

Wetting Front News



Soil and Water Management Research Unit

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regions with advective climatic conditions.

Thermal remote sensing based energy balance models are better suited for estimating water use on uneven landscape with heterogeneous ground cover at a regional scale (Samani et al., 2010). Therefore, numerous remote sensing algorithms have been developed for estimating magnitude and trends in regional land surface energy fluxes and ET rates at a regional scale (Gowda et al., 2008). However, ground-based ET observations are necessary to check the accuracy of resulting ET maps. Conventional techniques for measuring ET on the ground including EC and BR systems require homogenous surface covers within their flux footprint areas that are difficult to locate in the arid and semi-arid irrigated regions. Land surfaces in the Texas High Plains are heterogeneous with extreme dry and irrigated conditions, which are mixed with pasture and other land uses. These conditions require a special technique to validate remote sensing based crop water use estimates.

A scintillometer is an optical instrument that consists of a transmitter that emits a beam of light and a receiver that can measure the amount of scintillations over a horizontal path. The scintillations recorded can be expressed as the structure parameter of the refractive index of air, C_n^2 . This structure parameter gives the turbulent strength of the atmosphere that in turn describes the ability of the atmosphere to transport sensible heat and water vapor. The relative contribution of the temperature and humidity fluctuations to the refractive index fluctuations is wavelength dependent (Andreas, 1989). The sensible heat (H) and LE fluxes can be derived from the structure parameter of temperature and humidity, respectively, using Monin-Obukhov Similarity Theory (MOST) (Wyngaard et al., 1971). Information about G and the friction

velocity (u^*) is required. The u^* can be derived from wind speed profile data.

Definition...

A scintillometer is an optical instrument that consists of a transmitter that emits a beam of light and a receiver that can measure the amount of scintillations over a horizontal path.

The Large Aperture Scintillometer (LAS) uses near infrared light source ($\lambda = 880$ nm) and provides a path-averaged value of structural parameter of the refractive index of air (C_n^2) up to 4.5 km. The LAS setup in the field consists of a transmitter and receiver devices installed at a known distance called path distance (L) and height (z_{LAS}) above the surface, and both units have an aperture diameter (D) of 0.15 m. The electromagnetic radiation emitted by the transmitter in the direction of the receiver is scattered by the turbulent atmosphere. The observed air refractive index intensity fluctuations (or scintillations) are analyzed at the receiver side (σ_{lnA}^2), which can be expressed as C_n^2 . The relationship between path averaged C_n^2 and the variance of the logarithm of amplitude fluctuations (σ_{lnA}^2) is given by Wang et al. (1978) as:

$$C_n^2 = 4.48 \sigma_{lnA}^2 D^{7/3} L^{-3}$$

In summary, C_n^2 data together with corresponding wind speed and air temperature measurements and estimates of the surface roughness and displacement height, permit H to be calculated iteratively. More information on calculating H is presented in Chehbouni et al. (2000). Further, LE can be calculated, using net radiation (R_n) and soil heat flux (G) data, as the closure term of the surface energy balance equation ($LE = R_n - G - H$), where

units of all terms are in $W m^{-2}$).

Scintillometer's path integrating capabilities over several kilometers can be a tool that can bridge the gap between the current availability of primary point based observations (reference ET weather stations and lysimeters) and the demand for large-scale spatially averaged surface fluxes. Further, the spatial scale of the flux data collected from scintillometers is comparable to the spatial resolution of satellite images and grid size of distributed hydrologic models. Therefore, this method is a useful tool for validation of remote sensing based ET maps and crop water use monitoring. So far, this instrument is being calibrated using eddy correlation (EC) and Bowen ratio (BR) energy balance measurements. However, it is known that EC has an energy balance closure problem i.e. $R_n \neq H + LE + G$ (Oncley et al., 2000). In this study, the main objective was to evaluate the capability of LAS to estimate H and ET rates using lysimetric measurements over cotton managed under dryland and irrigated management conditions. The study was conducted during the Bushland Evapotranspiration and Agricultural Remote sensing EXperiment - 2008 (BEAREX-08) in the USDA-ARS Conservation and Production Research Laboratory (CPRL) at Bushland, Texas.

STUDY AREA

The geographic coordinates of the CPRL are $35^{\circ} 11' N$, $102^{\circ} 06' W$, and its elevation is 1170 m above mean sea level. Soils in and around Bushland are classified as slowly permeable Pullman clay loam soils. The major crops in the study area are corn, sorghum, winter wheat, and cotton.

The CPRL has four large monolithic precision weighing lysimeters. Each lysimeter (3 m length \times 3 m width \times 2.4 m depth) is located in the middle of 4.7-ha fields and all four lysimeters are arranged in a block pattern (Fig. 1). Dryland cropping systems are managed on two lysimeter fields in the west and irrigated cropping systems are managed on two lysimeter fields in the east with a 10-span lateral move sprinkler system. In 2008, cotton was planted on all four lysimeter fields. Each lysimeter field was equipped with one net radiometer [Q*7.1, Radiation and Energy Balance Systems (REBS), Seattle, Wash.] and two infrared thermometers (IRT) (2G-T-80F/27C, Exergen, Watertown, Mass.) for measuring R_n and surface temperature, respectively. More information of

