



# COLORADO WATER

Newsletter of the Water Center of Colorado State University

*AUGUST 2004*

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*Doris Carpenter, Ward Carpenter, Brian Werner, and Robert Ward attended the Tables of Contents gala (see story on page 16) at Morgan Library on the CSU campus where the collection of Delph Carpenter's papers now reside (see story on page 14).*

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## EDITORIAL



## Change in Water Research

By Robert Ward

As many people are aware, higher education in Colorado has experienced several years of severe budget reductions. These reductions are impacting all aspects of the university, including university support for the Colorado Water Resources Research Institute. As a result of budget constraints in higher education, CWRRI must reduce its budget by \$50,000 for 2004-05 (a 25% reduction in CSU support for CWRRI).

The current budget reduction forces CWRRI to suspend its state-based water research competition. The CWRRI Advisory Committee on Water Research Policy (ACWRP) will meet August 27, 2004, during the annual Colorado Water Congress Summer Convention, to discuss options for adjusting CWRRI's operations to a reduced budget as well as strategies to enhance support of water research in Colorado in the future.

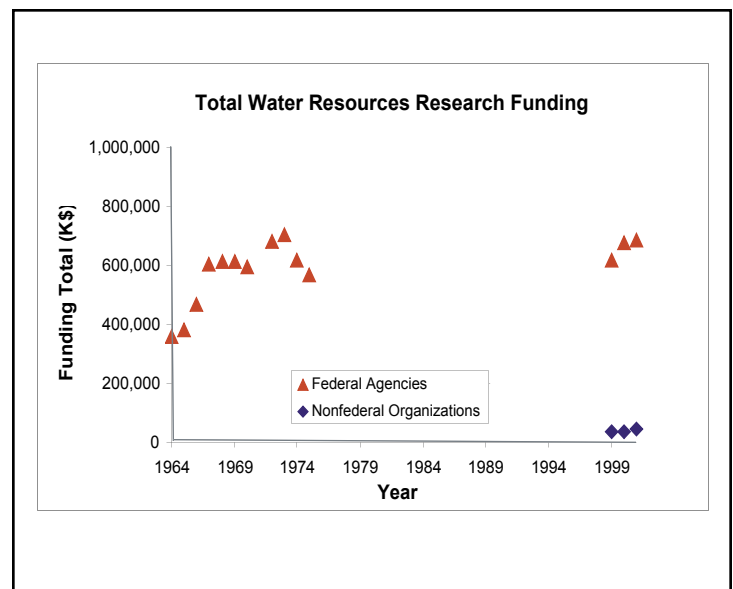
CWRRI's water research program collaborates with Colorado water managers and users, per its Congressional and Legislative mandates. The program operates as follows. CWRRI's ACWRP establishes priorities for new knowledge that could improve water management in Colorado and/or reduce crisis and conflict. CWRRI invites faculty in Colorado's higher education system to submit responsive, creative, and sound science proposals. The proposals are peer reviewed and the ACWRP ranks the proposals with respect to both the quality of the science and relevance to their needs. The ACWRP tracks progress of the research and provides input to insure the research continues to address the needs of water managers (as new understanding is obtained, there are often additional questions posed during the course of the research). The CWRRI water research competition, operating under a constant budget for over 15 years, has seen its buying power steadily erode. Thus, the program devolved to more of a 'seed grant' program which helped faculty initiate new lines of study which, if successful, often led to larger grants from local, state, and federal organizations. The seed grant role is unique and provides faculty with an opportunity to work closely with Colorado water managers in addressing an emerging Colorado water issues.

Reduced funding for water research is not only an issue in Colorado. On June 17, 2004, the National Research Council (NRC) issued a report entitled: "Confronting the Nation's Water Problems: The Role of Research," a congressionally mandated report which analyzes federal water research investments and coordination. Nationally, the NRC report notes, real levels of spending for water research have remained relatively constant (around \$700

million in 2000 dollars) since the mid 1970s. Over the past 30 years the number of emerging issues requiring new research, such as aquatic ecosystem restoration, has increased. Thus, funding for water supply augmentation and conservation, water quality management and protection, water resources planning and institutional issues, and resources data, within the total water research picture, have declined severely since the mid 1970s. Similar statements could also be made regarding CWRRI's funding over its 40-year life.

Funding for water research is not decreasing on all fronts. In this issue of *Colorado Water*, new studies in the Arkansas Valley are described (see page 11). This research is being undertaken by the State of Colorado to more accurately estimate the amount of water used by crops in the Arkansas Valley. A key feature of the new research will be the installation of two large weighing lysimeters at the Rocky Ford Experiment Station. The lysimeters will enhance the science behind efforts to accurately estimate evapotranspiration (ET) as Colorado strives to comply with the Supreme Court rulings surrounding the Arkansas Compact lawsuit with Kansas.

The National Science Foundation is helping fund a new non-profit organization to facilitate the acquisition of hydrologic data at scales much larger than traditional single investigator (or single university/agency) studies permit. The Consortium of Universities for the Advancement of Hydrologic Sciences (CUAHSI) is taking a lead in organizing the hydrologic community to acquire and share hydro-



logic data at large watershed scales. An article beginning on page 5 of this issue describes the efforts of CUAHSI.

