve about 10,000 acre-feet of water in corn crop production systems and 25,000 acre-feet of water in cotton crops. This represents one irrigation cycle of 6 inches on 20,000 acres of corn and 50,000 acres of cotton, respectively. Extension specialists used four result demonstrations, two field days, two newspaper articles, radio, and television to promote this technology.

> Guidelines for citrus and sugarcane irrigation established

Texas Cooperative Extension developed irrigation guidelines for citrus and sugarcane in the Lower Rio Grande Valley. These guidelines are being used to develop irrigation plans and determine how much water should be applied over the average year. The irrigation procedures are being combined with soil moisture readings, making it possible for farmers to conserve about 17,000 acre-feet of water.

> Irrigation systems studies show significant water savings possible

Studies of different irrigation methods in citrus crops show that water savings for drip and microspray jet irrigation would result in water savings of 10,800 to 12,700 acre-feet compared to traditional flood irrigation. When this method was used for onion and cabbage crops, water use efficiency values increased by 180 percent and 60 percent, respectively, compared to flood-irrigated plots.

> Counties turn out for on-farm demonstrations

Texas Cooperative Extension conducted a drip irrigation field day at Charles Loop Farm in Cameron County. One hundred people attended the educational event to discuss relationships between crop yield and water use efficiencies. Some 300 attended a pre-planting cotton workshop in Cameron and Hidalgo counties, where participants learned the proper use of simulation tools and models for crop water management. The two counties also conducted an on-farm crop-monitoring demonstration with corn, grain, sorghum, and cotton, in which growers received weekly feedback on soil water status for irrigation scheduling and ways to improve water use efficiency.

> Crop commodity fact sheets detail efficient use of water resources

New Mexico Cooperative Extension produced a series of crop commodity fact sheets on New Mexico agriculture. These fact sheets detail water management and efficient use of water resources for food and feed products grown in New Mexico, as well as economic returns to the state. They provide a mechanism to explain the benefits of cropping in the state, including homeland use, conservation, regeneration of water supplies, and filtration through cover crops and vegetation, as well as aesthetic benefits from agriculture.

> New Mexico DVD introduces water conservation projects

A DVD titled *Irrigation Efficiency in New Mexico* introduces some of the current Rio Grande Basin Initiative projects and water programs supported by research and Extension in New Mexico. The DVD demonstrates the water conservation practices in agricultural crops that are in process and the need to continually show how conservation can protect soil and water resources in New Mexico.



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Task 05 Extension

Urban Landscape Water Conservation



> Residents shown alternative water source through rainwater demonstrations

A rainwater harvesting demonstration system has been installed at the Hidalgo County office building in Weslaco. Stored water will be used for flower beds around the building. In addition, a conference was held early this year to inform residents about using harvested rainwater to irrigate native landscapes. Extension specialists distributed outreach resources such as rainwater harvesting and gray water fact sheets, bulletins, and videos to counties in the Lower Rio Grande Valley.

> Specialists to share survey results about water conservation strategies

City council members, mayors, and water conservation and utility staff were surveyed in 30 cities along the Rio Grande Basin in both New Mexico and Texas. Information was collected on water conservation strategies, including preference-feasibility, barriers to water conservation, and the definitions of water conservation. Results from this survey will be published in a technical report. Data collection presentations have already begun and will continue throughout the year at seminars in both states.

> In-home water conservation kits will help reduce water use

Extension housing specialists are conducting a water conservation study to determine how much a family of four can reduce its water consumption over a three-month period by installing water saving toilets, showerheads, and faucet aerators. The specialists will also determine which method of conservation results in the greatest reduction in water usage. Fifteen families from Hidalgo, Starr, Webb, Pecos, and Val Verde counties will participate in the study. In-home water conservation kits have been delivered to agents in the participating counties and in New Mexico for a study involving residents in that state.

> New Mexico Extension team conducts conservation conference

A team with New Mexico Cooperative Extension conducted a community water conservation conference in collaboration with the New Mexico Water Conservation Alliance. The conference addressed the breadth of problems associated with managing indoor and outdoor water use and strategic management and planning of water resources. A total of 33 speakers took part in the conference, with 165 registrants from six western states.

> DVD emphasizes principles of xeriscaping

A recently produced DVD, *Xeriscapes of the Southwest*, illustrates the top seven principles of xeriscaping and water conservation practices in landscapes. The seven principles are (1) planning and design, (2) efficient irrigation, (3) mulching, (4) soil preparation, (5) appropriate turf, (6) appropriate plant material, and (7) appropriate maintenance. The DVD emphasizes the need to select drought-tolerant native landscapes that conserve water resources in New Mexico.

> Field day emphasizes water conservation in turfgrass systems

More than 100 participants attended a turfgrass field day hosted at the Fabian Garcia Research Center in New Mexico. The field day emphasized water conservation in turfgrass systems and ornamental plants. Subsurface irrigation was highlighted as a water saving alternative to conventional sprinkler systems. In addition, New Mexico Cooperative Extension has xeriscape demonstration sites located in eight counties. The sites are used as an educational tool to demonstrate the beauty of New Mexico's drought-tolerant vegetation.