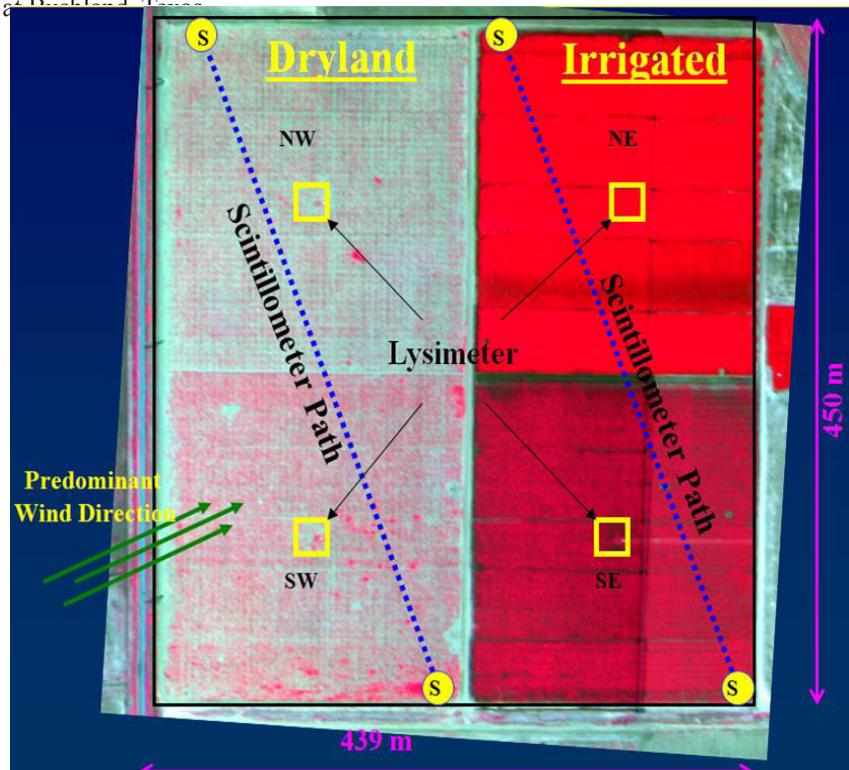


Figure 1. Lysimeter fields in the USDA-ARS Conservation and Production Research Laboratory, Bushland, Texas.

lysimeter setup can be found in Howell et al. (1995).

METHODS AND MATERIALS

The experiment setup consisted of two Kipp & Zonen LAS for measuring C_n^2 , one each deployed over cotton crops managed under irrigated and dryland conditions (Fig. 1), respectively. The orientation of the LAS was configured to have its path perpendicular to the predominant southwest wind direction. The aperture diameter of both transmitter and receiver (D) was reduced from 15 to 10 cm to avoid signal saturation. The height of the LAS was set to 2 m to conform to heights (2 m) at weather station installed on each lysimeter. After aligning the transmitter and receiver, the path length dial knob setting value was calculated using an equation from the LAS manual provided by the manufacturer, and the receiver control panel was set for the path distance. The C_n^2 measurements were made at 1 Hz and averaged to 15-min, and were synchronized with weather station, R_n and G measurements.

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The C_n^{-2} measurements were made between July 13-16 on irrigated cotton, and between July 22-27 on dryland cotton, both during the 2008 summer growing season. The C_n^{-2} data were evaluated for quality and erroneous data were removed before using it for estimating LE and ET fluxes. Sensible heat fluxes at 15-min intervals were calculated using a step by step methodology provided in the LAS instruction manual. The hourly ET rates were calculated, using estimated H with measured R_n and G fluxes, as a residual from the energy balance equation after dividing by the latent heat of vaporization ($L = \sim 2.45 \text{ MJ kg}^{-1}$) and water density ($\rho_w = \sim 1.0 \text{ Mg m}^{-3}$) and compared against lysimetric data. Since each LAS was deployed over two lysimeter fields, measured ET rates from two corresponding lysimeters were averaged to compare against LAS-based predicted ET. Coefficient of determination (R^2) and Root Mean Square Error (RMSE) were used for comparing predicted daily ET against lysimeter data.

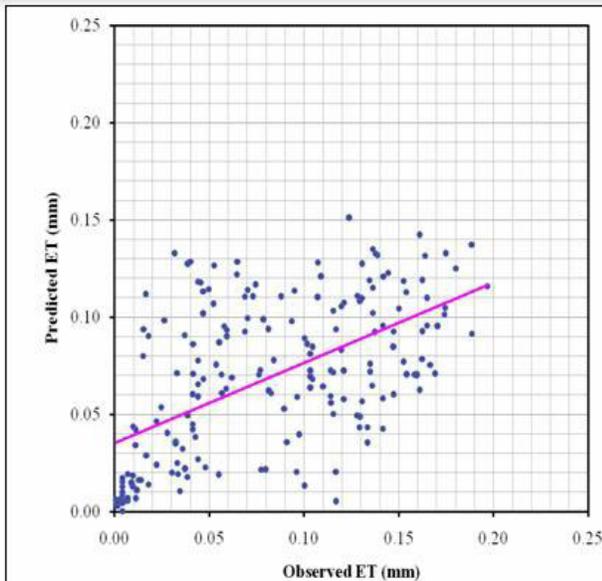
RESULTS AND DISCUSSION

The path lengths for LAS on irrigated and dryland lysimeter fields were 480 and 450 m, respectively. Evaluation of the LAS data showed that more than 98% of the C_n^{-2} measurements were within the required C_n^{-2} turbulent range of $10^{-12} - 10^{-17} \text{ m}^{-2/3}$ indicating no signal saturation during the experiment. Figure 2(a-b) illustrates the comparison of LAS-estimated 15-min ET fluxes against lysimetric data. For the irrigated cotton, the LAS was able to explain only

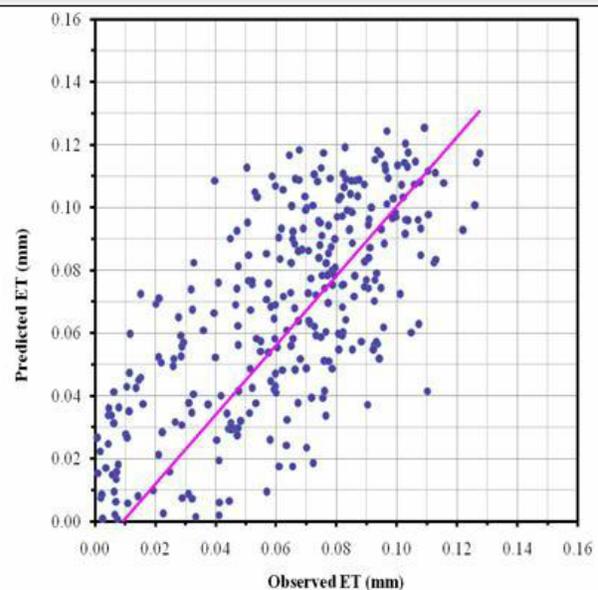
about 32% of the variability in the observed ET measurements. The RMSE was about 0.04 mm. Lower performance of the LAS over irrigated cotton may be partly due to its inability to accurately measure relatively smaller H fluxes. However, further evaluation of the LAS is needed to make this assessment. The LAS performed relatively better for dryland cotton, with an R^2 of 0.77, than irrigated cotton. The RMSE (0.02 mm) with dryland cotton experiment was about 40% of the observed mean lysimeter-based ET. This is comparable to ET prediction accuracies reported with EC and BR systems (Gowda et al., 2010).

