[2005–2006 Rio Grande Basin Initiative]

Progress and 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 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.

2005–2006 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

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On the cover

La Acequia del Llano, a community irrigation ditch in Dixon, New Mexico, was registered with the New Mexico State Engineer on May 13, 1909, but is known to pre-date the 1848 Treaty of Guadalupe Hidalgo. Approximately 5 miles long, the acequia transfers water from the Rio Embudo to the Rio Grande, just above the Embudo Gauge. *Photo by Leeann DeMouche.*

** Publications represent work from 2001 to present.*

[Task Areas]

2005–2006 Extension Accomplishments

[Task 1 Extension]

Irrigation District Studies

Economists host workshops on the value of water

Responding to invited requests, economists have presented and facilitated a series of workshops and discussions for irrigation districts (IDs) and representatives of municipal water suppliers about the value of water in the Texas Lower Rio Grande Valley. The region's changing landscape from traditional production agriculture has fostered contentious positions between the traditional owners of water rights (i.e., primarily irrigation districts) and cities' needs for abundant and secure volumes of water to parallel their rapidly expanding populations. This changing landscape is affecting IDs' clientele structure and ultimately their finances. Thus the "value of water" issue requires economists to simultaneously address the related issues of delivery costs and the interaction of rates (charged by IDs) to help IDs improve and secure their financial well-being.

Economists survey the costs of delivering water

Affected by the region's changing landscape and clientele structure, as well as farmers' increased use of efficient water-application techniques and districts' prior financial decisions, the costs of delivering water are changing for irrigation districts (IDs) in the Texas Lower Rio Grande Valley. Survey results are prodding IDs to rethink some of their business strategies as results indicate a review and increased understanding of total costs, significantly affected by shocks in energy costs and inflation, can improve financial positions. Mirroring costs are the rates charged by IDs to recoup their expenses. The intertwined relationship between delivery costs and rates charged by IDs (to agricultural, municipal and industrial users) is requiring economists to address conjoined issues in their efforts to provide objective analyses and educational outreach to help IDs lower their exposure to risk and improve financial positions.

Economists developing VIDRA© (Valley Irrigation District Rate Analyzer)

In light of the changing costs of delivery and the need for irrigation districts (IDs) to remain economically viable nonprofit entities, economists are collaborating with select ID managers to develop VIDRA, a spreadsheet program capable of estimating likely financial outcomes of IDs' changing water-delivery rates to agricultural, municipal and industrial users. ID rates typically include some combination of flat-rate (i.e., per acre watered) and delivery-rate (i.e., per acre-foot of water delivered) assessments. VIDRA incorporates appropriate accounting, economic and institutional factors that allow users to analyze "what-if" scenarios of changing flat/delivery rates. In its trial implementation, for Hidalgo County Irrigation District No. 2 (HCID2), VIDRA revealed the shortcomings of the current rate structure and highlighted a significantly different rate regime. This regime not only exposed HCID2 to lower financial risk, but also resulted in farmers paying the same total amount of money for the same amount of water. In direct response to this analysis, HCID2 implemented a plan to modify its rates as highlighted, and it complimented VIDRA's developers on the program's usefulness. Since that time, seven other IDs have requested rate-analysis assistance.

Infrastructure rehabilitation projects estimate considerable water savings

Economists continue to complete Rio Grande Irrigation District Economics (RGIDECON©) applications for 19 authorized projects in the Lower Rio Grande Valley. Irrigation managers, consulting engineers, the U.S. Bureau of Reclamation and the Texas Water Development Board are joining with the RGBI economist team to analyze final costs to compare with pre- and postconstruction estimates of water infrastructure rehabilitation. According to the U.S. Bureau of Reclamation, all projects constructed and implemented (to date) will save an estimated 80,145 acre-feet of water each year. Of this total, projects analyzed with RGIDECON are estimated to save at least 55,000 acre-feet annually.

Engineers complete maps of irrigation districts

Texas Cooperative Extension engineers have provided direct assistance through RGBI to four small irrigation districts in mapping and rehabilitation project planning. Engleman, Progresso, Los Fresnos and Bayview Irrigation Districts have saved $40,000 in engineering services. Engineers have also completed detailed maps of field lots, roads, irrigation-distribution systems and river pump locations for each of the four counties.

Infrastructure rehabilitation proves water savings for Lower Rio Grande Valley

Engineers originally estimated about 211,000 acre-feet of potential water savings with investments in infrastructure rehabilitation. The associated cost estimate to attain that level of savings (using 17 representative projects) was $157.8 million. After further studies, the estimate was revised to 243,092 acre-feet of potential water savings to result in a revised estimate of $181.7 million in required investment to attain an efficient 90 percent delivery rate in the Lower Rio Grande Valley.

Engineers respond to individual requests to project water savings

Due to educational programming and seepage-loss testing of canals in Hidalgo County, Texas Cooperative Extension engineers have documented 1,076 acre-feet of water savings. By relining 7.5 miles of canals in Hidalgo County Irrigation District No. 2, the water saved can be sold to other users for $54,000 per year. Over the next 10 years, the district can save 10,760 acre-feet and increase revenue by $544,000. Similar seepage-loss problems were found in the United Irrigation District, and replacement of these infrastructures has shown a projected 362 acre-feet water savings per year.

Engineers provide technical assistance to irrigation districts

Engineers with Texas Cooperative Extension continue to provide technical assistance to 22 irrigation districts through the Rio Grande Basin Initiative. The following work has been completed this year: seepage-loss tests (5 tests in 3 districts), database maintenance (22 districts), leak detection in canals (9 districts), flow measurements (8 sites in 4 districts), GPS and surveys (6 surveys in 3 districts), and GIS and district mapping (6 districts).

Irrigation district operations evaluation

Working in collaboration with Elephant Butte Irrigation District, a team of economists, scientists and engineers is evaluating irrigation district operations to identify parameters that affect water needs and water-use efficiency. To help agricultural producers improve farm irrigation management practices, a workshop, "Using Soil Moisture Meters and Flumes," was conducted. Through this workshop,

a Water Task Force report was developed and published to demonstrate to local and state agencies, agricultural specialists and farmers how to construct their own portable flume at a reasonable cost and to demonstrate how to use the portable flume so they will be able to measure and apply water rather inexpensively.

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[Task 2 Extension]

Irrigation Education and Training

Training courses provide valuable water conservation knowledge

Texas Cooperative Extension engineers in the Lower Rio Grande Valley continue to hold workshops, short courses and field days. A water measurement workshop was held in Weslaco. It consisted of a three-day workshop for water resources specialists from Central Asia, in cooperation with the U.S. Department of Commerce, and a one-day demonstration of portable canal-flow measurement equipment for Engleman Irrigation District. The workshops were held to help irrigators and other water specialists implement water conservation practices. These trainings have proven very helpful to those who have attended; for example, a landscape irrigation auditing and management course showed a 35 percent knowledge increase.

Engineers to assist with Turfgrass Drought Recovery Study

Texas Cooperative Extension engineers have teamed up with Texas Turfgrass Producers and the San Antonio Water System for a 60-day Turfgrass Drought Recovery Study. The goal is to design a rainout shelter and turf drought recovery experimental facility to help manage the new ordinance the City of San Antonio will enforce beginning in January 2007. The ordinance will require builders to ensure that there is at least 4 inches of soil covering any area where they plant grasses at new residential or commercial sites. It will also require that during new-home construction, landscapers plant grasses that will survive a 60-day drought, a practice applicable throughout the Rio Grande Basin.

New tools will help calculate water savings

Engineers are implementing a large-scale demonstration and evaluation of a variety of "smart controllers" to anticipate water savings for the Lower Rio Grande Valley. These controllers will be installed at residential sites to show how effectively they operate and to assist in setting up irrigation schedules. Water savings, costs and benefits of technology related to water savings, landscape appearance, and participants' satisfaction levels will be evaluated with these new controllers. Smart controllers have the potential to be effective landscape water conservation tools.

New rainfall rates for Texas cities published

Rainfall rates for 21 cities in Texas have been recalculated, updated and published on the TexasET Web site (http://TexasET.tamu.edu). This Web site has provided valuable data that is widely used by irrigation district managers and other irrigators for irrigation scheduling. State agencies and city water conservation departments also use the Web site for water budgeting and planning.

Rainwater harvesting can reduce municipal water use

New Mexico Extension horticulture specialists conducted a series of rainwater harvesting workshops throughout the state. The workshops demonstrated how to convert cheap plastic garbage bins into rain barrels and included the basic concepts of using rainwater for irrigation and capturing rainwater for future use. Research from this project has estimated that residents of New Mexico can reduce their municipal water use by 90 percent with the use of organic mulches and rainwater.

New Mexico irrigation guidance provided

A statewide New Mexico Extension irrigation program is being developed that will distribute information from recent research to assist urban landowners. This program will include a basic hands-on class demonstrating the necessary drip irrigation systems that are appropriate for certain geographic and topographic areas throughout New Mexico. In addition, a publication guidebook will be produced to help Master Gardeners and residents of New Mexico locate materials for drip irrigation systems. The project, "User Friendly Drip Irrigation/Mulch Systems for Urban Specialty Crop Production," has demonstrated that on average, water application was reduced by 29.3 percent. Cooperators reduced water applications from 2002 to 2004 by 44.8 percent relative to control plots. Moisture probes used by cooperators in two herb-variety trials in Santa Fe and Taos helped reduce water application in the mulch plots by 27.4 percent and 27.9 percent, respective to their locations, when compared to the control plots.

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[Task 3 Extension]

Institutional Incentives for Efficient Water Use

On-farm flow meters make great impact on irrigation districts in Rio Grande Basin

In cooperation with Great Plains Meter, Inc., Texas Cooperative Extension engineers have been demonstrating the effectiveness of permanent on-farm flow meters equipped with telemetry data that transmits data back to each irrigation district office. A Web site is being developed for instantaneous reporting of flow information for internal district use. Great Plains Meter, Inc., donated four meters for this study. Improvement of the technical skills of irrigation district personnel will facilitate improvements in water supply and distribution control. An improvement in water-use efficiency, increasing water conservation, increasing agricultural production, reductions in pumping costs and improved data management have been significant benefits for users of these meters.