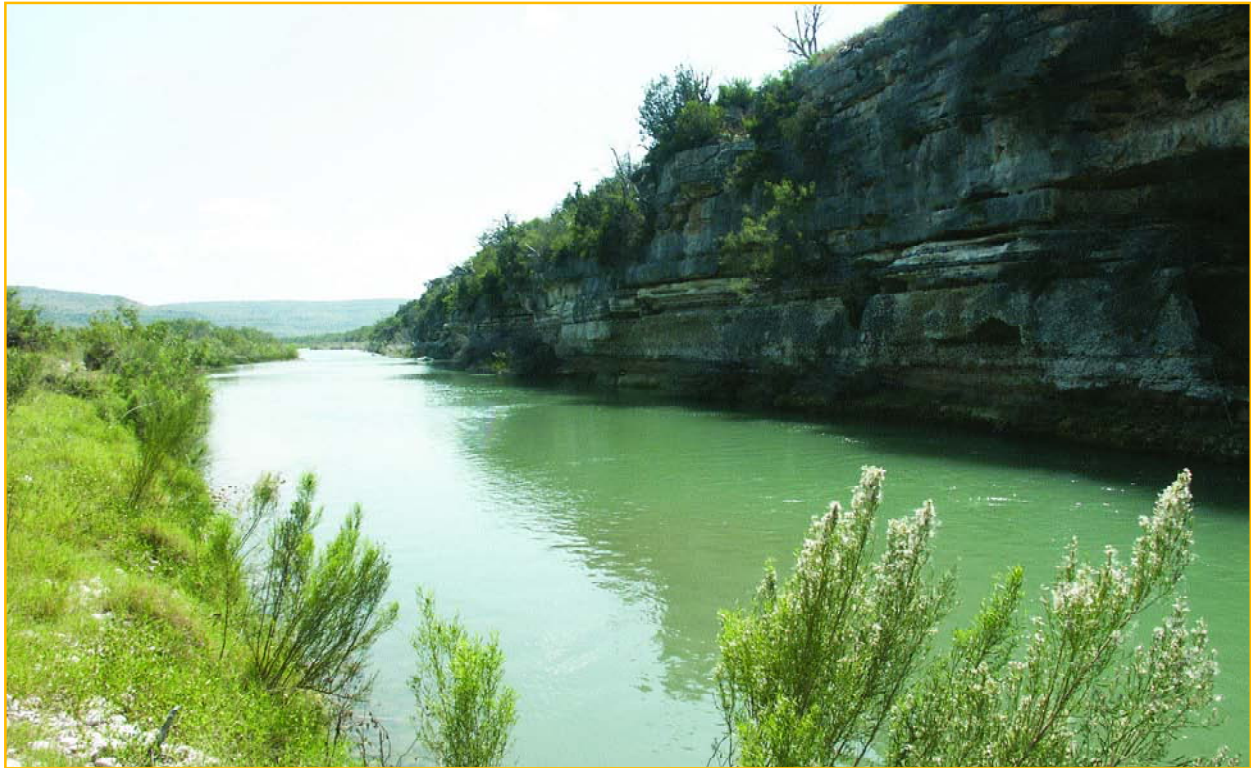


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Task 06 Extension

Environment, Ecology, and Water Quality Protection



> Pecos River Ecosystem Project under way in five-county region

With over 50 percent of the 418 miles of the Pecos River being treated for saltcedar infestations in 2004, the Pecos River Ecosystem Project (PREP) was developed to continue reviving the Pecos River as well as its tributaries in Culberson, Pecos, Crockett, Terrell, and Val Verde counties. More than 2,600 acres of saltcedar were treated and removed last year along these waterways. Extension specialists made six presentations at events in Texas, New Mexico, Colorado, and California about the goals of the PREP. These goals are to establish water quality and quantity monitoring, educate rural and urban stakeholders, develop a watershed protection plan, and maintain salinity monitoring efforts along the Pecos River. Six additional monitoring wells were also established along the Pecos, with water loss estimates available in March 2005. Cooperative efforts are under way to analyze groundwater well designs to estimate water salvage from control of saltcedar.

> Specialists educate public on rangeland watersheds

Extension specialists established paired watershed plots in three counties to demonstrate the relationship between rangeland health and quantity and quality of runoff from rangelands. They held a field day at the Presidio County demonstration site for the Big Bend Chapter of the Native Plant Society of Texas. Extension agents educated the 18-member group on rangeland ripping and seeding as a method to enhance drought recovery. Educational programs and field days on rangeland watersheds and monitoring are planned for the Val Verde site in the spring of 2005 and the Crockett County site in summer 2005. A summary of rainfall, runoff, vegetation, and photo monitoring points will be published in March 2005.

> Extension outreach teaches about aquatic vegetation control

The AQUAPLANT Web site has been updated to include streaming video and news releases of the aquatic vegetation control demonstrations in the area. "Invasive Aquatic Weeds of the Rio Grande" posters are still being distributed to county extension agents. Specialists also conducted Advanced Master Naturalist training in El Paso for county residents. Information about the control of invasive aquatic species is also available through an annual newsletter.

> Reduction in nutrient loadings reduces threat to surface and ground waters

Extension installed special soil-testing programs in the Rio Grande Valley to help reduce nutrient loadings. More than 300 soil sampling probes were distributed to farmers in the area, a 62 percent increase from the previous year. Soil tests confirmed a fertilizer reduction of 1.3 million pounds of nitrogen and 2 million pounds of phosphorus. These reductions in nutrient loading helped decrease the amount of nutrients being washed into the area's waterways. Farmers also saved more than \$809,388 in fertilizer costs by soil testing their land.

> Aquatic weed control unclogs canals in LRGV

Extension specialists conducted aquatic vegetation control demonstrations for irrigation districts in the Lower Rio Grande Valley. They have successfully used grass carp to control hydrilla and other aquatic vegetation. Hidalgo County Irrigation District No. 1 saved more than \$100,000 in costs by implementing the grass carp, freeing up over 170 miles of canals. Over the next three years, the Hidalgo irrigation district will save an estimated \$500,000 by using the grass carp control method. Brownsville Irrigation District has reported an annual cost savings of more than \$6,100 by using chemicals to control hydrilla in their canals. Rancho Viejo Irrigation District reported an annual savings of \$264,000. The three irrigation districts saved a total of \$370,000 by implementing one of the recommended control methods for aquatic vegetation. In addition, Cameron County Irrigation District No. 6 used herbicide control to free their canals of water lettuce, resulting in a water savings of 20,000 gallons per day.