SUMMARY

Path integrating capabilities of scintillometer over several kilometers make it a potential tool that can bridge the gap between primary point based observations (lysimeters, Bowen ratio, or eddy covariance) and the demand for large-scale spatially averaged surface heat fluxes. Further, the spatial scale of sensible heat fluxes (H) derived from a scintillometer is comparable to the spatial resolution of satellite images. Therefore, scintillometer data may be useful for validating evapotranspiration (ET) maps derived from satellite data. Performance of the LAS over dryland cotton was comparable to eddy covariance or Bowen Ratio systems. However, the LAS was able to explain only 32% of the variability in measured ET over irrigated cotton field. Further evaluation of the LAS is needed before using it for assessing accuracy of remote sensing based ET maps.



(a) Irrigated Cotton

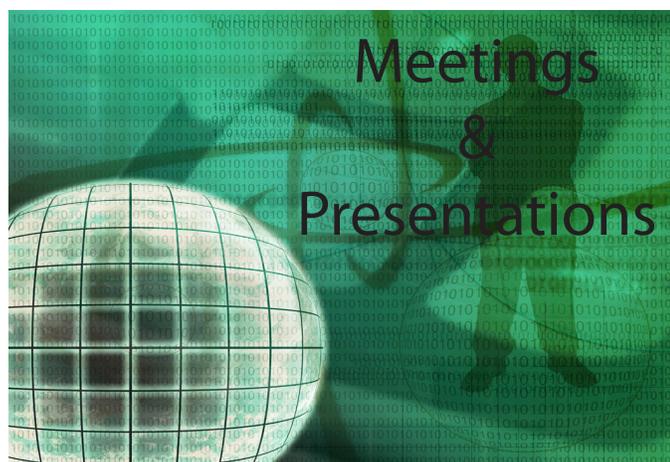


(b) Dryland Cotton

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Louis Baumhardt talked on Deficit Irrigation at a workshop hosted by Winget in Hereford, TX, December 7, 2010.

Louis Baumhardt presented an invited talk to the Irrigation Workshop at the Beltwide Cotton Conference in Atlanta, GA, January 4-7, 2011.

Proceedings from Meeting:

Baumhardt, R.L. and Paul D. Colaizzi. 2011. Cotton water use and yield response to deficit irrigation strategies, tillage, and application method.

Susan O'Shaughnessy and Terry Howell attended the High Plains Irrigation Conference, January 21, 2011, Amarillo, TX.

Terry Howell hosted Talel Stambouli from Spain on a training internship on sprinkler irrigation efficiency and uniformity from Feb. 6th until May 14th, 2011.

Terry Howell and Andy Cole attended the ARS Southern Plains Area Research Leaders Conference in College Sta-

tion, TX on February 23-24, 2011.

Susan O'Shaughnessy, Steve Evett, Louis Baumhardt, Judy Tolk, Dave Brauer, Terry Howell, Paul Colaizzi, Robert Schwartz, and Prasanna Gowda participated in the Ogallala Aquifer Program workshop Lubbock, TX, March 8-10, 2011. Sharon Parkhurst and Gwen Coyle assisted in the workshop arrangements and operations.

Dave Brauer attended the Agriculture, Food, Nutrition and Natural Resources R&D Round Table on March 15, 2011. The Round Table was organized by a consortium including Farm Foundation, NFP, Charles Valentine Riley Memorial Foundation, and several agriculture related professional societies. *Proceedings of the Agriculture, Food, Nutrition and Natural Resources R&D Round Table: Research partnerships yield greater societal returns.* R.L. Ridgway (ed). Charles Valentine Riley Memorial Foundation, Flower Mound, Texas, USA. 2011. (Proceedings)

Proceedings from Meeting:

Brauer, D., Devlin, D., and Howell, T.A. Exemplary case study of cooperative research and development project: Sustaining rural economies through agricultural production and water management.

Prasanna Gowda attended the Annual meeting of the Texas Society for Microscopy in Ft. Worth, TX, April 7-9, 2011. Presented Celik, Y., N. Ghosh, U.R. Rangappa, S. Angadi, and P.H. Gowda. 2011. Microscopic evaluation of stomatal index, water use efficiency, and shared tolerance in legumes, *Texas Journal of Microscopy*, 42(1):9.

Robert Schwartz attended the European Geophysical Meeting in Vienna (April 4-8, 2011) and presented two posters; (*Monitoring Near Surface Soil Water and Associated Dynamics of Infiltration and Evaporation Fluxes* by R.C. Schwartz, S.R. Evett, A.L. Schlegel, and R.L. Baumhardt; and *Local and profile soil water*

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content monitoring: *A comparison of methods in terms of apparent and actual spatial variation* by S.R. Evett, R.C. Schwartz, N. Ibragimov, N.T.H. Mazahreh, and N. Katbeh-Bader).

Proceedings from Meeting:

Schwartz, R.C., S. R. Evett, and A.J. Schlegel. 2011. *Monitoring near surface soil water and associated dynamics of infiltration and evaporation fluxes.*

Prasanna Gowda attended the World Environmental and Water Resources Congress 2011. Bearing Knowledge for Sustainability Proceedings of the 2011 World Environmental and Water Resources Congress, May 22-26, 2011, Palm Springs, CA.