Engineers provide valuable tools for district rehabilitation

Texas Cooperative Extension engineers continue to use and develop the Irrigation Conveyance Evaluation (ICE) for cost-effective measures for prioritizing district rehabilitation and for projecting water savings in the Lower Rio Grande Valley. ICE is expanding to include farm turnout flow optimization, quantification of head problems and spills. Engineers are also evaluating use of satellite imagery to analyze trends in land use as an aid in rehabilitation-project planning. Along with geographic information systems (GIS), these satellite images can provide valuable information for rehabilitation efforts.

Drought model to guide decision making

A team of economists from New Mexico State University, Texas A&M University and Sienna College (New York) is working to construct a hydro-economic model to be used by legislators and others to assist in the evaluation and identification of economic and hydrologic impacts of policy measures in addressing severe drought. This model will be applied to an interactive Web site, where users will be able to model the Law of the River and the economic value of water in alternative uses during existing and potential drought-coping situations. An educational workshop intended for legislators is being planned. This workshop will support educational development of water conservation policies in the Rio Grande Basin and the use of the interactive Web site.

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[Task 4 Extension]

On-Farm Irrigation System Management

Subsurface drip irrigation proves water savings in onion crops

Extension specialists in Weslaco have discovered that onions irrigated with subsurface drip irrigation conserved 9 inches of water per acre compared to the traditional furrow irrigation method. At the same time, with drip irrigation, yields were increased from 94 to 159 tons per acre, and onion quality was significantly improved. There are about 11,308 acres planted with onions in the Lower Rio Grande Valley, and about 15 percent of farmers have already adopted this technology. It is expected that more farmers will apply drip irrigation to conserve water and increase quality and productivity, with the help of the Rio Grande Basin Initiative.

Sugarcane water-use and irrigation guidelines developed

Texas Cooperative Extension has developed sugarcane water-use and irrigation guidelines for the Lower Rio Grande Valley. Continuous sugarcane yield improvement has been observed as a result of better irrigation management in the Valley through the RGBI. Sugarcane yields have increased from about 38 to 45 tons per acre in the last five years. An Extension effort in Weslaco is under way to classify farmers by productivity to screen for education needs and to better target technology transfer to them for water savings benefits.

On-farm crop monitoring shows significant water savings

Extension specialists have conducted on-farm irrigation monitoring and demonstrations with several producers in Cameron and Hidalgo counties. Soil water status was monitored using the Crop Production and Management Model (CroPMan) to help manage irrigation scheduling. Cotton, grain sorghum and corn crops were studied, comparing furrow and drip irrigation practices. Based on estimates of normal irrigation water usage by producers in the Rio Grande Valley, which varies depending on growing season precipitation, several acre-inches of potential water savings were found. For example, grain sorghum showed 8 acre-inches of water savings by modifying drip and furrow irrigation practices. Cotton showed 6 acre-inches of water savings using the furrow irrigation method, whereas cotton under drip irrigation methods showed up to 12 acre-inches of potential water savings. Using CroPMan, a decision tool was developed to assess risk and economic trade-offs for various cropping alternatives. Statistical probabilities for crop yields by soil type, irrigation practice and irrigation water salinity concentration were also developed. This data will help guide educational programs with producers to maintain profitability and save water.

Publications promote water efficiency, provide crop production guidance

New Mexico Extension has published a series of crop commodity fact sheets on New Mexico agriculture. The commodity fact sheets promote efficient use of water resources for food and feed products grown in New Mexico and outline economic returns to the state. These publications can be used as educational tools to provide decision makers with information about water-use efficiency and economic returns on investments.

Research helps conserve New Mexico's natural resources

New Mexico Extension agronomy specialists have developed and produced a DVD titled *Optimizing Irrigation in New Mexico.* The production introduces some of the current Rio Grande Basin Initiative projects and water programs supported by research and Extension in New Mexico, demonstrates water conservation practices for use in agricultural crops, and shows how properly managed cropland can benefit the state's soil and water resources.

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[Task 5 Extension]

Urban Water Conservation

Three water conservation strategies identified as most important

Elected city officials and water managers in the Rio Grande Basin of Texas and New Mexico were surveyed and have identified three water conservation strategies as the most viable for their communities. Encouraging drought-tolerant landscapes; mounting public education campaigns about water conservation; and conducting residential water audits to review use, check for leaks and suggest conservation measures were the top three strategies chosen. The survey was conducted to help city officials identify the most preferred and feasible strategies for persuading residents in the Rio Grande Basin area to adopt water conservation practices.

Demonstration home will implement water and energy conservation techniques

Extension specialists evaluated the potential for building a green-construction home. They visited the Florida House, which was constructed to demonstrate water and energy conservation techniques that can be implemented during construction or home remodeling. A site adjacent to the Hidalgo County Extension Office is an ideal location for construction of the water conservation demonstration home. Potential funding avenues for constructing this home are being explored.

In-home conservation study will identify water use before and after intervention

Three families in Webb, Pecos, Starr, Ward, Val Verde, Crockett, Hidalgo and El Paso counties, and six families in Cameron County, are participating in an in-home water conservation study. This study will identify how much water they used in their home prior to conducting focused educational programs and associated demonstrations, and then how much water each family uses in their home after intervention. County agents have already conducted water audits in each of the 30 households. Educational information and a list of recommended behavior changes were provided for Household A. Educational information, a home water audit, and a list of recommended behavior and fixture changes were provided for Household B. One family received all of the above, as well as water-efficient fixtures such as toilets, showerheads and aerators. Data will be collected for a total of four months. The study is currently under way to determine the most cost-effective way to achieve in-home water conservation.

Rainwater harvesting system demonstrates water collection techniques at Hidalgo County Extension Office

A rainwater harvesting demonstration system constructed at the Hidalgo County Extension Office shows three methods to collect water for use in the landscape. A new roof and gutter system were constructed on the building, which provided an opportunity to demonstrate water harvesting techniques. Three sections of the roof were directed to three different storage systems. Downspouts were plumbed into a roof washer that collects first flush water, and an overflow connects to a piping system for conveying water to the collection tank. One collection tank is a 500-gallon galvanized steel tank set in a rose garden and connected to a drip irrigation system. This system shows how the collection system can be a prominent part of the landscape. A second collection tank is a 300-gallon green poly tank placed under a tree with low-hanging branches and also connected to a drip irrigation system. This tank demonstrates a method to blend the rainwater harvesting system into the landscape. The third collection system functions as a method to store extra water for use in the first two systems. A sump tank and pump are used to convey the collected rainwater from the roof to a remote location for storage. This extra water is then conveyed through a pressurized system to the first two tanks.

Rainwater harvesting conference delivers practical information for implementing a collection system

A rainwater harvesting conference held in Edinburg was attended by 80 people interested in learning about techniques to harvest rainfall for use in their landscape. The program consisted of morning and afternoon lectures and a tour of the demonstration facility constructed at the Hidalgo County Extension Office. A light drizzle fell during the tour, helping participants visualize the purpose for the various components of a rainwater harvesting system. Participants at the meeting were eager to share their experience with others. This resulted in invitations for Barbara Storz and Billy Kniffen to attend the Landscape Architecture conference in October 2005 and present information on incorporating rainwater harvesting systems into a residential landscape.

Fact sheet shows methods for using graywater in residential landscapes

Graywater collection, treatment and distribution systems are a method to use wastewater from showers, bathroom sinks and laundry for irrigating residential landscapes. This water was previously used in the home and can be directed to the landscape to irrigate vegetation. A fact sheet covers regulatory requirements, design considerations, realistic estimates of water generated, and techniques for irrigating plants. These systems can reduce the total water needed to irrigate a landscape and can also reduce water costs.

Workshops will help suppliers create water conservation and drought plans

New Mexico Cooperative Extension Service is collaborating with the New Mexico Water Conservation Alliance and the New Mexico Office of the State Engineer to develop a series of workshops to teach water

suppliers throughout New Mexico how to produce and implement the proposed Water Conservation and Drought Management Plan. The workshops are being developed to identify areas with the greatest need and to invite stakeholders to the table to define ways to foster water conservation.

Field day emphasizes water conservation in turfgrass systems

Subsurface irrigation and salinity-tolerant grasses were the highlight of the second annual Turfgrass Field Day, hosted by New Mexico State University at Fabian Garcia Research Center. More than 100 participants from New Mexico, Arizona and Texas attended the field day, which emphasized water conservation in turfgrass systems and ornamental plants. Subsurface irrigation was highlighted as a water-saving alternative to conventional sprinkler systems. Sprinkler-irrigated plots received a total of 29 inches of irrigation. Drip-irrigated plots received 18.9 inches of irrigation, which is 35 percent less than the sprinkler-irrigated plots. Subsurface-irrigated plots (ECS, tray system) received 17 inches of irrigation, which is 41 percent less than sprinkler-irrigated plots. The field day demonstrated to professional golf course managers throughout the state the Rio Grande Basin Initiative research on different irrigation methods and different root zone materials that affect water use, turf performance and quality, soil physical properties, water movement and soil gas composition in sloping and flat areas seeded with creeping bentgrass.

Symposium focuses on urban water-use efficiency

Increasing efficiency of water use in urban landscapes was the highlight of the Symposium on Efficient Water Use in the Urban Landscape. The goal of the symposium was to provide opportunities for professionals to share ideas, knowledge and scientific methods to update and identify methods to increase efficiency of water use in urban landscapes. This symposium also increased collaboration among all professionals involved in water conservation.

Database will promote planning for water-conserving landscapes

Development of a comprehensive database providing definitive information and use of common landscapes, trees, shrubs, turf and ornamental grasses suitable for water conservation landscapes continues. The development of this resource in both print and electronic form is needed. The outcome of this project is to create a printed manual of landscape plants for New Mexico that can be used by the public and in a classroom setting and to develop an interactive Internet-based image database of the plant materials.

Extension agents trained to conduct New Mexico in-home water conservation project

Extension housing specialists at Texas A&M and New Mexico State University are working with several counties in each state to conduct an in-home water conservation demonstration project. The project will be conducted in five New Mexico counties and will include three families in each county. The goals of the project are to increase awareness of home water conservation and to encourage reduction of in-home water use through behavior and equipment changes. A joint training session for both Texas and New Mexico Extension agents was conducted at the El Paso Texas A&M Research Center.