> "Water for West Texans" program in full swing

Extension and education outreach programs are in full swing in Far West Texas counties. Specialists held a water camp for 20 students, in addition to three rainwater harvesting meetings attended by 44 people. Rainwater harvesting demonstration sites are also in the process of being installed in El Paso, Hudspeth, Culberson, Terrell, and Brewster counties. Seventy-two residents interested in water conservation, irrigation efficiency, and improved alfalfa varieties participated in an irrigators meeting. Cooperation efforts with the Riparian Buffer program were also organized for Brewster and Presidio counties. More than 250 home water conservation kits were purchased for demonstration use in the region. A project to plant trees to provide buffers is under way in El Paso.

> Water quality parameters identified through well screenings and youth camp

Extension conducted private water well screenings in Real, Kinney, Edwards, Webb, El Paso, Zapata, and Duval counties. The water was evaluated for the presence of fecal coliform bacteria, nitrate concentration and salinity, and arsenic concentration. Twenty-five residents attended a water quality educational seminar in Webb County to learn about the water quality of their private wells. In addition, demonstrations showed the proper technique for plugging an abandoned well. Several high school students had the opportunity to participate in a water quality educational session and wet lab as part of the Texas 4-H Water Camp. Students received hands-on training in analyzing water samples for nitrates, total dissolved solids, pesticide presence, chlorides, and other contaminants.

> Model examines effects of habitat interruption on aquatic birds

Extension specialists have developed a spatial simulation model that identifies bird abundance and water availability in the Lower Rio Grande Valley. The model investigated how actual or potential water availability scenarios altered the distribution and abundance of aquatic birds. Results indicated that by reducing the area of canals and water of resacas, the distribution and abundance of aquatic, diving, and shorebirds was decreased. In addition, the population of these same bird species decreased when wetlands in wildlife refuges decreased.

> Best method for water purification determined

Extension specialists are evaluating the long-term potential use of the material surface modified zeolite in a study involving field demonstrations of pathogen removal. Results indicated that there was no removal of *E. coli* and coliphage pathogens. Currently, this approach does not positively affect water purification goals. A manuscript containing results from this study will be published in the coming year.

> Weed garden established

A recently established weed garden at the New Mexico State University Leyendecker Plant Science Research Center shows water usage and root growth of weed species common in canals, farm fields, and riparian areas. A field day conducted in the summer of 2004 detailed weed identification, root growth of plants, soil characteristics, and hyperspectral technologies.



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Task 07 Extension

Saline and Wastewater Management and Water Reuse



> Wastewater treatment subject of demonstrations and outreach

Extension specialists have conducted several short courses on basic and advanced on-site wastewater treatment for homeowners and spray distribution of effluent and high strength wastewater for practitioners in areas along the Rio Grande. Fact sheets, presentations, and demonstrations about rainwater harvesting, gray water, portable subsurface drip distribution fields, and wastewater treatment have also been developed and implemented.

> Turf specialist evaluates nonpotable water for turf irrigation

A turf specialist with New Mexico Cooperative Extension is evaluating how the use of nonpotable water for irrigation on turfgrass can save 156,000 acre-feet of high quality drinking water in northern New Mexico and 186,000 acre-feet in southern New Mexico. High-saline water significantly delayed and reduced establishment rate when compared to potable water in the study.

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Task 08 Extension

Basinwide Hydrology, Salinity Modeling, and Technology

> CropMan scheduled for use in additional research programs

Extension specialists are demonstrating the CropMan model on sites in Hidalgo, Cameron, and Starr counties to improve real-time water management, maximize production and profit, increase irrigation efficiency, and identify limitations to crop yield. Agents are establishing a weather station in Starr County and coordinating demonstration activities with sugarcane, corn, sorghum, and cotton research programs in the Lower Rio Grande Valley. An analysis of growing-season savings and a newsletter of CropMan results will be completed by May 2005.



2005

County Programs





County Programs

> Cameron, Hidalgo, and Starr Counties

Extension agents in Cameron, Hidalgo, and Starr counties demonstrated polypipe technology to Lower Rio Grande Valley farmers. The use of polypipe and water metering devices to replace earth ditches and siphon tubes has steadily increased throughout the farming community. Approximately 55 percent of farmers use this technology, which represents a savings of 10 percent of total water used. County agents continue to promote the technology.

> Edwards and Kinney Counties

Extension agents in Edwards and Kinney counties are studying the effects of Ashe juniper brush and other mixed species, such as cedar, on watershed health and water yields to the Edwards Aquifer. Before working on miniature watersheds, the agents had to clear the area by burning cedars and grasses. After the burning was complete, they installed electronic rainfall monitors and studied interception rates. The results showed interception rates relied on the frequency and intensity of rainfall events. In Ashe juniper plots, more than 1/2 inch of rainfall was required before any of the precipitation could infiltrate the canopy of the juniper trees. Interception rates were 88 percent between 1/2 and 1 inch of rainfall, 60 percent between 1 and 2 inches, and 30 percent of rainfall over 5 inches.

> Culberson County

Extension specialists, Texas Parks and Wildlife biologists, and Natural Resources Conservation Service conservationists collaborated to train 32 local patrons about the planning and designing of water capturing techniques. A demonstration for Culberson County ranchers included newly adopted rainwater capturing methods to provide water for wildlife consumption.

> El Paso County

El Paso County Extension agents held landscape design courses for homeowners, in cooperation with El Paso Water Utilities (EPWU), to encourage participants to plant water-smart varieties for landscapes. EPWU promoted the program via announcements on the back of approximately 175,000 customer water bills. Thirty-six homeowners participated in this program.



They learned how to design their home landscape to conserve water and take advantage of EPWU's turf-rebate program, in which each resident receives \$1 per square foot of turf replaced with water-smart landscaping plants.