Proceedings from Meeting:

Ha, W., P.H. Gowda, T. Oommen, T.H. Marek, D.O. Porter, and T.A. Howell. 2011. *Spatial interpolation of daily reference evapotranspiration in the Texas High Plains.*

Hernandez, J.E., P.H. Gowda, T.A. Howell, J.L. Steiner, F. Morjarro, E.P. Nunez, and J.R. Avila. 2011. *Groundwater modeling of the Calera Aquifer Region in Central Mexico.*

Gowda, P.H., T.A. Howell, G. Paul, P.D. Colaizzi, and T.H.

Marek. 2011. *SEBAL for estimating hourly ET fluxes over irrigated and dryland cotton during BEAREX08*

Paul, G., P.H. Gowda, P.V. Varaprasad, T.A. Howell, and S.A. Staggenborg. 2011. *Evaluating surface energy balance system using aircraft data.*

Terry Howell participated in the PhD Defense for Denis Mutibwa at the Biological Systems Engineering Department at the University of Nebraska-Lincoln on June 15th, 2011.

Joaquin Casanova attended the ASABE Annual International Meeting, Louisville, Kentucky August 7-10, 2011.

Proceedings from Meeting:

Casanova, J. J., S. R. Evett, and R. C. Schwartz. 2011. *Design and Testing of Access-Tube TDR Soil Water Sensor.*

September 10, 2011 Terry Howell attended the 50th Annual Scholarship Awards Ceremonies for the Department of Agricultural Sciences at West Texas A&M University and other Awards. Several of our CPRL student employees were recognized for their scholarship and excellence at WTAMU. Dr. N. Andy Cole, CPRL Research Animal Scientist, recognized as a Graduate of Distinction from West Texas A&M University, and donor for the Cole Agriculture Scholarships awarded two students. Dr. B.A. Stewart, former CPRL Director, and wife, Jane Ann donors for the B.A. and Jane Ann Stewart Dryland Agriculture Scholarships awarded ten students.

Terry Howell and Andy Cole participated in a tour of the CPRL for Dr. Craig Nessler, Director of the Texas AgriLife Research and Vice Chancellor of the Texas A&M University System with an evening dinner with Mr. John Sharp, Texas A&M University System Chancellor on September 13th, 2011.

Steve Evett, Susan O'Shaughnessy, Prasanna Gowda, Judy Tolk, Louis Baumhardt, Robert Schwartz, Bill Rice, Rick Todd, Heidi Waldrip, Joaquin Casanova, Jerry Ennis and Jourdan Bell attended the ASA-CSSA-SSA Interna-

tional Annual Meeting, Fundamental for Life: Soil, Crop, & Environmental Sciences, October 16-19, 2011, San Antonio, TX. **

Meeting Abstracts and Presentations:

Angadi, S., S.Begna, U.M. Rangappa, M. Marsalis, I. Lepcha, P. Gowda, L.Lauriault and F. Contreras-Govea. 2011. *Sorghum and Legume Intercropping to Improve Resource Use Efficiency of Forage Production Systems In the Southern High Plains.* (CD-ROM)

Angadi, S., P.Gowda, U. Rangappa, T.Oommen and P.V. Vara Prasad. 2011. *Evaluating Shade Effects On Crop Productivity In Sorghum-Legume Intercropping Systems Using Support Vector Machines.* (CD-ROM)

Baumhardt, R.L. and R. C. Schwartz. 2011. *Tillage, Residue, and Crop Rotation Effects On Rain Infiltration and Sediment Transport.* (CD-ROM)

Bell, J.M., R.C. Schwartz, K.H. Mcinnes, T.A. Howell and C.S. Morgan. 2011. *Quantification of Soil Water Evaporation Using TDR-Microlysimetry.* (CD-ROM)

Cassanova, J.J., S.R. Evett, R.C. Schwartz and S. Anderson. 2011 *Field Tests of a Down-Hole TDR Profiling Water Content Measurement System.* (CD-ROM)

Evett, S.R., N. Agam, W.P. Kustas, P.D. Colaizzi and R.C. Schwartz. 2011. *Soil Heat Flux Determined From Diel Water Content and Temperature Variations.* (CD-ROM)

Gowda, P., T. Howell, W. Ha and K. Copeland. 2011. *Lysimetric Evaluation of Eddy Covariance Fluxes Over Irrigated Cotton In the Texas High Plains.* (CD-ROM)

Gowda, P., T. Howell, J. Ennis, T. Marek and D. Porter. 2011. *Bushland Reference ET Calculator.* (CD-ROM)

Ibragimov, N.M., R.C. Schwartz, S.R. Evett, M.Y. Esanbekov, F.M. Khassanova, I.T. Karabaev and L.A. Mirzaev. 2011. *Tillage Intensity and Residue Effects on Early Season Evaporation and Yield in Mung Bean.* (CD-ROM)

O'Shaughnessy, S.A., S.R. Evett, C.M. Rush and F. Workneh. 2011. *Use of a Wireless Sensor-Based Irrigation System to Improve Water Use Efficiency In Diseased Wheat.* (CD-ROM)

Paul, G., P. Gowda, P.V. Vara Prasad, T. Howell and S. Staggenborg. 2011. *Automated Methodology for Selecting Hot and Cold Pixel for Remote Sensing Based Evapotranspiration Mapping.* (CD-ROM)