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[Task 6 Extension]

Environment, Ecology and Water Quality Protection

Water-well screenings for fecal coliform, nitrate concentrations, TDS and arsenic

Specialists worked with 23 youth at the 2005 Texas 4-H Water Camp in July to screen water samples for nitrates, salinity, pH and presence of pesticides, to name a few. Private water-well screenings in Webb and Duval counties and the Water Quality Educational Seminar for citizens of Webb County were conducted in October. Samples were being tested for fecal coliform, nitrates, salinity and arsenic concentrations. Out of 57 total samples screened, 13, or 23 percent, were found positive for fecal coliform bacteria. For all samples, the average nitrate-nitrogen concentration was 2.4 parts per million (ppm), and the average concentration for total dissolved solids (TDS) was 1,098 ppm. Of the 50 samples screened for arsenic, 26 samples had no arsenic detected, 21 samples had concentrations of less than 10 parts per billion (ppb), and three had arsenic concentrations between 10 and 30 ppb.

Saltcedar control programs and data loggers provide water salvage estimates

To date, more than 13,000 acres of saltcedar have been treated within the Pecos River Basin of Texas. Additionally, more than 16,000 acres of saltcedar have been treated along the Pecos River in New Mexico. Shallow groundwater monitoring wells along the Pecos River and Rio Grande were maintained through November 2005. Data loggers were maintained and downloaded on a monthly basis throughout the year.

Data analysis will be performed during the winter of 2005 and 2006. Five years of data has been collected and needs to be analyzed. With acreages treated through 2005, potential water salvage for the entire river is between 20,000 and 40,000 acre-feet annually (6.5 to 13 million gallons). Current research indicates potential water salvaged from saltcedar is at least 2 acre-feet of water per acre of saltcedar controlled. Assuming this minimum amount of salvage, conservatively, more than 26,000 acre-feet of water is salvaged annually from saltcedar control programs within the Pecos River Basin of Texas.

Fact sheets address arsenic and radionuclides in groundwater, health risks and potential removal methods

Arsenic and radionuclide fact sheets were drafted through the use of a cooperative approach among Texas Cooperative Extension, the Texas Commission on Environmental Quality, the Texas Department of Agriculture and the Texas Water Development Board. The fact sheets were drafted to address the location of arsenic and radionuclide contaminants in groundwater resources, health risks associated with drinking arsenic- and radionuclide-contaminated water, and potential methods to remove arsenic and radionuclides from the drinking water supply. These publications will be part of an educational series titled *Drinking Water Problems.*

Soil-testing campaign estimates potential fertilizer savings

A four-county soil-testing campaign targeted agricultural producers in Cameron, Hidalgo, Starr and Willacy counties. The soil-testing programs were conducted in the fall and winter of 2001, 2002, 2003 and 2004. To implement the program, special regional educational events targeting nutrient management were conducted each year in Weslaco. The soil-testing campaign generated a total of 1,581 samples representing 69,824 acres. The primary crops included in the program were grain sorghum, which represented 27,285 of the sampled acres; cotton, which represented 17,956 acres; and melons, which represented 6,329 acres. Likewise, 436 samples were submitted for grain sorghum, followed by cotton and melons with 409 and 252, respectively. Estimated potential savings of 1,742,321 pounds of nitrogen with a value of approximately $446,338 and 2,345,310 pounds of phosphorus with a value of approximately $626,006 were calculated. This management practice not only provided environmental benefits by reducing nutrient loading to the soil and potentially to water resources, but also created the opportunity for an economic impact estimated at $1,072,344. Good nutrient management programs conserve water as well, through greater water-use efficiency.

Biological control of aquatic weeds saves irrigation districts money

Ongoing demonstrations of triploid grass carp as a biological control of submerged aquatic macrophytes in canals and *resacas* have saved five irrigation districts in excess of $500,000. Removal of submerged aquatic weeds has reduced labor costs, pumping costs and water loss from evapotranspiration and percolation/seepage from the canals. Recommendations were provided for chemical control of water hyacinth, water lettuce and taro (all noxious, non-native species) to three irrigation districts. Control has been successful, and all are extremely pleased with the results. Significant water savings are more than the previously employed manual control methods and with no water-use restrictions. The AQUAPLANT Web site has also been totally revised. Updates include new species of aquatic plants, expanded photos, new management techniques and an FAQs (frequently asked questions) section.

Rainwater harvesting demonstration planning and installation

Extension agents and specialists cooperated in the planning and installation of a rainwater harvesting demonstration site at the Culberson County Courthouse in Van Horn, Texas. Planning is under way for future rainwater harvesting sites at the El Paso, Lubbock and San Angelo Agricultural Research and Extension Centers; Sierra Blanca County Extension Office; Monahans 4-H Extension Center; Baptist Memorials Retirement Center; the Alpine Library; and numerous other locations throughout West Texas. McDonald Observatory at Fort Davis is also considering the use of a rainwater harvesting system to alleviate firefighting

water shortage issues. A joint plan to develop a new rainwater harvesting bulletin with the Lady Bird Johnson Wildflower Research Center in Austin was initiated, and the first draft has been written. A new publication, *Harvesting Rainwater for Wildlife,* has also been developed. A rainwater harvesting workshop is planned for Fort Stockton this spring to create more interest in this "old-but-new" method of conserving water.

Simulation model shows need for an increase in lagoon surface area

An object-oriented, spatially explicit, simulation model was developed to fill the need for investigating how various actual or potential water availability scenarios might alter the distribution and abundance of aquatic birds in the Lower Rio Grande Valley. The model describes temporal patterns in water use and aquatic bird distribution and abundance over time. More specifically, it represents water availability changes in irrigation systems, *resacas* and reservoirs. The impact of increasing the surface area of lagoons in wildlife refuges is also simulated to observe the potential change in the distribution and abundance of aquatic birds. Scenarios were selected based on current projects planned by the North American Development Bank. Approximately 3 percent of the canals have been or will be buried between 2003 and 2007. Simulation results indicate that with this decrease in canals, it would take an annual 2 percent increase in lagoon surface area to maintain the current abundance and distribution of aquatic birds in the Lower Rio Grande Valley. As we improve irrigation systems we need to make sure we take into account associated wildlife issues.

Rooting out canal water hogs

The establishment of a weed garden at the New Mexico State University Leyendecker Plant Science Research Center demonstrates usage and root growth of weed species. The weed garden plants include species that are common on the irrigation canal system of the Lower Rio Grande Basin, farm fields and riparian areas. The weed garden is being used to help the public, agricultural producers, Elephant Butte Irrigation District personnel and others identify common species of problem weeds. Using the garden, the "Water Hogs: Canal Weeds Field Day," was held during summer 2005. The agenda for the field day included weed identification, demonstration of root growth of plants using rhizotrons to show the water use of species found on the canal, demonstration of soil characteristics and how soil salinity affects plant growth, demonstration of GPS and hyperspectral technologies, and reflectance signatures of common weeds. Demonstrations showed the massive amount of water being used from weed species located in the canals and the need for developing a management plan for irrigation canals and farm ditches.

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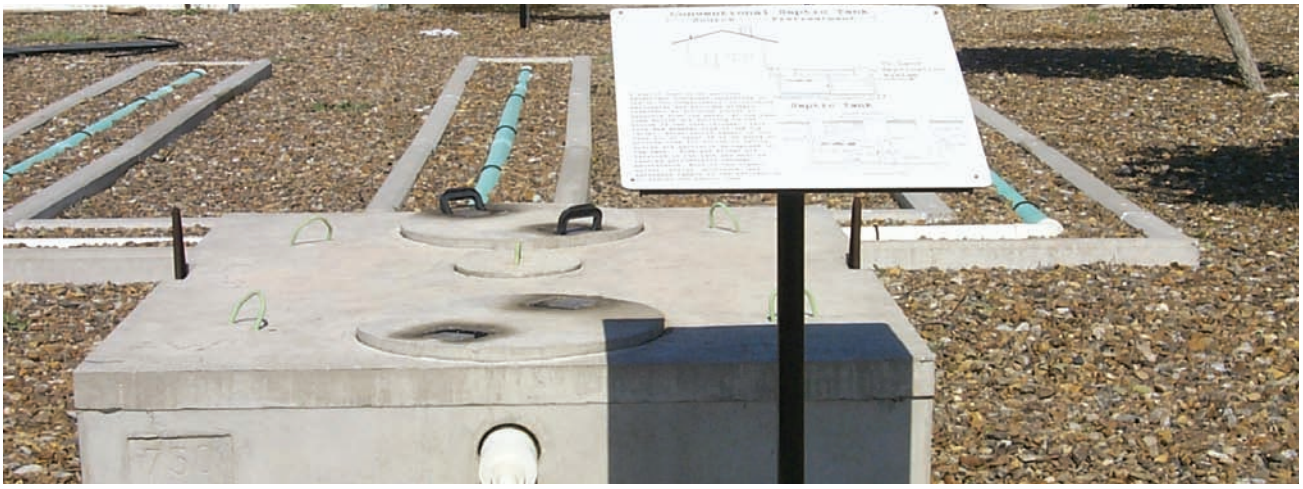

[Task 7 Extension]

Saline and Wastewater Management and Water Reuse

On-site wastewater technology fact sheets help homeowners make informed decisions when selecting technologies and services

Homeowners face a critical decision when they need wastewater services in rural and suburban areas. They must evaluate potential options and select the most appropriate system for their location. A series of fact sheets was developed to provide homeowners with information regarding various technologies to treat wastewater on-site. The series is designed to provide homeowners with critical information so they can make informed decisions. *A Homeowners Guide to Selecting a Maintenance Service Provider* is one of the fact sheets in this series to guide Rio Grande Basin residents. It describes different maintenance contract options being marketed by current maintenance providers and should assist homeowners in answering questions and selecting a maintenance company.