Students in El Paso County have limited opportunities to practically apply scientific principles to local water issues. Texas Cooperative Extension's El Paso faculty members worked together to coordinate a well water screening program to teach student groups about the process of screening water, the importance of well water screening, and how to apply laboratory principles in the classroom setting. A total of 198 students learned about local water quality issues and participated in hands-on laboratory experiments to test local well water samples for bacteria, nitrates, and salinity. The program was presented under the El Paso Youth Water Leadership Institute to help educate and involve local youths in water issues and to expand youth learning.

Texas Cooperative Extension agents in El Paso County joined EPWU to create the Pesticide Use Safety Education Program, which addresses the issue of pesticides detected in the wastewater treatment system. As a result of the 2004 education campaign, EPWU continued to report no failures in their periodic monitoring of direct measurements of pesticide residues in the wastewater. The results suggest better public awareness of the proper use and disposal of pesticides. Extension also had more requests for information and recommendations on pest control and alternative pest management methods, especially after a bilingual educational brochure was mailed, as a bill insert, to more than 160,000 EPWU customers.

> Hudspeth County

Texas Cooperative Extension conducted four major educational events about water conservation, xeriscaping, and water harvesting for residents, business owners, and agricultural producers in Hudspeth County.

> Pecos County

Texas Cooperative Extension conducted a Trans-Pecos and GLCI Water Harvesting Project in Pecos County. This hands-on project allowed participants to harvest and enhance the effectiveness of naturally occurring precipitation. It also provided a means for both individuals and governmental land stewards to understand and implement economically attainable water harvesting practices in arid environments.

> Reeves and Loving Counties

The Texas Agricultural Experiment Station and Texas Cooperative Extension established a field crop trial for the Trans-Pecos Region. Four topics included variety evaluation for brown midrib varieties, sorghum, and millet grain varieties. In addition, participants learned watering schedules and water quality, quantity, and salinity issues for such varieties in the western region. Attending participants included area dairy managers, alfalfa growers, and ranchers.

> Terrell County

Extension distributed 110 home water conservation kits to Terrell County residents. Water samples were collected from 18 locations and tested for irrigation, domestic, and livestock use. Cooperative efforts with Cactus Health Care Center are under way to demonstrate rainwater harvesting techniques. The water collected will be used on the surrounding landscapes. In addition, water monitoring on four turfgrass varieties has been established to identify water conservation and water quality practices. Four news releases were also published in the local newspaper, which reaches 545 subscribers.

> Uvalde County

Increased interest in the use of water conservation practices and equipment for both producers and homeowners led Texas Cooperative Extension to conduct six educational programs in Uvalde County. There were 288 participants, with 1,595 individual contacts made. Fifteen mass media programs were conducted in support of the program. Cooperators conducted result demonstrations that saved more than 4 inches of water per acre on 550 acres. Based on fuel costs of \$4.96 per inch, resulting savings were \$19.84 per acre, or \$10,912. Participants also saved 183.3 acre-feet of water by following recommended practices of scheduling irrigations based on soil moisture sensors, data loggers, and use of evapotranspiration data from weather stations.

> Val Verde County

A group of 30 participants in the Renewable Natural Resources Leadership Course sponsored by the Institute of Renewable Natural Resources from Texas A&M toured the Rio Grande rangeland conservation projects in Val Verde County. Participants gained knowledge on practices being implemented and on saltcedar control efforts in the county.

> Ward County

Rio Grande Basin Initiative funds were used to purchase 50 Water Conservation Kits in Ward County to teach youth at the 2004 State 4-H Water Camp. Kits cover the following aspects: faucet aeration, showerhead conservation, water use in toilets, water quality, and water availability. Youth attendance for the week-long camp was 21 participants. The State 4-H Water Camp relies heavily on the volunteerism of professionals from around Texas. Thirty-two volunteers attended the week-long camp in 2004.

> Webb County

To serve an increasing number of local landowners conducting water testing throughout the area, Texas Cooperative Extension held an in-depth land and water conservation educational program in Webb County, attended by 433 residents. Fifty water samples were taken from private water wells in Webb, Jim Hogg, and Duval counties. A healthy rangeland watershed program was held for 2,179 agricultural producers, game managers, youth, and the general public. Ten news articles were prepared and printed in the *Laredo Morning Times*, which reaches more than 70,000 people.