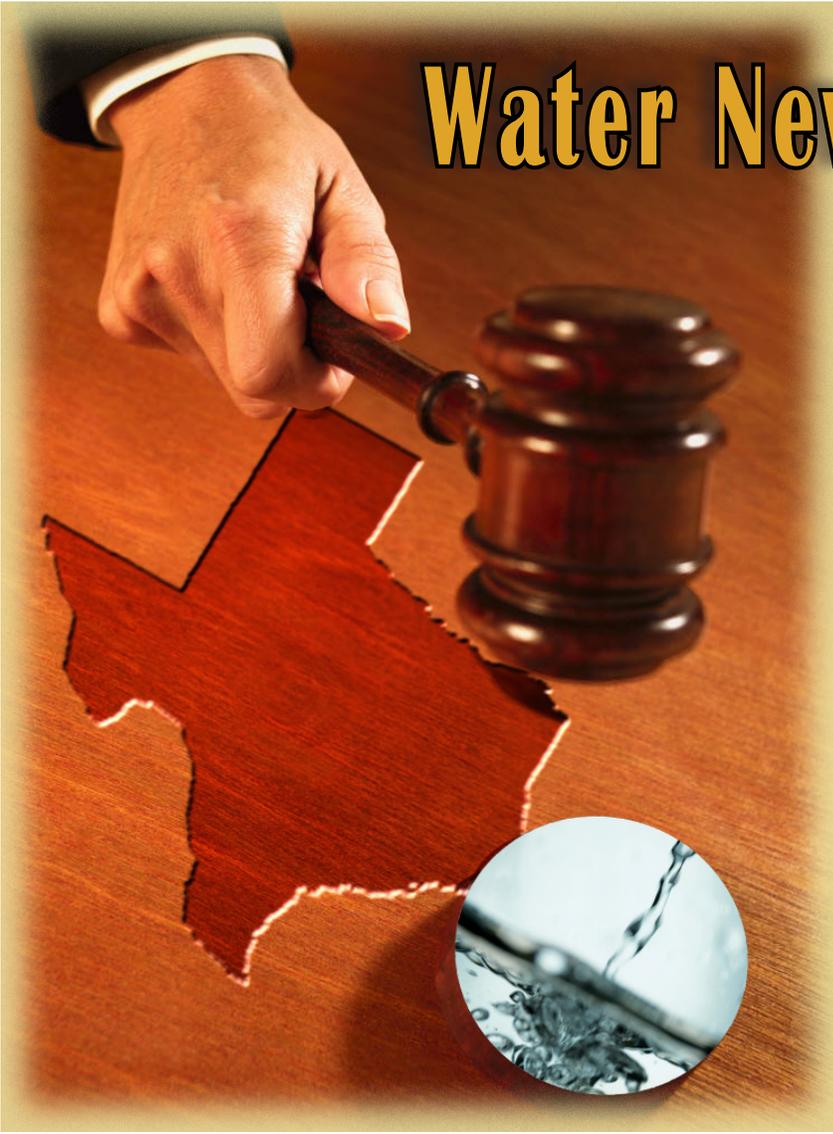
Schwartz, R.C., A. J. Schlegel, S.R. Evett and R. L. Baumhardt. 2011. *Monitoring near Surface Soil Water and Associated Dynamics of Infiltration and Evaporation Fluxes.* (CD-ROM)

Tolk, J.A. and T.A. Howell. 2011. *Sunflower Water Productivity In Four Great Plains Soils.* (CD-ROM)

Terry Howell and Dave Brauer attended the Ogallala Aquifer Research and Extension Symposium, October 19, 2011 at KSU, Manhattan, KS. Dave Brauer gave a presentation titled: *An overview of the Ogallala Aquifer.*

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Water News In Texas

An Ogallala Update

 by David K. Brauer

Legal suits between Mesa Water LP and Texas Water Development Board (TWDB).

In the Fall 2010 issue of the *Wetting Front*, I authored an update regarding the legal actions that could hinder the establishment of Desired Future Conditions (DFC) for the Ogallala Aquifer on the Texas High Plains. Establishment of DFC has the potential to reduce the water available for irrigation by requiring a certain amount to remain in the aquifer in 50 years. Establishment of DFC provides the rationale for groundwater conservation districts to implement rules to limit withdrawals from the Ogallala Aquifer. Several water districts have been creating rules this past summer to achieve reductions in withdrawals.

This installment may complete the story. As of last newsletter, Mesa Water LP and G&J Ranch had sued the TWDB regarding their support for the DFC adopted for the Ogallala Aquifer in Groundwater Management Area #1 (GMA #1). TWDB challenged the legality of the suit brought by Mesa Water LP and others based on a claim of immunity. Since the TWDB had only advised GMA #1 that its goals seemed reasonable and were established within the parameters defined by the law, TWDB could not be the target of the suit. On December 9, 2010, an Austin state district judge ruled that the law did protect TWDB from the suit.

Mesa Water LP attempted another challenge to the established DFC in GMA #1 by requesting an inquiry by the Texas Commission on Environmental Quality to dissolve local water conservation districts, dismiss their boards or force them to change their goals. This request was dismissed by the agency's Executive Director late in 2010.

All these legal challenges may now be mute. In April 2011, Mesa Water LP agreed to sell its water rights on approximately 200,000 acres of Roberts County land to the Canadian River Municipal Water Authority (CRMWA). CRMWA agreed to pay approximately \$103 million for the water or just less than \$500 per acre. CRMWA is the regional authority that supplies water to 11 towns on the Texas High Plains. In the past, CRMWA has relied on water from Lake Meredith for a substantial portion of its supply. However, low water levels in Lake Meredith have made this source unreliable for future uses (more later). The Ogallala Aquifer in Roberts County has the greatest saturated thickness in Texas and extensive development of irrigation has not occurred there because of its rolling terrain.

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Despite the sale of the water rights that Mesa Water LP held, on-going litigation may not be over. Lawyers representing Mesa Water LP have filed a brief in the Amarillo Court of Appeals in connection with the ruling by the Travis County district court. A brief by the TWBD is expected to be filed in the near future. So these legal challenges may or may not continue despite the sale of water rights held by Mesa Water LP.

High Plains Municipal Water Supplies.