Wastewater short courses provide practitioners with cutting-edge knowledge

Wastewater practitioners depend on continuing education courses to increase their knowledge, skills and abilities regarding on-site wastewater treatment. Three training manuals were developed to assist in conducting continuing education courses. These training courses are taught at several locations in the Rio Grande Basin. The On-site Wastewater Treatment Training Centers located at the Agricultural Research and Extension Centers in Weslaco and El Paso provide a means to incorporate hands-on training into the courses.

Septic tank installation guide proves invaluable to homeowners

Many residents in the Rio Grande border region have limited resources available for providing wastewater treatment. These residents also have the ability to potentially construct their own on-site wastewater treatment system. Adrian Hansen led a team consisting of Kitt Farrell-Poe, Craig Runyan, Bruce Lesikar and L. Mimbela to write a homeowners guide to installing septic systems. This instructional guide uses a comic-book format to convey critical knowledge to homeowners interested in installing their own system. The guide takes the homeowner step-by-step through the process of installing a conventional on-site wastewater treatment system consisting of a septic tank and drain field. The illustrations allow the homeowner to see the tools and skills needed to install a system. A parts list is included for a typical system so they can gain an appreciation of the components needed to install a septic system.

Wastewater system designers need help to address high-strength wastewater

On-site wastewater treatment systems are a permanent part of our wastewater infrastructure, and therefore all wastewater sources need an effective treatment system. Most guidance documents relating to on-site wastewater treatment are based on historical data for residential wastewater. However, the implementation of water conservation practices in residential and commercial facilities has increased the concentration of waste in the wastewater. The challenge arises when the wastewater systems are designed with guidance documents that address only the wastewater flow. Rio Grande Basin systems usually have a shortened life expectancy due to organic overloading, rather than the normal expectation of 30 years. Wastewater characteristics data was evaluated from 28 restaurants to determine the characteristics of normal design parameters and management practices. The data illustrated that the wastewater parameters for restaurants can be four to six times greater than typical design values for residential wastewater. This information provides insight regarding the premature failure of commercial wastewater treatment systems. The information is being shared with wastewater practitioners through presentations at professional meetings and through publication in professional magazines and refereed journals.

Wastewater application and conservation workshops help Las Cruces water personnel

City employees of Las Cruces, New Mexico, are now more capable of using an automated weather station to schedule irrigation, with the completion of an irrigation schedule protocol for treated industrial wastewater application management in the Chihuahuan Desert. The protocol was developed by researchers at New Mexico State University and Texas A&M. Researchers have transferred this technology through a series of irrigation scheduling protocol workshops for personnel with the City of Las Cruces Water Utilities Department. These workshops are training personnel to perform their own land application irrigation scheduling of industrial wastewater on 80 acres of city land. Development of a how-to publication for the land application process for industrial wastewater is also in progress and will lead to additional water conservation.

Irrigating turf can also mean saving drinking water

A New Mexico Extension turf specialist is evaluating how the use of non-potable water for irrigation of turf can save 342,000 acre-feet of high-quality drinking water in northern and southern New Mexico. High-saline water significantly delayed and reduced establishment rates of turfgrass when compared to potable water in the study.

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[Task 8 Extension]

Basinwide Hydrology, Salinity Modeling and Technology

Modeling water conservation with CroPMan aids New Mexico farmers

Scientists from New Mexico State University and Texas A&M are working together to incorporate New Mexico data into the Texas A&M Crop Production and Management (CroPMan) model to improve real-time water management, maximize production and profit, increase irrigation efficiency, and identify limitations to crop yield. Presently, scientists are coordinating activities to introduce and demonstrate activities of chili crops into the model.

Computerizing water conservation workshop is planned

Development of an evapotranspiration (ET) workshop for the New Mexico Office of the State Engineer is in progress. This workshop is designed to illustrate recent research of a modified Surface Energy Balance Algorithm for Land (SEBAL)–type evapotranspiration estimation algorithm called Regional Estimation ET Model (REEM), which uses Advanced Spaceborne Thermal Emission and Reflection Radiometer (ASTER) satellite data to provide real-time ET values with high accuracy.

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2005–2006 County Programs Accomplishments

[2005–2006]

County Programs

Rainwater harvesting demonstration systems introduce potential new resource

A rainwater harvesting demonstration system was installed at the Texas Cooperative Extension Office in Hidalgo County utilizing two fiberglass tanks, one poly tank and one metal tank, with a total collection capacity of 4,585 gallons of water. The Rainwater Harvesting Conference was held in Edinburg, with 109 registrants from Hidalgo and Cameron counties. Fifty-three participants toured the rainwater harvesting demonstration system at the Extension office. The Hidalgo County horticulture agent is working with a local architect on a rainwater harvesting demonstration site for the public library in Rio Grande City, Starr County, which will include an educational program for local residents.

Rio Grande Basin Initiative funds were also used to purchase a 1,500-gallon tank and gutters, pipe and other materials to be used in establishing a rainwater harvesting demonstration at the George and Opal Bentley 4-H Center in Monahans, Texas. The demonstration will be used to teach Ward County residents how to collect and use rainwater as an alternative water resource. All materials have been purchased, and the site has been selected and secured. A pad for the tank has been constructed, and the pipe and guttering were installed in February 2006. The rainwater harvesting demonstration site is now complete and awaiting rain.

Polypipe and water meters result in 30 percent water savings

Extension educational programs and Experiment Station researchers, in partnership with private enterprise, have encouraged the use of flexible plastic pipe (commonly called polypipe) and water-metering devices to replace earthen ditches and siphon tubes in Texas' Lower Rio Grande Valley and in Mexico. Three demonstrations conducted in Mexico showed a 30 percent water savings with the use of polypipe. A Texas Cooperative Extension publication explaining the advantages and disadvantages of using this technology, with illustrations and details about its installation, is available in English and Spanish. The publication has been used in the Lower Rio Grande Valley and in Mexico. Use of these water-conserving devices is rapidly expanding.

Texas-Mexico collaboration proves successful

Mexico extended two invitations for Texas personnel to talk about irrigation experiences in the Lower Rio Grande Valley. Reaching this broader audience has water conservation implications in the Rio Grande Basin. The use of pressurized irrigation systems, polypipe and measuring-device technologies have slowly been transferred, and Mexico has adopted these technologies.

Cedar management can improve water conservation

Efforts to manage cedar growth continue along the West Prong area in Kinney County. Currently, seven bulldozers and seven excavators are working to remove cedar to improve rangeland and wildlife habitat areas and conserve water. A spring in the area has an average flow of 10 gallons per minute and provides an excellent wildlife habitat area for all game animals, small mammals and livestock. Approximately 97,000 acres are under cedar management in the northwestern portion of Kinney County, with significant water savings.

Master Gardeners contribute to water conservation

Master Gardener volunteers contributed more than 4,100 hours of service supporting programs to educate the public about water conservation and natural resource issues, totaling a benefit of more than $72,000 to El Paso County Extension. El Paso Master Gardeners were also involved in the yearly FloraFest and Native Plant Sale at the Chihuahuan Desert Garden at the University of Texas–El Paso's Centennial Museum. This event includes education activities as well as the sale of native, water-smart plants. In April 2005, 32 Master Gardeners helped with the event, volunteering 212 hours. More than 10,000 plants were sold, raising approximately $61,000 for the maintenance and growth of the Chihuahuan Desert Garden. El Paso County residents can visit the garden to see what various native plants look like in a water-conserving landscape.

Master Gardener volunteers create water-conserving landscapes

Master Gardener volunteers in Cameron County were trained on using drip irrigation in the landscape. They participated in three hands-on activities, in which 12 Master Gardener volunteers installed a drip irrigation system in a native landscape at Rangerville Elementary School to conserve water. The use of native plants and mulch in the landscape taught elementary students about landscape water conservation. This demonstration reached 200 youth and adults. Master Gardener volunteers also taught water conservation in a vegetable garden at two local sites. San Benito Veterans Academy Middle School and San Benito Sunny Glen's Children's Home youth increased their knowledge and skills using drip irrigation in a vegetable garden to conserve water. More then 360 youth participated in the spring vegetable garden.

Producers save money by reducing fertilizer use

A successful soil-testing campaign for row crop and forage producers was held in Willacy County. Producers saved from $9.47 to $27.07 per acre by reducing fertilizer use, and decreased fertilizer use meant decreased fertilizer runoff into water sources. Producers adopted residue management practices on their farms, which conserved soil moisture. They gained knowledge about crop physiology that enabled their crops to benefit from more timely irrigation and water use. Producers also learned the economic and environmental benefits of soil testing and proper nutrient management. Another result was reduced nutrient loading, which decreased the potential threat to surface water and groundwater.

Water Fest 2005 is successful

In October, the binational, tri-county and tri-city Water Fest was held, reaching 450 students. They learned about water quality and conservation practices via an Integrated Pest Management exhibit and mini training sessions and saw a watershed demonstration model. Students and teachers viewed the non-point pollution water model to gain insight into the dangers of contaminating underground water sources. Teachers were provided packets to extend the exhibit/demonstration activities to the classroom. Materials included home water conservation tips, *Investigating Water* curriculum lessons, mulching practices for water conservation, and other home and garden water conservation tips.

In-home water conservation participants are recruited

Family and consumer sciences agents conducted nine Parenting Along the Border series, with 156 parents participating. Part of the program included in-home water conservation information and handouts with tips. In October, agents attended the in-home water conservation meeting and recruited three El Paso County families to participate in the in-home water conservation retrofitting project. A plumber has been hired to do the retrofitting, and the 2004 water bills have been collected from the families involved.

Three families in Pecos County participated in a three-month in-home water conservation project with several other RGBI counties. In Pecos County, first-year results were opposite from previous expectations. Those who received the most instruction on water-saving techniques and had new water-saving retrofittings actually increased their water consumption during the study. Those with lesser instructions used about the same or slightly less than before the study began. However, the first home has six girls under age 17 in a blended household, making a total of eight in the family. All three families in the study understand and agree with the concept of in-home water conservation and are making a conscious effort to reduce their personal water consumption. A second study is currently under way for 2006, using three different Pecos County families.