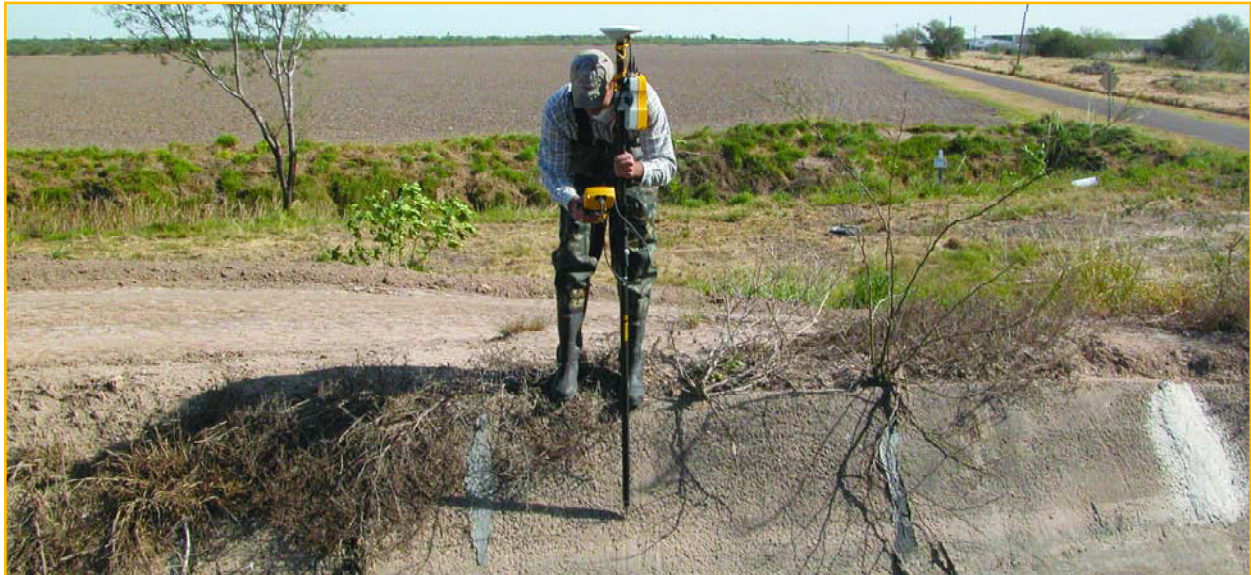
2005 Task Areas

Research



Task **01** Research

Irrigation District Studies



> Economists analyze cost of saving water for Rio Grande Valley infrastructure

Texas Agricultural Experiment Station economists have analyzed the cost of saving water and energy for rehabilitation projects throughout the Lower Rio Grande Valley. Initial calculations show that about \$200 million in investments will provide 211,000 acre-feet of water savings a year from the water delivery infrastructure in the area. However, using engineering data for life cycles of each structure, the estimated cost of saving water ranges from \$16 to \$251 to save 1 acre-foot of water. Comparing these costs to irrigation district water rates will allow economists to determine the economic efficiency of future rehabilitation projects.

> New handbook for stakeholders provides rehabilitation planning systems

Texas Agricultural Experiment Station and Texas Cooperative Extension economists, with the U.S. Bureau of Reclamation, are creating a collaborative report from the cost-of-saving-water data on the rehabilitation of waterways in the Lower Rio Grande Valley. In lieu of individualized project analyses, this handbook will provide irrigation district managers, consulting engineers, and other interested stakeholders with engineering and economic considerations in choosing alternative canal-lining and piping systems. The handbook will prove useful in the early planning stages because comparative life-cycle costs will indicate which rehabilitative product or combination of products (shotcrete lining, protected lining, or pipe) will provide the most appropriate system.

> Scientists assess flood-control benefits

A team of Texas Agricultural Experiment Station economists, soil and crop scientists, and geospatial information specialists conducted a rapid economic assessment of the benefits of four regional flood-control projects on the Rio Grande for the U.S. International Boundary and Water Commission. Flood-control agricultural and urban benefits-or avoided losses-for the four project areas from a one-time event is an estimated \$323 million, increasing to \$506 million when including roads and vehicles.

> Seepage loss proves to be problem in El Paso

Texas Agricultural Experiment Station researchers estimated seepage losses from 10 to 30 percent of the total amount of water delivered in El Paso's Franklin Canal. Ponding results show water seepage rates from 160 to 62 acre-feet per mile along the canal, and current meter inflow/outflow measurements show even higher seepage losses. Losses along the Westside Canal measure 400 to 800 acre-feet per mile. Especially during the irrigation season, losses vary spatially and temporally due to different soil types and hydraulic conditions. Test results have shown losses are higher in the Upper Valley than in the Lower Valley of El Paso.

> NMSU team provides regional ET maps using NASA data

A team of investigators at NMSU has developed software to provide regional evapotranspiration (ET) maps using data from the ASTER sensor on board the NASA-TERRA satellite. The process, Regional ET Estimation Model (REEM), can provide real-time ET values with high accuracy. Recent innovations in satellite technology have made it possible to process satellite data to estimate ET and consumptive water use on scales ranging from individual farms to whole watersheds. The model is intended to take the guesswork out of irrigation scheduling for producers and urban horticulture managers. It increases water use accountability and is an ideal solution to the problem of overwatering crops and landscapes.

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Task 03 Research

Institutional Incentives for Efficient Water Use



> Saltcedar control creates water savings on the Pecos River

Researchers at the Texas Agricultural Experiment Station in El Paso have implemented a saltcedar control study on the Pecos River in Texas. There is limited knowledge of the long-term effects of water consumption of saltcedar and, more importantly, the potential water savings from saltcedar eradication. With the Pecos River Watershed Protection Plan, researchers are helping to answer these questions, as well as evaluate cost-effectiveness and methods and practices for improved watershed management and riparian restoration.



> Survey identifies incentives for conserving water

A water management survey conducted by the New Mexico Agricultural Experiment Station shows that an individual's water conservation incentives are weakened when the benefits produced by that conservation are shared by others. Producers have a greater incentive to save water for the future by reducing current use when they are financially rewarded, according to the survey. Further results found that because most farmland is leased, producers have little incentive to invest in capital expenditures that could conserve water.

> Researchers team to study drought models

Researchers with the Texas Agricultural Experiment Station in El Paso have teamed with New Mexico State University and Siena College researchers to collaborate on integrated economic, institutional, and hydrologic models to be used to study the Upper Rio Grande Basin. Potential benefits of creating policies would allow for intra- and intercompact water marketing that would help meet high water demands during drought conditions. Initial research shows drought losses could be reduced by 20 to 30 percent.

> Economic damage proves worse from lack of water in Rio Grande Valley

The Texas Agricultural Experiment Station in El Paso and Texas Cooperative Extension in Weslaco have teamed with the USDA-Economic Research Service to conduct research on the impacts to and responses of Lower Rio Grande Valley farmers due to water shortages from underdelivery of treaty water by Mexico. Preliminary results indicate that economic damages are greater than previously estimated, in part because of institutional set-ups that affect how growers can substitute water and land resources, as well as make use of risk-mitigating products such as crop insurance and disaster programs.

