Rio Grande Basin Initiative

OUTCOMES

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Agricultural Demonstration Initiative

Collaborators evaluate irrigation water use efficiency in citrus

by
Danielle Supercinski

With water scarcity being a prominent issue for growers, Rio Grande Basin Initiative researchers are collaborating with a Lower Rio Grande Valley (LRGV) project aimed at demonstrating cost-effective and efficient irrigation technologies to growers.

RGBI researcher Dr. Shad Nelson, soil scientist at Texas A&M University–Kingsville, is collaborating with the Agricultural Water Conservation Demonstration Initiative (ADI) project to evaluate irrigation use efficiency. Sponsored by the Texas Water Development Board (TWDB), ADI demonstrates cost-effective technologies integrating state-of-the-art irrigation water distribution network control and management, and on-farm irrigation technology and management systems.

In 2002, Nelson joined the RGBI on-farm irrigation management team to evaluate drip and microjet spray compared with flood irrigation practices in citrus production. These preliminary RGBI investigations regarding water conservation in citrus helped to leverage funds from the TWDB to evaluate on-farm water conservation field demonstration projects in citrus, vegetable and crop production on various growers' farms throughout the LRGV over a 10 year time span (2005-2014).

Dr. Shad D. Nelson, associate professor of agronomy and horticulture at Texas A&M University-Kingsville, monitors water depletion in an ADI grower's drip irrigated onion field using real-time ECH2O EC-10 soil moisture sensors and automatic Em50 data loggers manufactured by Decagon Devices, Inc.

Through the ADI, Nelson focuses on potential low-use irrigation strategies in citrus and vegetable production within the Valley. Other research focuses on comparing water use efficiency from conventional flood and furrow irrigation practices to crop production using drip, sprinkler or microjet-spray irrigation.

"It is anticipated that as we gather more information from designated demonstration sites, that field days will be planned for other growers to attend that are interested in these projects and potential water conserving practices," Nelson said.

Nelson works with Dr. Juan Enciso, agricultural engineer at the Texas A&M Agricultural Research & Extension Center in Weslaco, to establish agreements with growers within the LRGV who are willing to participate in a long-term evaluation of crop production and water use using different irrigation systems. Currently, under their direction, 14 growers are associated with the ADI project with 27 working field sites and crop locations. Citrus crops include grapefruit, oranges and tangerines, and vegetable crops include onions, celery and corn.

"These demonstration sites focus on various irrigation methods such as drip, microjet-spray, flood, furrow and polypipe furrow irrigation systems," Nelson said.

An integral part of water conservation is monitoring water consumption. Soil moisture monitoring can be an effective mechanism improving crop sustainability by scheduling irrigation based on soil moisture levels. To effectively study the soil moisture regime in different soil profiles and under different crops, soil moisture sensing equipment has been installed along with automated data loggers and rain tipping buckets to measure precipitation on-site, he said.

"Data is periodically downloaded for further evaluation of the plant available water content and the moisture movement patterns in the soil profile,"

Eddie Esquivel, ADI project coordinator, installs and monitors ECH2O probe soil moisture sensing and data logging equipment from Decagon Devices, Inc. beneath the canopy of microjet spray irrigated Rio Red grapefruit in an ADI collaborator's orchard.

Nelson said. "Crop water requirements throughout the production season will help us better identify efficient strategies for sustainable crop production and improved crop water use efficiency."

Others working with the ADI project under Nelson are Heriberto "Eddie" Esquivel, ADI project coordinator for TAMU–Kingsville, and graduate students who are currently training in geographical information systems (GIS) programming to be able to dedicate these skills to various sites across the LRGV. Nelson said goals include correlating data with different irrigation practices to establish a "rule of thumb" aspect in relation to available soil moisture content and when irrigation must be added.

"We anticipate that information gathered from these on-farm demonstration sites will provide meaningful information to all growers in the LRGV and provide an accurate picture of how cost effective alternative irrigation practices are and will be in the near future," Nelson said. "This is an exciting and rare opportunity for growers to participate in meaningful projects that will impact irrigated agriculture in the Valley."

ADI has contracted the services of Texas A&M University–Kingsville, Texas Cooperative Extension Service, Delta Lake Irrigation District and Axiom-Blair Engineering. These agencies assist ADI with technical support, economic evaluation and execution of the demonstration projects. For more information and newsletters on the ADI project, visit http://www.hidcc1.org/node/6.