Several news stories since August 2010 have appeared regarding the low levels of water in Lake Meredith and that CRMWA would use little, if any, water from the reservoir for its supply to member cities and towns in 2011. Reductions in supply from Lake Meredith have been anticipated, as is evident by the number of cities in western Texas and eastern New Mexico that have initiated plans to secure water from other sources. CRMWA, as mentioned above, has secured water rights from Mesa Water LP, thus enhancing its rights to Ogallala Aquifer water in Roberts County. The City of Amarillo had in the past secured water rights in northeast Potter County. In the past year, the City has started drilling wells and building a pipeline from the Potter County area to Amarillo so that this water can be used for municipal supply. The pipeline was completed before the end of the summer of 2011 and a supply of at least 5 million gallons per day has started to flow into Amarillo. These events indicate that the Ogallala Aquifer may be a more important source of municipal water for some cities on the Texas High Plains in the future than it has been in the past.

Not all towns and cities in the region are looking towards the Ogallala Aquifer as a source of municipal water. The city of Lubbock is developing pumping stations and a pipeline to bring water from Lake Alan Henry. The Lubbock Water Advisory Commission in April 2011 warned that peak water demand in Lubbock during the summer of 2011 may exceed the 63,000,000 gallons per day that the system can supply. Such warn-

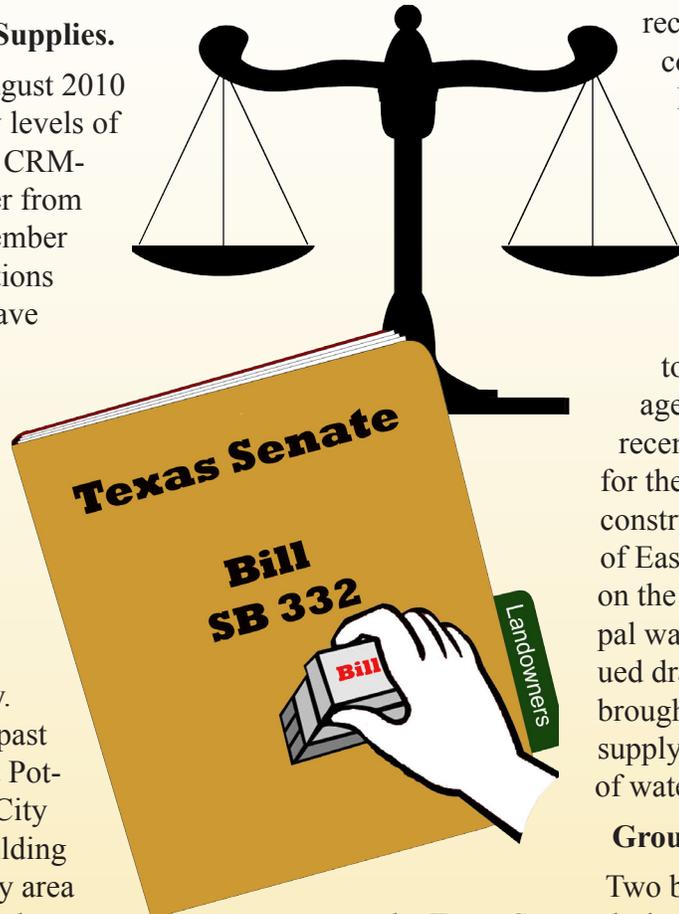
ings indicate the need for the city of Lubbock to have greater supply. Towns in eastern New Mexico including Portales and Clovis are investigating the possibility of using water from Ute Lake as a municipal water source. Ute Lake was constructed in the early 1960's and can maintain a reservoir capacity of 200,000 acre-feet in accordance with the Canadian River Compact. Up until

now, Ute Lake has been used for recreational purposes and flood control. The Eastern New Mexico Rural Water System (ENMRWS) has been awarded over \$20 million since 2004 by the State of New Mexico for planning and design of the system to bring water from Ute Lake to seven municipal and county agencies. In June 2011, the most recent funding from the state was for the first phase of the system's construction. Historically this part of Eastern New Mexico has relied on the Ogallala Aquifer for municipal water supply. However, continued draw down of the aquifer has brought into question its ability to supply the required 16,500 acre feet of water in the foreseeable future.

Groundwater Rights in Texas.

Two bills were introduced into the Texas Senate during the 82nd session earlier this year. One (SB 332) was sponsored by Senator Fraser and the other (SB 667) was sponsored by Senator Duncan. Both of these bills were to address ambiguity resulting from the Texas Supreme Court ruling in 1904 establishing the rule of capture as the governing principle for groundwater rights. The right of capture essentially states that a Texas landowner has the right to capture the groundwater underneath their property without being liable for damage to others. Later, the Texas Legislature created groundwater conservation districts as the preferred method of managing groundwater resources. An argument has been made by some districts that the landowner does not have an interest in the groundwater until they capture it. Both of these bills were to affirm a landowner's interest in the groundwater

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beneath their property. A lengthy and spirited hearing was held on March 1, 2011. In the end, Senators Fraser and Duncan agreed on support for a revision to SB 332. As of May 30, 2011, the Texas Legislature had passed the bill and forwarded it to Governor Perry.

The salient points of SB 332 are two-fold: 1) the bill specifically states “that a landowner has a vested ownership interest in groundwater below the surface as an interest of the landowner’s real property”; 2) the bill does not “affect the ability of a district to regulate groundwater production as authorized under Section 36.113,

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Water Planning for Texas Panhandle

Texas Water Development Board

36.116 or 36.112”. Therefore, the intent of SB 332 is to clarify the rights of landowners to groundwater but does so in such a way that regulation by groundwater districts is not impaired. In many respects, SB 332 would maintain the status quo regarding groundwater rights in the state of Texas.

For more details read the newspaper article ‘We have to get serious’ Studies: Impossible for lake to ever reach 1966 expectations Posted: November 5, 2011. <http://amarillo.com/news/local-news/2011-11-05/we-have-get-serious>.