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Task 04 Research

On-Farm Irrigation System Management



> Economists use programming to assess water economic information

Development, validation, and reporting of a nonlinear programming resource allocation model (regional) is being implemented in the Lower Rio Grande Valley to evaluate how changes in agricultural water supplies affect crop mix, input use, economic returns, and other economic factors. For example, Texas Agricultural Experiment Station economists have estimated assessments of drip and sprinkler irrigation economics in sugarcane and row crops. Irrigated producers in South Texas can use the GAMS programming language to provide such data as the marginal value for water.

> Growers take part in Precision Irrigators Network

Researchers with Texas Agricultural Experiment Station developed and organized a project called the Precision Irrigators Network to conduct an on-farm research demonstration in which growers were actively involved in the evaluation of the limited irrigation program that best fits their farm. Computer models such as CropMan and PET were run to record growth and development and evaluate production practices. Research and Extension personnel conducted educational programs to inform producers on the use of irrigation scheduling tools. Because the on-farm research demonstrations include most of the large irrigated farms in the Rio Grande region, 311,000 to 413,000 acre-feet of water per year will be saved, based on 620,000 acres of irrigated land in the region.



> Efficient irrigation for sugarcane

Using 120,000 to 140,000 acre-feet of water annually, sugarcane is the most water-thirsty crop grown in the Lower Rio Grande Valley. Texas Agricultural Experiment Station researchers are studying the effects of diverse irrigation methods for sugarcane. Results show that furrow irrigation is inefficient, and scheduling that is not based on crop water use results in considerable waste. Therefore, using the methods being developed by this research in combination with more efficient application systems and scheduling based on a sound understanding of crop water use would result in an approximately 30 percent water savings.

> Development of irrigation management tools

Researchers with the Texas Agricultural Experiment Station in Weslaco are developing a set of integrated management tools for water conservation in vegetable production systems in the Lower Rio Grande Valley. Using onion and cabbage plots, furrow and drip irrigation and soil moisture depletion patterns were studied. Studies showed more water was lost and at a higher rate in the furrow irrigation than in the drip system. Yields in both crops were significantly higher under the drip system than the furrow system. The outstanding yield and water use efficiency of subsurface drip irrigated crops emphasizes the method's value for water conservation. This research is expected to provide the basis for the development of best management practices for on-farm water conservation.

> Deficit irrigation provides water savings in spinach crops

A Texas Agricultural Experiment Station study of variable spinach populations under center pivot irrigation showed that net marketable yield was not affected by a shortage of irrigation. At the range of 200,000 to 300,000 seeds per acre, an increase in water use efficiency was 50 percent higher. Deficit irrigation provided 23 percent water savings, which would result in a 1,100 acre-feet water savings (or 361 million gallons) per year in South Texas.

> Researchers identify water conservation strategies for citrus production

Citrus crop studies in the Lower Rio Grande Valley by researchers at the Texas Agricultural Experiment Station in Kingsville are under way. Varying N and P fertilization treatments were combined with and without compost application under mature citrus trees for the second consecutive year. Mature trees that have had root systems developed under flood irrigation for many years were converted to drip and

microspray irrigation systems. Results will take time, especially for harvest yields to stabilize at high levels. Harvest trends showed that average Rio Red grapefruit yields of flood-irrigated plots were initially greater than microspray and drip-irrigated yields. Fruit size in the flooded plots tended to be larger than in the microspray and drip plots. However, significant water savings are possible with the microspray and drip systems.

> Researchers develop scaling factor for immature pecan orchards

Researchers designed and developed a scaling factor to help producers manage water usage of immature pecan orchards. Water during flood irrigation was measured to determine a scaling factor on mature to immature pecans. An application efficiency of 79 percent was determined and compared to other flood-irrigated orchards. Yearly cumulative irrigation on mature pecan orchards was determined to be 56 inches (annual water use on mature orchards).

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Task 05 Research

Urban Landscape Water Conservation



> Rose and crape myrtle studies identify hardy varieties and common disorders

Experiment Station researchers have examined rose plants to determine effects of calcium additions in relation to salt tolerance. Researchers have determined that the addition of calcium enhances salinity tolerance. The variety *Rosa manetti* was found to be the most salt tolerant rootstock for homeowners and nurseries. A common disorder was also examined in crape myrtle species. Zinc deficiencies were found to be prevalent in varieties with the foliage disorder. The effect of irrigation water quality and its relationship with the chemical properties associated with many plant disorders will be considered in future research.

> Water conservation strategies topic of concern

A survey was given to city council members, mayors, and water conservation and utility staff in 30 cities along the Rio Grande Basin. Respondents were located in both New Mexico and Texas. Participants gave responses on water conservation strategies including preference-feasibility, barriers to water conservation, and the definitions of water conservation. The survey results will be published in a technical report. Researchers have begun giving presentations at several conferences throughout Texas and New Mexico.

> Sap flow measurements determine community water use levels

Researchers collected sap flow estimates for 12 trees in a gradient from the water edge to dry upland. Micrometeorological measurements were made at this site in order to determine environmental impacts on saltcedar gas exchange. Nearly 400 saltcedar trees were measured along the Pecos River and the Rio Grande. Community water use estimates will be derived from the data collected on these tree measurements.

> Water budgets save millions of gallons of water

Some 24 to 34 million gallons of water could be salvaged each year if homeowners practiced landscape water conservation. More than 800 homes were surveyed in Weslaco, and 51 percent were found to be using excess water for landscape irrigation. By using monthly water budgets based on landscape size, potential evapotranspiration value, and landscape coefficient, homeowners could reduce their landscape irrigation water use by 48 percent annually.

> Survey shows residents are aware of the role of water in their communities

A survey conducted by the New Mexico Agricultural Experiment Station suggests that New Mexico residents are increasingly aware of the role of water in their communities and state. The way households manage and use water to create desired landscapes and outdoor living spaces can be significant. For example, if residential outdoor water use could be cut by one-fourth in just the three communities profiled in this study, annual water savings could approach 6 billion gallons of treated, potable water (approximately 17,000 acre-feet). Conservatively valuing this water saved at a rate of \$1 per thousand gallons yields nearly \$6 million to the residents of those communities.