Water table management shows promising water savings

Monitoring of the water table depth (via a piezometer) shows that for 2004 and 2005 the water table was never shallower than 7 feet on 13 of the 14 monitored sites. The one site shallower than 7 feet (6 feet) was at the end of El Paso's Lower Valley, near the Rio Grande, late in the season and after heavy, uncontrolled river runoff due to rains. The benefits are that salts will start moving down from the 3-to-5-foot depth, root systems will extend to reach leached nutrients, more oxygen will be available for root performance, and less irrigation will be needed. There is an up to 25 percent water savings potential. Through an extended root system, pecan trees could save 18,750 acre-feet annually.

Producers benefit from water conservation practices seminars

One hundred fifty-nine producers in the Uvalde area participated in educational programs addressing water conservation practices. As a result of these efforts, 72 producers reported they learned the definition of

potential evapotranspiration (PET) and gained increased knowledge of how soil moisture sensors can be used to monitor moisture conditions in a crop. They also reported an increased knowledge of weather stations in the area and of ways to apply the information to PET. Five producers grew 720 acres of corn utilizing soil moisture sensors and data loggers to monitor soil moisture to time irrigations. Three producers grew 370 acres of cotton utilizing soil moisture sensors and data loggers to monitor soil moisture to time irrigations. One weather station was installed near Sabinal to provide the latest weather and PET information to growers in the area.

An irrigation water conservation project that was established in 2004 in Val Verde County on five pivot irrigation systems is being continued as a long-term project. This project is utilizing watermark soil moisture sensors to establish benchmarks for the most efficient irrigation for both maximum forage production and water conservation. Data will become available as the project continues. This data will be very useful to producers, since little previous work has been done in this area of the state. In 2005, a similar project was planned with a new producer, to begin in 2006, to provide even more data for Val Verde County on water efficiency in pivot irrigation systems. Significant water savings are expected.

Rio Grande Basin Initiative helps support youth water conservation training

Rio Grande Basin Initiative funds were used to support activities of the Ward County 4-H Horticulture Project and Junior Master Gardeners. Materials purchased include two metal troughs used in a landscaping project at the George and Opal Bentley 4-H Center. This project was implemented by youth and was funded jointly by the Rio Grande Basin Initiative, the USDA-NRCS' Resources Conservation and Development Program, and Ward County 4-H Parent Boosters. Four to six youth participated regularly in Junior Master Gardeners under the direction and supervision of three adult volunteer leaders.

Webb County program addresses importance of water quality testing

The 2005 Agriculture/Natural Resources Outcome Program on Water for Webb County addressed water infiltration, erosion, evaporation, compaction and environment-related issues. The 2005 program reached approximately 2,300 agricultural producers, landowners, game managers, youth, educators and the general public. Extension agents coordinated approximately 340 office and site consultations regarding water-related issues with clientele, including urban, rural and colonia residents. Water-screening days were also conducted for landowners. A total of 56 water samples were submitted from water wells and stocks from Webb, Jim Hogg and Duval counties. Increased awareness regarding the importance of water quality testing has been the main objective.

Careful monitoring allows savings when substituting non-potable for potable water

The continued monitoring of pH and total dissolved solids (TDS) of water used for farm irrigation allows farmers to be aware of potential salt problems when using water blends that include recycled wastewater from the city or saltier water pumped from their own wells. The potential increase in soil salt will create adverse

conditions for plant growth in which higher amounts of water must be used to satisfy plant requirements, along with higher applications of fertilizer to compensate for the fraction of nutrients tied up in the soil's salt.

The use of portable devices such as pH meters and electroconductivity (EC) meters by farmers allows them to closely monitor water quality and take corrective measures—such as acid injection or increasing the amount of water—to ensure plenty of water to satisfy plant needs in accordance with their irrigation schedule and plant growth stage. Significant savings of potable water can be made by substituting non-potable water.

Recommendations for farm management brings $5 million to El Paso Valley

For the past 10 years, the prevailing drought in the Upper Rio Grande area of Texas forced farmers to use groundwater or wastewater that had a high content of total dissolved solids. The use of this saline water, combined with a poor drainage system, led to an accumulation of soil salts, which in turn had an impact on farming practices. High salt thresholds for saline-sensitive crops can cause a yield reduction of 10 to 25 percent. For this reason, Extension conducted workshops, demonstration research and one-on-one consultations with farmers to help them manage their resources and improve production conditions in their fields.

According to preliminary results, participants had an increase in knowledge of at least 40 percent. With this knowledge, farmers were able to make better decisions on how much to fertilize, when to irrigate and how to better manage their crops. Participants reported an increase in cotton production of at least one extra bale per acre for more than 10,000 planted acres, increased production and quality in about half of the total El Paso pecan fields (more than 6,000 acres), and increased alfalfa production of 2.5 tons per acre. Chili producers reported dry red yields above 3,500 pounds per acre (more than 2,000 acres), an improvement of 10 percent compared to previous years. The total economic impact of this increase in production in El Paso Valley is estimated to be more than $5 million.

New management practices save thousands of dollars for farmers in El Paso

Oftentimes, farmers try to control weeds by mixing and spraying chemicals or undiluted substances in their fields without reading and following the instructions on the labels. When chemicals are improperly mixed, their expected effect can be neutralized. It is common for chemical dealers to recommend the use of stickers, buffers and higher dosages of herbicide for good weed control; however, the more chemicals are mixed in a tank, the bigger reaction they will have in neutralizing the herbicidal effect.

Understanding that situation and being able to read chemical-product labels is vital for good weed control, and Extension has been teaching farmers how to do this. Once each product label was analyzed, recommendations to avoid mixing incompatible chemicals or high concentrations of prediluted chemicals were given. Farmers were also told that if they applied herbicides when the plants are at their most sensitive stage, the number of applications can be reduced.

After taking all these factors into account, farmers can save on herbicide applications, improve soil and water conditions and reduce the overall cost of crop production. Herbicide application can be reduced from six applications to only two. The average cost per application ranges from $22 to $32 per acre. This practice has been implemented on at least 1,500 acres, saving about two applications. Direct savings to the farmers who are following this management practice are $66,000 ($22 x 1,500 acres x 2 applications = $66,000).

Soil testing helps improve fields, gardens and environment in El Paso

Homeowners often overapply fertilizers to their home landscape and turfgrass, not knowing for certain the soil pH and salt levels or which nutrients are missing in their soil. Applying unnecessary nutrients is not only a waste of time, money and effort; it is also a source of pollution. Fertilizers may wash down the street into storm drains or build up in the soil and cause nutrient toxicity problems in landscapes. Proper fertilization also helps conserve water.

Soil testing is the best way to determine what combination of nutrients is needed. Texas Cooperative Extension, in cooperation with the El Paso Water Utilities Conservation Department, offered a free soil-testing promotion to residents. The $10 fee for each test was paid by the El Paso Water Utilities Conservation Department. Participants attended an informational meeting to learn how to take a good sample. All samples were sent to the Texas A&M Soil Lab in College Station for testing. Once the results were received, participants had a chance to talk one-on-one with experts about their personal report and how to handle their particular situation.

Each soil report contained a detailed analysis of pH, soluble salt and nutrient concentrations of their landscapes, and recommendations for plants that were already growing in the tested area (e.g., lawn, trees, shrubs, vegetables and flowers). Eighty-six soil samples were sent for analysis. Participants were mostly homeowners, but testing was also done for high-school football fields and landscapes at apartment complexes. ❑

[Task Areas]

2005–2006 Research Accomplishments

[Task 1 Research]

Irrigation District Studies

Researchers provide tool to determine fate of seepage water

Texas Agricultural Experiment Station researchers in El Paso continue to characterize the hydrological properties of canal beds and assess the fate of seepage water from canals in the Rio Grande Basin Initiative area, in collaboration with El Paso County Water Improvement District No. 1. By integrating water quality and hydrological analyses, researchers are providing a useful tool for the irrigation district to determine the fate of this water seepage. Based on their systematic strategies for managing regional water resources, water salvaged by lining major canals (estimated 10 to 30 percent of the diversion, or 30,000 to 90,000 acre-feet of water per year for El Paso, Texas, with a normal annual allotment of the Rio Grande Basin Initiative) is expected be used to supplement municipal and industrial water supplies and in turn reduce withdrawal of native fresh groundwater. In addition, lined canals provide a higher delivery efficiency of the limited surface water supply during drought. To further extend conjunctive uses of surface water and groundwater, salvaged surface water can be stored in the regional aquifer during wet years or low-demand periods for recovery during drought or high-demand periods through a managed aquifer recharge (MAR) or aquifer storage and recovery (ASR) system.

New publication will serve as guide to least-cost ways to save water

When the objective is to save water within a water-delivery system (i.e., increase delivery/use efficiency rates), deciding which rehabilitative system provides the most "bang for the buck" can be difficult. Texas Agricultural Experiment Station economists continue to collaborate with the U.S. Bureau of Reclamation to complete a joint publication that will serve as a guide on engineering considerations (i.e., selection criteria, project costs,

etc.) and their economic counterpart (i.e., life-cycle costs) for comparing the estimated costs of saving water (dollars per acre-foot) across alternative rehabilitative systems used for improving waterways. Rehabilitative systems include numerous types and sizes of shotcrete, impermeable liners, protected liners and pipe. Each has its own initial costs, expected useful life, maintenance costs and water-saving efficiency. This guide will provide comparative costs for each system (dollars per acre-foot of water saved). The information will provide irrigation district managers and consulting engineers with a useful tool, particularly in the conceptual and planning stages of a rehabilitative effort.

Team compares crop evapotranspiration and irrigation practices in New Mexico's Elephant Butte Irrigation District

A recent evaluation of the water budget has shown that only 56 percent of the water in New Mexico's Lower Rio Grande is unaccounted for. This 56 percent likely includes domestic water use, riparian vegetation use, supplementary farm irrigation pumping and off-season runoff. A team of engineers, scientists and economists at New Mexico State University is using satellite data and mathematical algorithms to estimate evapotranspiration (ET) to establish a better accounting of various uses of water and sources of beneficial and nonbeneficial use, and ultimately to optimize the use of water resources. Spatial and temporal variation of ET information will be used on practical irrigation scheduling at the farm level. Real-time ET maps are being developed and made available so that information on water use at a specific farm can easily be accessed and used for irrigation scheduling. Through the support of the Rio Grande Basin Initiative, this project received significant additional funding through the New Mexico Water Resource Research Institute Seed Grants program.