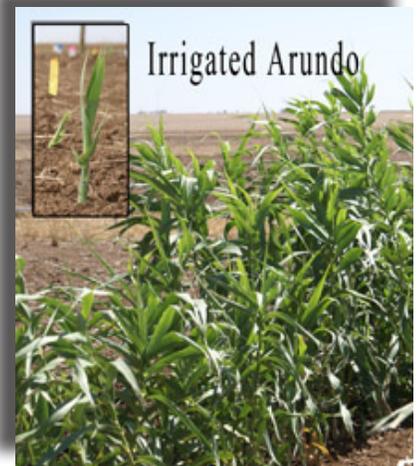


Scientists from the Soil Water Management Research Unit met with Bob Joseph, Director, George B. Ozuna, Deputy Director, Natalie Houston, Hydrologist in Houston, Tim H. Raines, Hydrologist in Ft. Worth, and William H. Asquith, Hydrologist in Lubbock, all with the USGS Texas Water Science Center to discuss Ogallala Aquifer water issues and related research on January 19, 2011.

On January 3-5, 2011, Paul Colaizzi met with Drs. Bill Kustas, Joe Alfieri, and Martha Anderson at the USDA-ARS Hydrology and Remote Sensing Laboratory, Beltsville, MD to discuss newly

developed models for evapotranspiration mapping with remote sensing and manuscript development for the BEAREX08 Special Issue in Advances in Water Resources.

Paul Colaizzi and Don McRoberts assisted Drs. Alex Racelis and John Goolsby of the USDA-ARS Biological Control and Integrated Pest Management of Pests and Weeds Research Unit, Kika de la Garza Subtropical Agricultural Research Center, Weslaco, TX, with establishing experimental plots of irrigated arundo at Bushland as part of their research to evaluate arundo in the vast range of climates throughout Texas.



On February 10, 2011, Steve Evett met with Drs. Bill Kustas, Joe Alfieri, Martha Anderson and Mike Cosh at the USDA-ARS Hydrology and Remote Sensing Laboratory, Beltsville, MD to discuss ongoing collaborative research on remote sensing and ground truthing.

Robert Schwartz talked about tillage, evaporation and stored soil moisture on the KGNC Program, CREET BEAT Aired February 25, 2011 in Amarillo, TX.

On February 27, 2011, Dave Brauer presented an overview of the Ogallala Aquifer and the Ogallala Aquifer Program to visitors from Poland as part

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of Texas AgriLife's "Linking agriculture in the United States with Poland to enhance import/export opportunities".

In March, 2011, CNN televised a story entitled "Farmers fear future dust bowl" which detailed possible declines in agriculture output from the Texas High Plains as water from the Ogallala Aquifer is depleted and featured a brief interview with Dave Brauer. The story was also run on local TV stations in Lubbock and Amarillo, TX.

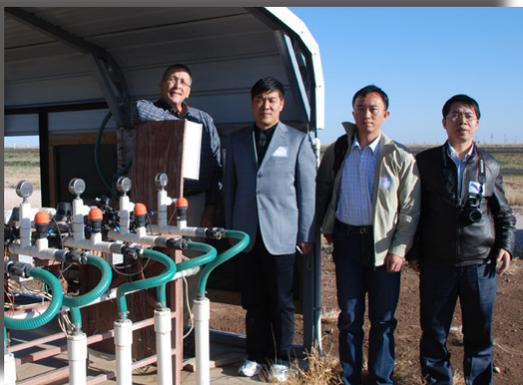
On April 1, 2011, Dave Brauer was on CREET BEAT, KGNC, Amarillo, TX, with the story, "Farmers fear future dust bowl-Rebuttal". Dave explained that his outlook for agriculture on the Texas High Plains was not as bleak as the tone of the CNN story that had appeared in March, 2001.

April, 6, 2011, Robert Schwartz consulted with Dr. Lee Heng of the International Atomic Energy Agency (IAEA) at the International Center in Vienna, Austria. Current research activities and potential areas of collaboration were discussed. Dr. Heng requested that Dr. Schwartz write a brief article in the IAEA Soils Newsletter, to which he agreed. He also visited with Dr. Karuppan Sakadevan (IAEA, Vienna). During the afternoon he visited the IAEA Laboratory at Seibersdorf and was given a tour of the lab, greenhouse and field facilities by Jose Luis Arrillaga.

Susan O'Shaughnessy spoke to students from the Ag Education class at WTAMU regarding "A Day in the Life of an ARS Scientist" on April 14, 2011, Canyon, TX.

On April 27, 2011, the WTAMU Soil & Water Conservation class visited the laboratory and received a presentation on variable rate sprinkler tests with catch cans from Steve Evett.

Terry Howell, Steve Evett, Judy Tolk, Paul Colaizzi, Susan O'Shaughnessy and Robert Schwartz



met with visitors from the China Institute of Water Resources and Hydropower Research, Department of Irrigation and Drainage, May 5, 2011.

On May 17, 2011, Robert Schwartz helped the Bushland Elementary 4th grade class build models of animals.

Radiation Safety Training classes for nuclear moisture/density gauges were held on April 8, and June 2, 2011 in the Conference Room of the USDA-ARS Conservation and Production Research Laboratory, Bushland, Texas. This all-day class covered moisture, density, and moisture/density gauges. Dr. Steven R. Evett conducted the trainings.

Susan O'Shaughnessy, Judy Tolk and Paul Colazzi, met with visiting Russian scientists on June 14, 2011.



Dave Brauer was a guest expert on the Ogallala Aquifer for the James Hunt Show broadcasted at the end of July 2001 on Amarillo TX KGNC.

Judy Tolk and Steve Evett visited with Dr. Roberto Martinez, researcher at INTA, Argentina, visiting scientist at ARS Maricopa on August 22, 2011.

Scientists from the Soil Water Management Research Unit met with NRCS engineers: Jerry Walker Ft Worth, Don Sternitzke Woodward OK, Cleon Namken Lubbock, Greg Sokora Lubbock, Troy Headings Amarillo, on August 30, 2011.