> Research demonstrates value of sub-irrigation to turf managers

Many turf managers throughout New Mexico are making plans to convert to the water saving application of sub-irrigation. Research conducted at New Mexico State University shows a dramatic potential water savings of 80 percent. Sub-irrigation helps to counter the two greatest challenges faced by turf managers: (1) poor water distribution and (2) insufficient quantities of irrigation water.



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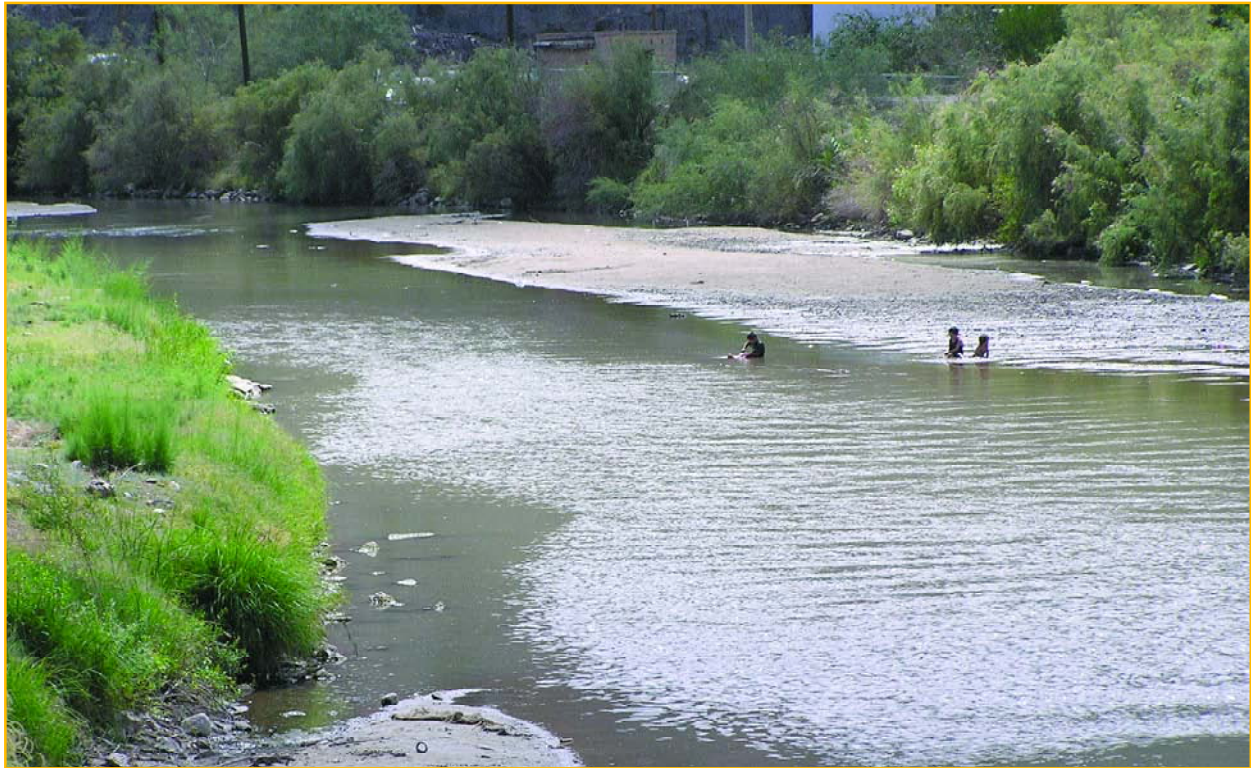
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Task 06 Research

Environment, Ecology, and Water Quality Protection



> Pathogen levels in Rio Grande identified

Researchers have determined exactly how much *Giardia* and *Cryptosporidium* are present in river water after release from wastewater treatment plants along the Rio Grande. During the nonirrigation season, pathogen levels in the river are too high, so drinking water plants use groundwater as a source for drinking water. During the irrigation season, river water is diverted to drinking water plants. Knowing the levels of pathogens in the water entering those plants helps researchers determine the amount of treatment necessary to create a safe and healthy drinking water source. Genetic typing is also under way to determine the human or animal source of the detected pathogens so that potential risks to humans can be assessed.

> Researchers study river–groundwater interactions

New Mexico State University researchers studying the interaction of groundwater with the Rio Grande determined that irrigation ditch seepage is being stored as groundwater and providing additional water to agricultural, municipal, and urban users downstream in northern New Mexico. Modeling of flood-irrigated alfalfa shows that any excess water beyond crop needs is seeping into the shallow groundwater. Researchers are now evaluating the benefits to users downstream of irrigating beyond plant needs. Further investigation of the river–groundwater interactions will provide an integrated assessment of the fate of seepage across the agricultural corridor, enabling completion of the hydrologic budget and characterization of important interactions between ditch seepage, flood-irrigation seepage, and shallow groundwater flow.

> Research shows irrigation drains could support silvery minnow for short periods

Innovative research being conducted on agricultural irrigation systems for conservation of native fishes indicates that naturalized habitats of irrigation drains could support Rio Grande silvery minnows at least for short periods of time. It is not known whether silvery minnows could successfully reproduce in artificial naturalized habitats. Promising research shows that continuing to allocate water to irrigation could have significant secondary benefits for conservation of the endangered silvery minnow by using return flows in irrigation drains as minnow habitats.