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[Task 3 Research]

Institutional Incentives for Efficient Water Use

Drought Watch outreach publication distributed

Seven issues of the educational outreach publication *Drought Watch on the Rio Grande* were produced to increase public and water-user knowledge and encourage conservation. Drought Watch is a collaborative effort involving the Rio Grande Basin Initiative, Texas Agricultural Experiment Station in El Paso and the U.S. Bureau of Reclamation. This publication is distributed to news media, water managers, government agencies, elected officials and e-mail subscribers. In the Far West Texas and southern New Mexico area, newspaper and television reports reach an audience of more than 800,000 people and reach more than 2.2 million in the El Paso-Las Cruces-Juarez Rio Grande border region.

Benefits and impacts of alternative water policies analyzed

Texas Agricultural Experiment Station economists in El Paso, in collaboration with New Mexico State University, have analyzed the benefits and impacts of alternative water management policies. Water marketing and transfers in the Upper Rio Grande were investigated using integrated hydrologic, institutional and economic models. Researchers found that, compared to existing rules governing the river system's water use, future drought damages could be reduced by one-fifth to one-third per year with intrastate and interstate water markets. These markets would permit water transfers across jurisdictions and be able to better strategize through drought impacts.

Project information used in regional water plan and for management

Texas Agricultural Experiment Station scientists in El Paso provided water resources information through the Coordinated Water Resources Database Project and GIS Web site (http://www.pdnwc.org). Irrigation district network data has been collected for incorporation into the Coordinated Database and GIS. One workshop (50 participants) on the Coordinated Database was delivered to regional stakeholders and state agencies. Another training workshop (12 participants) was offered on the RiverWare and flood-control model configuration. Scientists gave four additional presentations on the Coordinated Database and flood-control planning model at meetings of the New Mexico–Texas Water Commission, which consists of irrigation districts and water utilities, and to the steering committee meetings of the Upper Rio Grande Water Operation Model Project, which includes the U.S. Bureau of Reclamation, U.S. Fish and Wildlife Service, U.S. Geological Survey, Bureau of Indian Affairs, the International Boundary and Water Commission, and the U.S. Army Corps of Engineers as well as state agencies and irrigation districts. Information has also been used in development of regional water plans, especially on water conservation strategies.

Institutional barriers to water conservation in the Lower Rio Grande Basin

The Agricultural Producers' Water Management Survey, conducted in 2003 and 2004, shows that an individual's water conservation incentives are weakened when the benefits produced by the 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. Survey results showed that most farmland is leased, giving those producers no incentive to invest in capital expenditures that could conserve water. Legal barriers indicated by the survey results showed that the lack of adjudicated land gives producers no incentive to conserve water. Issues pending over how the duty of water will be derived are actually compelling producers to adjust crop changes toward a higher-water-usage plant, such as pecans or alfalfa. Survey results also showed that most irrigation scheduling was determined by the irrigation district. This knowledge has recently guided the irrigation district to adjust its irrigation protocol. These protocol changes have forced producers to manage their own decisions about when to irrigate and the amount of water to use for irrigation.

Economically sustainable agriculture water conservation policies in the Rio Grande Basin

A team of economists from New Mexico State University, Texas A&M University and Sienna College (New York) is working to construct an economic model to be used by legislators to assist in the evaluation and identification of economic and hydrologic impacts of policy measures in addressing severe drought. This model will be applied from an interactive Web site where users will be able to model the Law of the River and the economic value of water in alternative uses during existing and potential drought-coping programs.

A market-based approach to water conservation on the Rio Grande

The Water Market Survey, conducted by the New Mexico Agricultural Experiment Station during the summer of 2005, examines producers' preferences regarding water transfer mechanisms in the Elephant Butte Irrigation District in the Lower Rio Grande Basin in New Mexico. More than 160 producers were interviewed regarding their production practices, water management practices, risk management practices and water transfer preferences. A random, geographically stratified sample of producers with at least two water-righted acres was drawn from a population of 3,600 producers. Preliminary survey results indicate that 69 percent preferred continuation of the status quo, in which the administration of the irrigation district handles all water transfers. However, 83 percent believe that water-right owners should be able to buy, sell and/or rent their water at individually negotiated prices. Survey results show that 54 percent of the producers prefer water banking as their water market transfer mechanism. An overall conclusion of the survey is that producers would find it feasible to institute a formal water market system to conserve water in the Rio Grande Basin.

Reviews planned for irrigation districts

A review of the history, organization, rules, water allocation mechanisms, methods of electing a board of directors and defining roles of the irrigation district manager are being completed by Texas Agricultural Experiment Station economists. Results from San Benito, Harlingen and Delta Lake irrigation districts are being published through the Texas Water Resources Institute as a supportive measure to water-saving efforts. This series of reports will aid in understanding institutional aspects of the region's water-delivery system and therefore facilitate improved policymaking decisions affecting the Lower Rio Grande Valley's water supply and usage.

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[Task 4 Research]

On-Farm Irrigation System Management

Onion crops show subsurface drip irrigation increases yields and water savings

Texas Agricultural Experiment Station researchers, using affordable totalizing water meters to accurately measure irrigation water inputs, have quantified potential water savings in drip- and furrow-irrigated onions. Using commercial onion fields in Hidalgo County as an example, results of the irrigation studies found that .9 acre-feet of water could be saved by using subsurface drip irrigation instead of furrow irrigation. This translated to nearly 8,000 acre-feet of potential water savings in onion production for the Lower Rio Grande Valley of Texas, given that only about 10 percent of the 11,000 acres of onions currently grown in the area are drip-irrigated. Researchers also found that onion yields increased by a range of 70 to 125 percent.

Initiative makes impact on Lower Rio Grande Basin of Texas

Through the Rio Grande Basin Initiative, impacts of efficient water conservation practices on economically important crops have been confirmed in the region. Researchers with the Texas Agricultural Experiment Station have been focusing on spinach, onions, watermelon, artichoke and several varieties of peppers to evaluate and develop deficit-irrigation practices. These practices also include nitrogen fertilization, which is environmentally important for the soils and groundwater resources. In collaboration with local partner agencies and industries, increased interest is being placed in large-scale evaluations of the less expensive low-pressure drip system, and this system is being considered for incorporation into the U.S. Department of Agriculture Cost Share Programs. This practice will lead to significant water savings.

Citrus production increases water savings with drip and microjet methods

With approximately 27,000 acres of citrus in the Lower Rio Grande Valley, saving water is extremely important to local growers. Texas Agricultural Experiment Station researchers in Kingsville have compared drip, microjet and flood irrigation practices. Flood irrigation in 2003 and 2004 resulted in the application of 12.6 to 17 inches more water per year than drip or microjet spray methods. If microjet or drip irrigation practices were implemented for every acre of citrus crops in the region, somewhere between 28,000 and 38,000 acre-feet of water would be saved annually.

Compost application may not be a conservation method for citrus production

Compost application is being evaluated by researchers with the Texas Agricultural Experiment Station as a means of conserving water for citrus crops in the Lower Rio Grande Valley. Nitrogen and phosphorus fertilizers were applied, along with a 2-inch layer of compost, to the base of a sample of trees. New Spectrum WatchDog data loggers equipped with WaterMark soil moisture sensors were also installed. Soil moisture levels, monitored at 6-, 18- and 30-inch depths under drip, microjet and flood irrigation, were compared with and without compost. Increased root growth was observed under trees with compost application; however, this increase in roots near the soil surface has led to faster water depletion than in noncomposted trees. These studies suggest that compost application may lead to increased water use due to improved root exploration.

Sorghum and onion crop water use studied

Researchers with the Texas Agricultural Experiment Station in Uvalde have been studying sorghum and onion crop coefficients to determine exact plant water usage and crop evapotranspiration. Irrigation scheduling can then be improved for growers to avoid overwatering and to more precisely meet the crop water demand, leading to optimum yields. Crop coefficients also help growers produce greater yields, improved crop quality and enhanced water-use efficiency.

Precision Irrigators Network project continues to help growers

The Precision Irrigators Network project continues to help growers in the Lower Rio Grande Valley of Texas. This project, managed by researchers of the Texas Agricultural Experiment Station in Uvalde, includes growers in the research process, actively involving them in evaluations of irrigation programs that best fit their farms. Data from research is being used in pilot studies to demonstrate the ability to save a minimum of 25 percent of the normal crop water amendments without depleting yields. About 50 fields have been studied since the project began last spring, and Texas Cooperative Extension agents have participated in the research. Currently, 18 growers from the Edwards and Carrizo aquifer regions have agreed to cooperate in the program.

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Alternative water supplies will supplement surface water shortage during river drought identified in El Paso

Prolonged drought in the Upper Rio Grande Basin has significantly reduced surface water supplies in the Rio Grande and has reduced water deliveries to farms by 34.1 and 38 percent of the full irrigation allocation (4 acre-feet) in 2003 and 2004, respectively. Agricultural water users supplemented surface supplies with pumped groundwater. Research at the Texas Agricultural Experiment Station in El Paso helped farmers and irrigation districts to identify suitable groundwater sources for irrigation to reduce crop damages and economic losses from drought. Historic data was compiled to determine spatial and temporal variation of surface and groundwater quality. These irrigation supplies were monitored each month. More than 200 water samples were analyzed, primarily for salt loads and salt composition. As a consequence, the contribution of groundwater pumping on water quality was also identified. Research results will provide decision-making tools for district water managers and farmers to identify timely irrigation strategies to maximize water-use efficiency and minimize crop damages, especially to pecan orchards.

Researchers evaluate water use of sugarcane crops

Texas Agricultural Experiment Station researchers in Weslaco have completed a sugarcane irrigation study evaluating different levels of water application and nitrogen fertilization responses. Drip irrigation showed a lack of yield responses with increasing water application levels. This indicates that sugarcane may require less water than previously believed. Volumetric soil moisture monitoring was also studied for sugarcane to compare crop water use based on evapotranspiration. Thus far, crop water use as determined by this monitoring has been less than predicted. Initial indications are that sugarcane may require 20 percent less water than previously thought, depending on the method and timing of application.