Water Conservation is Child's Play

Valencia County Extension implements after-school program

by
Jane Moorman

How many ways can one conserve water in the home? That was the question asked of the children participating in the Valencia County Boys and Girls Club after-school program at Belen, New Mexico's Jaramillo Elementary School.

They learned the answer during a four-week water conservation education program presented each Tuesday by the New Mexico State University Cooperative Extension Service's Valencia County staff.

"Since Gov. Bill Richardson has declared this the 'Year of Water,' we thought it would be a good time to teach the 75-plus students where our water comes from," said Rhonda Meadors, program assistant. "During the program the youth have learned such topics as how New Mexico uses its water, how irrigation has changed over the years, how water is used residentially and ways to conserve it wisely."

The group leaders followed the "Rio! The Water Detective" curriculum that was developed by the New Mexico Office of the State Engineer.

"The curriculum included a booklet of weekly learning activities and the board game 'Aquifer Game,' which the students took home to enjoy and teach other family members ways to conserve water," said Meadors.

Meadors and her staff of three presented the hands-on learning experience to students at Belen's Dennis Chavez Elementary School and Los Lunas' Katherine Gallegos Elementary School after-school programs during March and April.

"The program is funded by a grant from the Rio Grande Basin Initiative, which set aside $50,000 of its federal funding for Extension educational

*See **Program** on page 6*

Coordinated Collaboration

Water resources database jointly developed

by
Danielle Supercinski

Through collaboration between RGBI and other universities, researchers developed a Coordinated Water Resources Database and GIS Web site to assist water users, stakeholders and state and federal agencies in daily operations and long-term planning of water resources.

Dr. Zhuping Sheng, assistant professor at the Texas A&M Agricultural Research and Extension Center (AREC) at El Paso, teaming with Dr. Ari Michelsen of El Paso AREC and Dr. Raghavan Srinivasan of Spatial Sciences Laboratory, has developed successful collaborations with Drs. Christopher Brown, Bobby Creel, J. Phillip King and Sue Tillery of New Mexico State University (NMSU); Dr. Alfredo Granados, Universidad Autonomos de Ciudad Juárez (UACJ); and the Paso del Norte Watershed Council on the development of the Coordinated Water Resources Database and GIS Web site as well as model development for Rio Grande flows.

Sheng has also developed a collaborative research program with Dr. Kevin Urbanczyk, Department of Earth and Physical Sciences chair at Sul Ross State University, by co-supervising a research assistant and sharing regional water resource data needed for enhancement of groundwater availability models (GAMs) to better understand aquifers and water availability in West Texas.

"Through collaboration with Urbanczyk as director of the Sustainable Agricultural Water Conservation project, which focuses on the regional groundwater resources in Far West Texas, regional water resources data is being expanded and shared," Sheng said. "An outcome of this collaboration is enhancement of the GAMs and a better, more accurate understanding of water resources and regional water planning."

The water resources in the Paso del Norte region are shared by three states and two nations (Texas and New Mexico on the U.S. side and Chihuahua on the Mexico side). The region covers Hudspeth and El Paso counties in Texas; Doña Ana and Sierra counties in New Mexico; and Juarez Valley in Chihuahua.

"Agencies' support and collaboration among researchers from different organizations and institutes were extremely important for developing the Coordinated Water Resources Database and GIS Web site and sharing of data," Sheng said.

Historically, the flow and water quality of the Rio Grande from Elephant Butte Dam, New Mexico, down to Fort Quitman, Texas, were separately measured and recorded at several points by federal agencies such as U.S. Bureau of Reclamation (USBR), U.S. Geological Survey (USGS) and the International Boundary and Water Commission (IBWC); irrigation districts such as Elephant Butte Irrigation District (EBID) and El Paso County Water Improvement District No. 1 (EPCWID#1), El Paso Water Utilities (EPWU), the City of Las Cruces and others. Each agency did it solely for achieving its mission with limited sharing of data and lack of coordination.

"This absence of real-time data-sharing and related coordination frequently led to unnecessary duplication of efforts, inefficient use of agency and institutional resources and contributed to challenges in water resources planning and management," Sheng said.

Now the Coordinated Water Resources Database and GIS Web site (accessible at http://www.pdnwc.org/ by going to "Interactive GIS Projects") is providing broad open access and sharing of numerous federal, state, city and irrigation district databases and information.

"This is helping water suppliers, users and scientists to understand and more effectively manage water resources in the region," he said.

In 2000, Texas A&M University and NMSU initiated formal collaboration to scientifically address common water resource issues in south central New Mexico and West Texas. To date, more than 13 research and outreach projects have been completed or are ongoing.