> New Mexico scientists develop weed species data library

Scientists with New Mexico Agricultural Experiment Station are continuing development of a spectral reflectance data library of individual weed species that are common to the Lower Rio Grande region. Spectral reflectance images are composite images of the vegetation and soil at sampling points. By identifying weed species along the irrigation ditches, scientists will be able to effectively design a weed management program for the Lower Rio Grande Basin that targets water-thirsty weeds. The spectral decomposition techniques developed in the project will be useful to other New Mexico and Texas projects under the Rio Grande initiative.



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Task **07** Research

Saline and Wastewater Management and Water Reuse



> Using saline irrigation for maximum landscape benefits

Researchers have studied the plant–salt tolerance relationship for different species of plants, providing guidelines for use of a specific amount of saline irrigation on different plant varieties. Conversion to a low-angle nozzle is also a practical way to reduce leaf damage when irrigating with high-saline water. Tolerant plants can tolerate up to 10,000 ppm of dissolved salts without suffering; sensitive plants can take up to 1,000 ppm. Research is still under way to develop management practices to reduce overall saline content in the soil and irrigation water.

> Booklet describes El Paso soil resources

A 48-page booklet titled *Soil Resources of El Paso: Characteristics, Distribution and Management Guidelines* highlights the rich soil resources found in the El Paso region. The book helps provide a better understanding of the different soil types in the area and ways to manage these soil types, especially when it comes to water. Topics include landscape and soil formation, soil characteristics and properties, utilization and management guidelines, and use of soil information for land use and water management planning.

> Researchers look to reclaimed wastewater as viable water source

Reclaimed wastewater is a major contributor to both urban and agricultural landscapes in the El Paso area. Reclaimed wastewater is about 60 to 80 percent of the cost of potable water supplies. Emphasis has been placed on the detection of contaminants in these water sources. By using phytoremediation treatment, \$170 per cubic yard can be saved compared to other technologies for removal of these contaminants. This will also help extend existing water supplies, ensure food safety and quality, create a safe and reliable water supply, and develop sustainable agronomic strategies to utilize reclaimed waters.

> Salt management strategy saves time and labor

A new method to detect salt-tolerant plants has been identified by Texas A&M researchers. Tetrazolium, a biochemical test, helped detect plant viability not otherwise seen with traditional testing methods. Only six to 24 hours of monitoring time was needed to complete the testing, compared to days with more traditional methods. This strategy will reduce the time, labor, and cost associated with screening plants for salt tolerance.

> International partnership determines risks associated with reclaimed wastewater

Residents of the Juarez Valley of Mexico rely on reclaimed wastewater for 90 percent of their water for agriculture and livestock. University researchers from both Texas and Mexico have found that using reclaimed wastewater for agricultural purposes does not lead to increased levels of metals in oat forage or in sheep grazing the forage. Therefore, consumption of locally produced meat products poses a low risk of ingesting these heavy metal contaminants. The presence of parasites, however, does pose a health threat to residents in the valley.



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Task **08** Research

Basinwide Hydrology, Salinity Modeling, and Technology



> Canal linings can reduce water seepage losses

Approximately 10 to 30 percent of the water delivered through canal systems is lost through seepage. Ponding tests have shown 160 acre-feet to 362 acre-feet of seepage loss in the Upper Rio Grande Valley, while current meter inflow-outflow measurements show seepage losses of 884 acre-feet to 1,986 acre-feet. By lining over 10 miles of canals in the area, enough water could be salvaged to irrigate 1,000 acres of crops or provide water to 8,000 households. Researchers are helping irrigation districts target canals that will result in the highest water conservation.

> RGBI county data maps available online

Natural resource data has been collected for counties along the Rio Grande and organized into spatial databases that provide GIS coverage for a particular county. To date, 16 Texas counties have been analyzed and mapped. Stakeholders can access and identify environmental, natural resource, and socioeconomic information for each county. Outside industries and companies can also use the information to assess opportunities for products or potential locations within the counties. Plans are under way to include health-related information for each of the 16 counties and to develop similar interactive maps for the nine New Mexico counties along the Rio Grande.

> Databases and GIS provide timely information along the Rio Grande

A Web site has been created with GIS interface for the Paso del Norte Watershed Coordinated Water Resources Database. The Coordinated Water Resources Database and GIS are designed to collect, synchronize, and provide timely online access to flow and water quality data for use by stakeholders, scientists, water agencies, and irrigation districts. By effectively and efficiently monitoring and operating the passage of Rio Grande flows and water quality in the region, water quality can be maintained within acceptable limits for effective water treatment, especially during low-flow periods.

> Spectral reflectance detects water stress in pecans

Researchers are currently field testing a method for detecting water stress on open-canopy pecan orchards using spectral reflectance. Using aerial and satellite data images, New Mexico State University scientists are detecting stress areas for use in irrigation management on pecans. This tool can be used in the statewide adjudication process for establishing water use of pecan trees, for irrigation district scheduling, and for conjunctive use of water during a drought.

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Partners

- > Cooperative State Research, Education, and Extension Service
- > Texas Agricultural Experiment Station
- > Texas Cooperative Extension
- > Texas Water Resources Institute
- > New Mexico State University Agricultural Experiment Station
- > New Mexico State University Cooperative Extension Service
- > New Mexico State University Water Task Force

Contact Information

> Texas Water Resources Institute

B. L. Harris

Project Director, Rio Grande Basin Initiative
Associate Director, Texas Water Resources Institute
1500 Research Parkway, Suite 240
TAMU 2118
College Station, TX 77843-2118
(979) 845-1851
bl-harris@tamu.edu
<http://riogrande.tamu.edu>

> New Mexico State University Water Task Force

R. Craig Runyan

Project Director, Rio Grande Basin Initiative
Coordinator, Extension Water Resource Programs
P.O. Box 30003 - MSC 3AE
Las Cruces, NM 80003
(505) 646-1131
crunyan@nmsu.edu
http://spectre.nmsu.edu:16080/rio_grande/

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