Tillage practices can reduce irrigation requirements

Researchers with the Texas Agricultural Experiment Station in Weslaco continue to study soil moisture using several different furrow-irrigated tillage systems. Conservation tillage practices are being applied with the goal of maintaining plant residues on the soil surface as much as possible and minimizing soil moisture loss. Conservation tillage can reduce irrigation requirements initially by 5 to 10 percent compared to conventional tillage (which results in soil drying caused by cultivations) and by more over time as soil physical properties are improved. Results have shown that, in cotton for example, yields are reduced by conservation tillage as compared to traditional tillage practices. Fall double crops, such as corn and soybeans, have been difficult to establish in conservation tillage due to surface residues, unpredictable soil moisture and extreme weather conditions.

Hydrologic budget affects seepage losses from flood irrigation on northern New Mexico acequias

A New Mexico State University study along the northern New Mexico acequias has improved understanding of the hydrology of acequia-irrigated agriculture. This study shows that with the use of acequia systems, seepage increases late-summer river flow for downstream users. The research has also shown that the

interaction of continued flood irrigation seepage from the acequias increases the groundwater table. Twelve to 33 percent of water diverted into acequias for irrigation likely returns within six to 12 weeks to the Rio Grande and therefore, this shallow groundwater return flow provides additional water to agricultural and urban users downstream. With assistance from the New Mexico Acequia Association, this project has provided a forum for the exchange of ideas and advancement of the scientific understanding of the acequia hydrologic functions. Through the support of the Rio Grande Basin Initiative, this project was able to receive additional significant funding through the U. S. Department of Agriculture-Cooperative State Research, Education and Extension Service and through the National Research Initiative Competitive Grants program.

Researchers develop practical method for measuring water consumption of pecan orchards

Researchers at New Mexico State University have evaluated two affordable evapotranspiration measurement techniques that can possibly be used by pecan producers to increase irrigation efficiency and conserve water. Both measurement techniques performed equally well in the field. One of the techniques is less expensive and easier to maintain, but it requires more data processing. Research was conducted on a range of three orchards located in the Lower Rio Grande Basin with effective canopy cover between 5 and 60 percent. The relationship between water use and canopy cover shows that the water requirements for immature orchards (canopy cover less than 60 percent) are much less than mature closed-canopy orchards. As a result, if producers adopt irrigation-scheduling recommendations based on the water-use relationship, then the annual irrigation water savings could be as high as 30 inches per acre per year, depending on their current irrigation practices. These affordable evapotranspiration measurement techniques could be used on any crop or cover type.

Research evaluates killed-mulch cover crop systems and water management in southern New Mexico

Researchers at New Mexico State University are evaluating the overlooked benefit of conservation tillage on soil moisture maintenance and water management. Researchers will eradicate a cover crop by chemical, mechanical or physiological means and then plant chilies directly into the residue on the soil surface. This project will determine the optimal planting dates for selected cold-sensitive annual cover crops while evaluating water usage, biomass production, soil moisture retention and weed suppression. An assessment of the economic benefits for producers who adopt this type of cropping system in the Lower Rio Grande Basin will also be conducted with this project.

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[Task 5 Research]

Urban Water Conservation

Calcium additions benefit salinized rose plants and rootstocks

Researchers evaluated the beneficial effects of calcium additions to rose plants and rootstocks subjected to increasing sodium chloride (NaCl) salinity. Preliminary results indicate that supplemental calcium applications to roses salinized with 12 millimolar (mM) of NaCl diminished the severity of yield and quality reductions compared to nonsalinized controls.

Chemical composition of salt affects rose plant productivity and quality

Results confirm that the chemical composition of salt has significant effects on rose plant productivity and quality. Binary salt mixtures (50:50 of two salts) had the least-damaging effects on growth of plants grafted onto the rootstock *Rosa manetti*, whereas those grafted onto *Rosa* x 'Natal Briar' had better growth when exposed to sulfate-based salinity. These results will be used to work on the development of fertilization management practices for growers having problems with water quality issues related to both salinity and sodicity.

Water use and crop coefficients of landscape plants determined

Water use and crop coefficients for a number of shrubs grown in containers (nursery practice) and lysimeters (similar to landscape conditions) have been determined and compared. Water use per unit of leaf area did not differ between the two culture systems; however, growth was affected. Researchers concluded that water use and crop coefficients of landscape plants can be readily estimated from container-grown plants of the same species.

Salt tolerance of trees and shrubs examined

Researchers examined the salt tolerance of a number of shrubs and trees, including black cherry, green ash, lacebark elm, Russian olive, sand cherry, sand plum and desert willow. From first-year results, the researchers found that elm was relatively tolerant, whereas sand cherry was relatively sensitive to elevated salinity among the tested species.

Drought-tolerant landscapes and education are preferred water conservation strategies

Communities face a variety of barriers when implementing water management strategies to reduce water usage. Each community has specific challenges to meet. However, most communities identified public education campaigns and the use of drought-tolerant landscapes as the most preferred and feasible methods to conserve water (see Silvy et al., 2005, September). Residential water audits were the next strategy deemed most preferred and feasible. Graywater reuse systems were next, but they had a lower rating with regard to feasibility. This evaluation of preference and feasibility provides decision makers with a means to review water management strategies from the perspective of their peers. However, final selection and implementation of strategies will depend on local barriers to adoption of the different practices.

Model uses integrated approach to demonstrating water-conserving landscapes

Survey results show that policymakers wishing to communicate methods to conserve water in an urban environment must include information on the likelihood of water shortages. New Mexico residents want to take an active role in conserving water but will only do so if they are aware of the drought situation. To tell residents about low-water-usage landscaping, a model site has been designed and developed that will track water use throughout traditional and xeriscape landscapes. This experiment will not only be able to track water usage in traditional landscape situations, but will also be used as a demonstration plot to show New Mexico residents other water conservation issues.

Researchers will identify minimum irrigation requirements for home lawns in the southwest

Researchers at New Mexico State University continue to study water requirements for cool- and warm-season grasses that may be suitable as lawn turf. Researchers are in the process of installing and establishing a variety of turf plots to be used in identifying specific water requirements that will develop and validate an irrigation-scheduling model based on crop coefficients for different turfgrasses used along the Rio Grande.

Sub-irrigation and soil amendments show promising irrigation efficiency and turfgrass quality

Turfgrass managers throughout New Mexico are making plans to convert to a water-saving application of sub-irrigation. Researchers at New Mexico State University working on sub-irrigation have found that this method, compared to traditional irrigation, shows a dramatic water savings of 80 percent. Turf managers face two challenges in the desert southwest: poor water distribution and insufficient quantities of irrigation water.

With 80 percent water savings, sub-irrigation is generating interest among investors in New Mexico for golf course and sports field community developments.

Survey evaluates xeriscape adoption trends along New Mexico's Rio Grande

A residential landscape survey (Hurd, 2005) examined attitudes and preferences for residential landscapes and factors that determine or limit choices. Urban households in Albuquerque, Las Cruces and Santa Fe value aesthetic characteristics of their homes and desire living spaces, landscapes and environments that are attractive and enhance their quality of life. The key is to approach landscape decisions with an awareness of the fundamental nature and role of water, to understand the differences in irrigation needs of various types of vegetation and landscapes, and to plan for and use water wisely and effectively in meeting the needs of the desired landscape with balance and consideration of the importance of this unique resource.

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[Task 6 Research]

Environment, Ecology and Water Quality Protection

DNA genotyping identifies human-specific and animal strains of parasites

Levels of *Giardia* and *Cryptosporidium* in Rio Grande river water are much higher during the non-irrigation season than during the irrigation season. *Cryptosporidium* and *Giardia* samples have been taken and analyzed by DNA genotyping. Human-specific and zoonotic (capable of being transmitted between humans and animals) strains were found in the samples. This data will be used to assess human and animal health risks associated with the use of winter return flows. This information will also be used to help develop strategies that can safely extend municipal and agricultural water supplies.

Sap flux estimates and sapwood area used to estimate water use

Hourly estimates of sap flux from saltcedar trees on the Pecos River near Mentone, Texas, and Iraan, Texas, from early spring through leaf fall, have been collected. Peak water use of 4 millimeters (mm) per day occurred between May 20 and June 30 at both sites and was less throughout the remainder of the growing season. Preliminary water-use estimates, combining the sap flux estimates and sapwood area of mature trees, suggest saltcedar transpires around 12 inches of water per acre per year. The trees are largely uncoupled from ambient precipitation and depend on groundwater for transpiration. Transpiration following precipitation of < 25 mm was independent of the rainfall. Following larger precipitation events (>25 mm), sap flow actually decreased due to lower air temperatures and higher relative humidity. More precise estimates of sapwood area per unit ground area are being developed to refine the stand-level transpiration estimates.

Researchers map problem and noxious weeds along irrigation canals

Researchers are making maps of the soils and plants that occur along the Lower Rio Grande Basin of New Mexico. They are also determining which of these weeds use the most water, how salinity affects water use, and how herbicide treatment affects rooting of desirable plants and weeds. Survey sampling of 219 samples along the Elephant Butte Irrigation District canals continues. Data collection includes soil samples, plant identification and density, and a spectral reflectance image. Data from this project will assist in development of a model that will identify how soil and canal characteristics affect presence and density of plant species, particularly those that are low and high water users. In addition, modeling will determine whether spectral reflectance indices can be used to remotely identify soil characteristics and plants along canals. This data will be used to develop and validate a standard model for plant and soil characteristics that can also be used on other irrigation districts in the Rio Grande Basin. The long-term goal is to determine which plants need to be managed to reduce water loss along canals.

Irrigation ditch seepage affects surface water–groundwater interaction

Research results show that a thorough evaluation of the effects of acequia ditch seepage in irrigated corridors requires comprehensive understanding of surface water–groundwater interactions across the entire corridor from ditch to fields to riparian areas and the river. Acequia associations in northern New Mexico, water resource managers, community members and the scientific community have obtained a better understanding of how to more effectively manage their natural resources through enhanced knowledge of the hydrologic and water quality functions of surface water–groundwater interactions in irrigated corridors.