"The objective is to facilitate, promote and efficiently conduct joint and cooperative water resources related research, Extension and outreach programs of mutual interest to both institutions," said Michelsen, resident director at the Agricultural Research and Extension Center at El Paso.

One of the results of this collaboration is the development of the Rio Grande flood control model for the Paso del Norte region using RiverWare modeling software, which has been developed by the Center for Advanced Decision Support for Water and Environmental Systems (CADSWES) at the University of Colorado in Boulder. RiverWare is designed to provide river basin managers with a tool for scheduling, forecasting and planning reservoir operations as well as for flood control.

The flood control model is designed to simulate Rio Grande flows for flood control planning for selected reaches between Elephant Butte Reservoir and El Paso, Texas. This model constitutes an important part of the Upper Rio Grande Water Operations Model (URGWOM) project, which was originally developed by six federal agencies to assess flood control planning, water accounting and water operations alternatives for the Upper Rio Grande Basin (http://www.spa.usace.army.mil/urgwom/default.asp).

Another important component in the flood control model configuration is the interaction of surface water and groundwater. A conceptual model for interaction of surface water and groundwater was developed using a time-series transfer function analysis of the relationship between diversions and drain flows using historical data from 1985 to 1999. The modeling results closely represented the historic flow conditions.

"It should also be noted that this project also fostered an international collaboration across the U.S.–Mexico border, where both groundwater and surface water are shared," Sheng said. Sheng works closely with Granados at UACJ in sharing water resources and land uses data. Granados has provided information about water resources, land uses and GIS coverage of groundwater wells in Ciudad Juárez, and the canals and ditches of the Valle de Juárez Irrigation District 009 in the Juárez Lower Valley, Chihuahua, Mexico.

Granados said in his report that water needs in this region have changed in recent years from being primarily for agricultural purposes to domestic and industrial needs. Irrigation districts in Mexico have played an important role for the agricultural economics of the region and for the general economic standards of the entire country. Mexico has improved throughout time on applying technology and generating inventories and statistics on the type of crop, volume of crop estimates and economic revenue of agricultural products.

"The next phase of this project will expand the database and GIS Web site by incorporating more real-time water quality monitoring stations," Sheng said. "It will also expand the flood control model to cover more reaches between El Paso and Fort Quitman for flood control planning and will enhance the model by integrating interfaces or linkage for simulating surface water and groundwater interaction."

A technical project report, "The Development of a Coordinated Database for Water resources and Flow Model in the Paso del Norte Watershed (Phase III)," was completed. Three technical reports have been prepared and will be published jointly by New Mexico Water Resources Research Institute (NMWRRI) and Texas Water Research Institute (TWRI). They will be available soon at http://wrri.nmsu.edu or http://twri.tamu.edu or can be requested through both institutes.

"Agencies' support is crucial for the success of this project," Sheng said.

The following agencies have either provided funding for implementation of the project or supported data access and sharing: USBR; U.S. Army Corps of Engineers (USACE); RGBI; IBWC; USGS; EPWU; EPCWID#1 and EBID; Paso del Norte Watershed Council; New Mexico–Texas Water Commission; TAMU; NMSU; UACJ; NMWRRI and TWRI.

"Special thanks go to Michael Fahy of EPWU; Gail Stockton, April Sanders and Michael Fies of the USACE; Conrad Keys Jr., consulting for USACE; Woodrow Irving and Mike Landis of USBR; Bill Harris and Allan Jones of RGBI; and the technical committee members of the Paso Del Norte Watershed Council for their continued support and leadership in managing funded projects," Sheng said.

TAMU and UACJ researchers conduct a GPS survey along the main canal in Juarez Valley, Mexico.

Program

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programs along the Rio Grande corridor, of which we received $5,000 that provided for materials and three additional employees, Sherlene Romero and high school students Alexandria Romero and Morgan Smith, to help present the lessons," Meadors said. "I also have additional help from Zach Romero, a volunteer from Los Lunas Middle School."

Valencia County Boys and Girls Club members at Belen's Jaramillo Elementary School learn how water erodes soil while watching the water flow in the Cuidad Soil and Water Conservation District's Rolling River exhibit. The children participated in a water conservation four-week program taught by the Valencia County Cooperative Extension Service staff.

The final day of the after-school program was a splashing success as students watched water flow through the Ciudad Soil and Water Conservation District's Rolling Rivers traveling exhibit.

"The Rolling River is a working model of a watershed, mounted on a trailer that is transported to schools and special events," said Sue Hansen, project manager who coordinates the exhibit for the district that serves Bernalillo and portions of Sandoval and Torrance counties.