Robert Schwartz and Steve Evett hosted visiting scientist Dr. Nazar Ibragimov from the Cotton



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Research Institute, Tashkent, Uzbekistan from October 8-25, 2011. Dr. Ibragimov traveled with them to the ASA-CSSA-SSSA Annual International Meetings in San Antonio where he presented a poster. They were joined there by Dr. Mohammed Jitan, visiting scientist from the National Centre for Agricultural Research and Extension (NCARE), Amman, Jordan. The four then traveled to Las Cruces, New Mexico where they visited the USDA-ARS Southwest Cotton Gin Laboratory and were hosted by Dr. Ed Hughes, RL, and other scientists for an explanation of cotton ginning research there and a tour of cotton, horticultural and tree crops (pecans) in the area. The four then visited the USDA-ARS Arid Lands Agricultural



Research Center in Maricopa, Arizona, where they were hosted by Dr. Kevin Bronson, RL for discussions of the joint research project “Effects of Agricultural Practices on Evaporation, Transpiration, Yield and Water Quality”, funded by CRDF. Dr. Jitan spent several days thereafter at Bushland before traveling to ARS Laboratories in Parlier, California and Beltsville, Maryland.

November 5, 2011, Jourdan Bell, Gwen Coyle, and Heidi Waldrip represented CPRL at the Women in Science Endeavors (WISE), held annually at Amarillo Area Center for Advanced Learning, Amarillo, TX, an event opened up to all middle school girls in the Texas Panhandle.

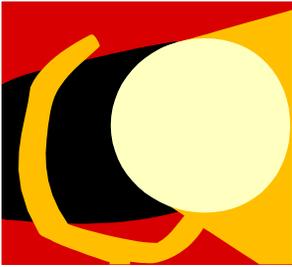


Robert Schwartz traveled to Uzbekistan on March 26 to April 2, 2011 to work with Dr. Nazar Ibragimov on a joint research project funded by CRDF (# 31032: Effects of Agricultural Practices on Evaporation, Transpiration, Yield and Water Quality). Dr. Schwartz visited the Uzbek National Cotton Growing Institute in Akkavak, Kibray District, approximately 16 km northeast of Tashkent, Uzbekistan, where he was hosted by Dr. Ibragimov, Head of the Soil Fertility Department. The purpose of the visit was to consult with scientists at the laboratory and review research progress. Besides Dr. Ibragimov, he consulted with Dr. Feruza Khasanova (Conservation Agriculture and Cropping Systems), Dr. German Bezborodov

(Irrigation Unit Head), and other scientists at the laboratory. He also worked with project participant Lutfullo Mirzaev (Agricultural Engineer) who was responsible for ensuring soil water measurements with the neutron gage and microlysimeter measurements of evaporation that were completed during the 2010 cropping season (Mungbean). Drs. Schwartz and Evett will examine the microlysimeter and soil water content measurements and work with Dr. Ibragimov in analyzing data for presentation at the American Society of Agronomy Meetings in San Antonio (October, 2011).

The US Embassy in Tashkent requested a meeting during the visit in Uzbekistan. Dr. Schwartz met with Armando Diego Rivera, Economic Officer and Dr. Bakhityor Mukhamadiev, Science Officer. Topics of discussion included the past and current involvement of Dr. Steve Evett with Uzbek Scientists at the Cotton Growing Research Institute and the excellent cooperation that ARS has had with the institute. Mr. Rivera indicated that a new agreement was signed with the Uzbek government in Dec 2010 to foster scientific exchange between the two countries. This Agreement provides a framework under which U.S. Government agencies, Government of Uzbekistan ministries, U.S. and Uzbek institutes, universities, and research centers, and private companies can cooperate in the fields of science and technology. Both Embassy Officers took notice that research carried out in both ARS Bushland and Uzbekistan were similarly focused on water conservation and that this could facilitate cooperative agreements.

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Conservation & Production Research Laboratory Shines in Excellence



Prasanna Gowda (left) receiving the award from Dr. Charles W. Rice, president of the Soil Science Society of America (right). The award “Outstanding Scientist of the Year 2011” given by the Association of Agricultural Scientists of Indian Origin (AASIO).

Notables: Judy Tolk was invited to serve as Co-Editor in Chief of the international journal *Agricultural Water Management* for a 3-yr term which began in July, 2011.

Prasanna Gowda has been elected as a vice-chair (2011-2014) for the ASCE-EWRI Evapotranspiration Task Committee.

American Society of Agronomy community leaders include Steve Evett, Presiding Chair, and Susan O’Shaughnessy, Vice Chair, Sensor Based Water Management Community; Prasanna Gowda, Presiding Chair, Remote Sensing of Evapotranspiration Community; and Judy Tolk, Presiding Chair, and Steve Evett, Vice Chair, Agroclimatology and Modeling Community.

The Ogallala Aquifer Program (OAP) was recognized as being An Exemplary Example of Cooperative Research And Development Programs at the Agriculture, Food, Nutrition and Natural Resources R&D Round Table (March 15, 2011). The Round Table was organized by a consortium including Farm Foundation, NFP, Charles Valentine Riley Memorial Foundation, and several agriculture related professional societies. The OAP was one of eight programs selected out of 50+ nominations. 2011. (Team Award)

Student Recognition:

On September 10, 2010, the 50th Annual Scholarship Awards Ceremonies were held in Canyon, Texas for the Department of Agricultural Sciences at West Texas A&M University along with other Awards. Several of the CPRL student employees were recognized for their scholarship and excellence at WTAMU. Those recipients were Travis Allison (left) who received the Leonard Wilson Excellence Award Scholarship; René Allison (middle) who was one of the recipients of the Panhandle-Plains Land Bank Scholarship; and Jim Belt (right) who was one of the recipients of the Bradley Jay Rickwartz Memorial Scholarship.



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The People's Garden' is an effort by USDA which challenges its employees to establish gardens at USDA facilities worldwide or help communities create gardens. With Texas experiencing one of the worst years of drought in history and number of days over 100 degrees, the Peoples Garden still managed to donate 1194 pounds of vegetables to the High Plains Food Bank.

Peoples Garden

Employee Spirit

Summer Employees

Summer Student Employees take time out for a photo, some students will continue working part-time in the fall and others could return next summer.



Campaign Kickoff



Employees kicked off The Combined Federal Campaign with a voluntary luncheon. Financial Technician Barbara Welch continues her 3rd year as campaign chair.



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