Study examines water saved through improved saltcedar management

With more than 25 to 30 percent of the Rio Grande in New Mexico being treated for saltcedar infestation, a Rio Grande saltcedar management project was developed at New Mexico State University to manage regrowth and seedlings after initial herbicidal and mechanical control. An NMSU researcher is using a leaf beetle to assist with follow-up management of saltcedar along the Pecos River. The leaf beetle may be a possible solution to control and permanently minimize regrowth of saltcedar after past herbicidal and mechanical control efforts. Presently the U.S. Fish and Wildlife Service will not allow release of these beetles on the Rio Grande. However, research along the Pecos River is exploring the potential of the leaf beetle to control regrowth saltcedar, allowing water usage of the plant to stay at a minimum. Saltcedar (*Tamarix,* spp.) is known to use a substantial amount of water, with a measured evapotranspiration of 52 inches per year. Water savings of 30 to 40 percent are possible by using herbicidal and mechanical controls.

Agricultural irrigation systems and conservation of native fishes

Researchers sampling irrigation canals near Albuquerque, New Mexico, have shown that all fish species occurring in the middle Rio Grande also occur in the canals adjacent to the river. Findings have led researchers to develop refugial fish habitats where return flows from agricultural irrigation enter the river. This project is collaborating with the development of the Silvery Minnow Sanctuary championed by New Mexico Senator Pete Domenici. This project will draw return-flow water from the Albuquerque Riverside Drain and utilize it in an engineered habitat within the river floodplain. This project supports several graduate student projects, and these will provide the foundation for numerous future studies on the system.

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[Task 7 Research]

Saline and Wastewater Management and Water Reuse

Researchers use salty groundwater or graywater for crop irrigation

A field demonstration was established to evaluate the use of reclaimed water for vegetable production at Rogelio Sanchez State Prison in El Paso, Texas. Vegetable crops in replicated plots were furrow-irrigated with either salty groundwater or graywater from the prison laundry. Soil, water and plant data were collected monthly from May to October 2005. Soil moisture sensors continuously collected data on subsurface moisture content and temperature. One growing season was completed, and chilies, bell peppers and tomatoes were produced. The field data is currently being analyzed. Potentially, 50 to 80 percent of surface water or well water used for irrigation can be replaced with reclaimed effluents or salty groundwater for rural areas in El Paso and Hudspeth counties without negative consequences. This could conserve up to 40,000 acre-feet of potable water annually.

Tools are reviewed for improving soil permeability under established turf

Poor water infiltration into irrigated turf increases the evaporative loss of water and salt accumulation in the root zone. Various available implements have been reviewed for improving water infiltration into established turf, and some were tested on-site. In the case of clayey soils developed in the Rio Grande floodplain, deep soil chiseling with subsoiling shanks, followed by top-dressing with dry sand, was found most effective for improving water infiltration and for reducing salt accumulation. Water savings up to 20 percent can be realized, with minimal salt accumulation.

Researchers develop schedule to monitor vegetation, soil and water quality in Chihuahuan Desert

New Mexico State University and Texas A&M researchers have completed the development of an irrigation-schedule protocol for treated industrial wastewater application management in the Chihuahuan Desert. This protocol is used to determine the best management practices for application of industrial wastewater. These practices include identifying the greatest allowable loading that encourages biomass production, provides measurable uptake and assimilation of wastewater salts and nutrients, and prevents contamination of ground-water resources through leaching from industrial wastewater. The City of Las Cruces has adopted this policy to use industrial wastewater on 80 acres of city land.

Specialist tests use of non-potable water to irrigate turfgrass

Golf course turf has doubled since the 1980s in New Mexico. A turf specialist at New Mexico State University is evaluating the use of non-potable water for irrigation on turfgrass. Non-potable water use can save a total of 342,000 acre-feet per year of high-quality drinking water in northern and southern New Mexico. Highly saline water significantly delayed reduced establishment rates when compared to potable and 50:50 mix water for most turf species.

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[Task 8 Research]

Basinwide Hydrology, Salinity Modeling and Technology

Tributaries influence salinity of Amistad International Reservoir

Salinity of the Amistad International Reservoir has been increasing since the 1970s. In 1988 it temporarily exceeded the drinking water limit of 1,000 milligrams per liter, also the water quality guideline for irrigating salt-sensitive horticultural crops. Researchers are nearing completion of an analysis of flow and salinity data for four main tributaries: the middle Rio Grande, the Pecos and Devils rivers, and the Rio Conchos from Mexico. This data is being analyzed to understand the cause(s) of salinity increases at Amistad Reservoir.

Reconnaissance survey documents findings on salt sources and loading into Pecos River

Researchers analyzed stream-flow and salinity data collected by the U.S. Geological Survey, carried out a reconnaissance survey, and identified three river segments where saline water is entering the Pecos River. These findings are documented in a progress report, which is currently being revised.

Pecos Basin county data collected and processed for Web hosting

Natural resources, socioeconomic and health-related conditions in the Pecos Basin counties have been collected and processed for Web hosting to complement work completed for Rio Grande Basin counties. In addition, agricultural census data for these counties has been collected and will be added to the existing study-area map. Researchers are collaborating with Texas State University, Sul Ross State University, New Mexico State University, University of Texas–Austin and the U.S. Geological Survey to share information and reduce duplication of data.

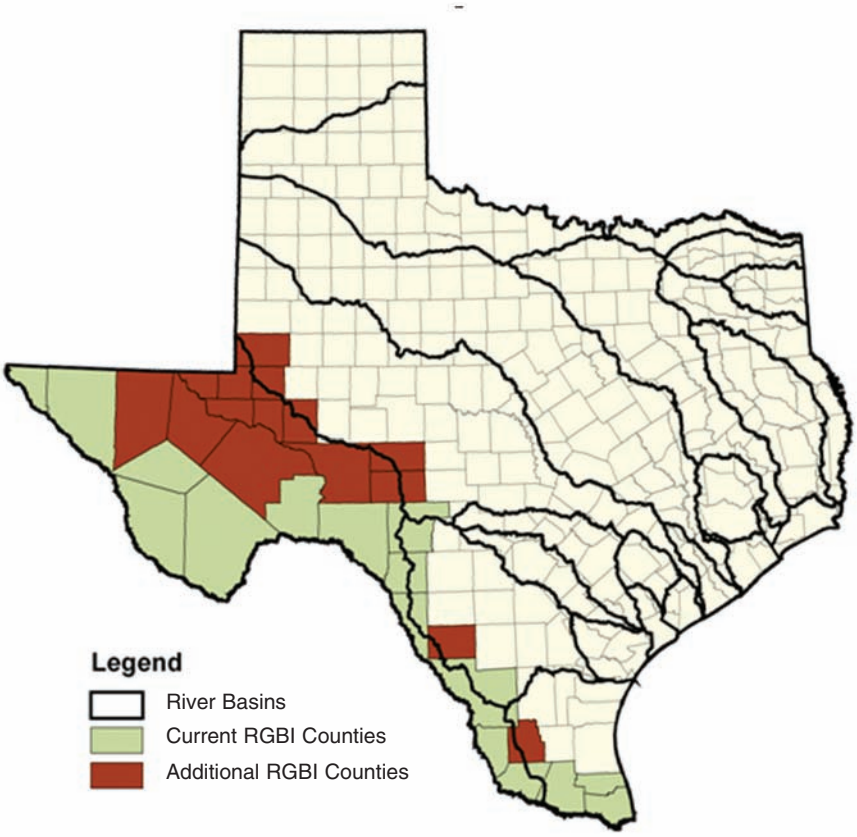
Protocols developed for sharing data and modeling results

Researchers have enhanced direct Web linkages with the U.S. Army Corps of Engineers' Upper Rio Grande Water Operations Model (URGWOM) project activities. Protocols have been developed for sharing historical and real-time data in the Coordinated Water Resources Database and GIS Project with development of the physical model and planning version of URGWOM. Other protocols have been explored for sharing modeling results for different management and planning alternatives through the Coordinated Water Resources Database and GIS Web site. Researchers are collaborating with New Mexico State University, Sul Ross State University, Universidad Autónoma de Ciudad Juárez, U.S. Army Corps of Engineers, International Boundary and Water Commission, U.S. Bureau of Reclamation, El Paso Water Utilities in Texas, the City of Las Cruces and the Elephant Butte Irrigation District in New Mexico.

Pecan model developed for irrigation, nitrogen and pruning management

New Mexico State University researchers continue with the development, validation and reporting of a pecan model using measurements of biomass production and water use. Using two years of data, the model has been found to have an accuracy of 93 percent when predicting total dry-matter production and nut yield. The model will aid in development of best management practices that can be implemented in the Lower Rio Grande Basin of New Mexico to increase the irrigation efficiency and yield of orchards. The model can also evaluate how changes in irrigation scheduling, fertilization and pruning can assist in the survival of pecan orchards under drought conditions. Additionally, growers can use the model to schedule prunings that will change the alternate bearing cycle of an orchard in order to maximize yield in an otherwise low-yield season.

The water savings resulting from the increased irrigation efficiency can be as high as 30 inches per acre annually, but more typical savings would be 8 to 10 inches per acre. Growers using the model may also find that they can lower their fertilizer costs without having any negative effect on yield.



Researchers estimate water use through satellite remote sensing

Researchers are using computerized programs (ASTER satellite data) to modify an evapotranspiration (ET) estimation algorithm called Regional Estimation ET Model (REEM). Modification efforts are being focused on a small farming region in the Lower Rio Grande Basin of New Mexico. Satellite data continues to be retrieved from NASA-TERRA satellite. The REEM model can provide real-time ET values with high accuracy. ET is a good measurement of irrigation effectiveness and total water consumption. Predicting ET through REEM will assist in eliminating a lot of field checking, be used in practical irrigation scheduling at the farm level, be used in adjudication of water rights, assess the impact of water conservation policies on a regional basis by measuring water use before and after policy implementation, and assess the economic returns from agricultural activities by linking ET to biomass production and crop yield. Through the support of the Rio Grande Basin Initiative, this project was able to receive additional significant funding through New Mexico Governor Bill Richardson's Water Innovation Grants program.

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[2005–2006 Rio Grande Basin Initiative]

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