The trailer is filled with sand-like plastic granules that can be molded into nearly any type of landscape by forming hills, plains and valleys. With the addition of toy houses, greenery, animals, roads and cars to the landscape, a miniature world appears. Hidden plumbing allows water to flow through the landscape to form a river, wetlands and a lake to rise and fall in response to simulated flood and drought cycles.

"The Rolling River exhibit is a wonderful way to conclude our water conservation program," said Meadors. "The students can see the affect of water on the landscape. They see sides of the arroyo erode as the water flows by and how the rising water in the lake causes the water table to rise into wetlands on the lower land."

Symposium Outcomes

Conference draws wide range of attendees from various locations

by
Tawney Lindsay

The Rio Grande Basin Initiative and Water Task Force at New Mexico State University sponsored the "River Terrace and Floodplain Hydrology Symposium" held in Las Cruces, NM on February 28–March 1, which drew 81 attendees from various locations, both nationally and internationally.

Drs. Alexander "Sam" Fernald, NMSU assistant professor in the Department of Animal and Range Sciences, and Steve Guldan, NMSU professor at the Ag Science Center at Alcalde, hosted the conference to assess the state of science in surface water/groundwater interaction and floodplain hydrology. Another goal was to identify gaps in understanding in order to determine future research directions.

Fernald said presentations and posters covered "basic research on hydrologic processes, computer modeling based on field measurements, remote sensing of valley water budgets and broader perspectives on managing floodplains from hydrology and ecosystem functions."

The symposium brought together experts from New Mexico, other parts of the United States and Chile. Such a variety of expertise seemed to be beneficial to the knowledge of all attendants.

Jose Luis Arumi, a civil engineer and head of the Water Resources Department at the University of Conception in Chile, provided insight into solving water problems in North America. Since problems here are similar to the problems in Chile, Arumi said sharing of knowledge at this conference will help to solve or prevent such problems in his country.

Dr. David Cowley, assistant professor of fisheries and aquatic ecology in the Department of Fishery and Wildlife Sciences at NMSU, said, "I was hoping to help dispel the notion that irrigation is always bad for rivers and the fish that live in them." Research presented by Cowley suggests a positive role of canals in restoring fish to the river after the channel dries. Managers looking for better ways to manage canal systems could use the information he has gained.

Hilary Brinegar, a water and natural resources policy specialist for the New Mexico Department of Agriculture, said she gained knowledge for research on surface water/groundwater interaction. "It was nice to see emerging research, and it will only be beneficial to hydrologic management," Brinegar said.

Fernald said it is a common goal for all people in attendance to "use science to manage hydrology of river floodplains to save water while simultaneously promoting the unique cultural aesthetic and ecological functions of the green river valleys that trace through the arid southwest."

The symposium concluded with a workshop to chart future research directions and needs. A special issue paper will be published and will contain a position paper based on the workshop, proceedings and submitted papers.

Faces of RGBI

A valuable addition to the team

by
Nargiza Rakhimova

Dr. Alexander "Sam" Fernald's major field of interest is river basin hydrology, but his scope of expertise is extensive. Housed at NMSU's Animal and Range Sciences Department, Sam's teaching and research topics led him into forestry, riparian health, soil, water and air relationships and related aspects of natural resources.

Currently, Sam is working on a large scale research project that evolved from earlier work showing that seepage from acequias (community irrigation ditches) benefits aquifer recharge. His new focus is to study the impacts of that seepage to basin hydrology.

"Sam is a great addition to the RGBI team," said Craig Runyan, New Mexico RGBI coordinator. "He is a conscientious researcher and does very well with his reporting and other deliverables."

Last month, Sam co-hosted the international "River Terrace and Floodplain Hydrology Symposium," an RGBI-funded scientific forum. Symposium proceedings and a dedicated journal edition are planned resulting from the event.

Sam has provided valuable contributions to the knowledge of the Rio Grande Basin hydrology. We thank him for his dedication and effort toward environmental science and extending that science to other.

Increasing Irrigation Efficiency in the Rio Grande Basin through Research and Education

Through Extension and research efforts, the Texas Agricultural Experiment Station and Texas Cooperative Extension and counterparts at New Mexico State University are implementing strategies for meeting present and future water demands in the Rio Grande Basin. These strategies expand the efficient use of available water and create new water supplies. This federally funded initiative is administered by the Texas Water Resources Institute and the New Mexico State University Water Task Force with funds from the Cooperative State Research, Education and Extension Service.

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