The Bureau of Reclamation initiated Water 2025 to reduce crisis and conflict in water management. The Water 2025 initiative recognizes that many conflicts in water management are caused by a weakness in our scientific understanding, particularly with respect to emerging areas of societal interest. A conference was held in Denver last November to discuss the ways enhanced science could help reduce water conflicts in the West (See the December 2003 issue of *Colorado Water* for a brief summary of the meeting).

Colorado water managers are organizing to support acquisition of new knowledge to address a growing concern regarding selenium standards. There is concern that the science behind reducing selenium (Se) standards may not be as sound as it should be. Thus, a number of Colorado water managers are approaching Congress to seek funding to better define the scientific understanding of Se impacts upon the life cycles of endangered fish.

Several States have passed 'credible data' laws in response to concerns that water management decisions (e.g. the Total Maximum Daily Load (TMDL) lists) are based on poor quality data. The laws call for the infusion of more 'sound science' in the acquisition of water quality data as well as in its analysis and interpretation. The General Accounting Office, in March 2000, released a report (GAO/RCED-00-54) that noted key decisions by environmental managers are limited by the inconsistent and incomplete data records employed in decision-making.

Thus, while CWRRRI's state-based water research competition is suspended and the total funding for water research remains flat, there are shifts taking place within the U.S. water research enterprise that result in more targeted, applied, research. As the NRC report notes, there is concern that the shifts taking place in the acquisition of new water knowledge, within a declining funding structure, raise concern about the development of fundamental science needed to conduct applied research in the future.

The NRC report concludes with the following statement:

"Publicly funded research has played a critical role in addressing water resources problems over the last several decades, both for direct problem solving and for achieving a higher level of understanding about water-related phenomena. Research has enabled the nation to increase the productivity of its water resources, and additional research can be expected to increase that productivity even more, which is critical to supporting future population and economic growth. Managing the nation's water resources in a more environmentally sensitive and benign way is more important than ever, given the recognition now afforded to aquatic ecosystems and their environmental services."

Higher education, despite its severe budget reductions over the past few years, will continue to work with Colorado water managers, through CWRRRI and other lines of communication, to insure that 'research' remains available to Colorado water managers. How such research is funded is, at present, an open question.

The future of Colorado depends upon having a plentiful supply of clean water to meet both human and ecosystem needs. To insure water for Colorado's future, we must be clever in resolving the inevitable conflicts over water. To be clever and reach agreements regarding water resource allocations, we must be well informed about the amounts and pathways water moves through our state (e.g. in the atmosphere, surface water and ground water). We must also understand how our human activities impact the ability of others downstream to meet their water needs. Colorado has always been a leader in developing the science and institutional arrangements to support an efficient and effective water management system. We can't stop producing new knowledge now without negatively impacting the ability of tomorrow's water managers to be well informed, and clever, in satisfying Colorado's future water needs.

**American Water Resources Association  
Colorado State Section  
Events and Workshops**  
For more information, go to  
<http://www.awra.org/state/colorado/>

September 2	Tamarisk/Salt Cedar Eradication
September 28	Supreme Court Decision regarding transmountain diversions
October 26	Centennial WSD's Water Use Rate Structure
November 30	SWSI
January 18	Endangered Species/Three-States Agreement
February 22	Bureau of Rec. Projects in Colorado
March 29	Fountain Creek USACE Watershed Study
April	Annual Symposium
May 24	Scholarship recipient presentations



CWRRI



## New University Consortium Provides Forum for Identifying Research Needs

By Robert Ward

In the past three years, a new, non-profit, corporation has been created to gain consensus within the hydrologic science community in suggesting needed hydrologic research thrusts to the National Science Foundation (NSF). The Consortium of Universities for the Advancement of Hydrologic Science (CUAHSI) currently has 90 member universities and operates with a grant from NSF.

CUAHSI Executive Director, Rick Hooper, met with faculty from CU Boulder, CU Colorado Springs, and CSU on June 22, 2004, to describe the new organization and its efforts to develop 'hydrologic observatories' (HO). Rick compared CUAHSI to the University Corporation for Atmospheric Research (UCAR), an organizational concept with which people in Colorado may be familiar.

CUAHSI's mission is to foster the advancement of hydrologic sciences by providing the field of hydrological sciences an organization that permits the acquisition and operation of facilities and equipment, and the storage and distribution of data at scales beyond the capability of individual universities. Specific CUAHSI objectives are:

1. Observations – CUAHSI will establish and maintain a set of Long-Term Hydrologic Observatories at which research can be conducted on pressing hydrologic problems by utilizing data generated by CUAHSI as well as by other entities in the environs of the observatories. Observatories will be selected on the basis of their regional representation and their viability as laboratories to study particular subsets of hydrologic problems from the master list, and data networks will be designed and implemented to study these problems. However, basic networks at each of the observatories will be implemented to assure that cross-laboratory syntheses can be conducted.
2. Information Technology - CUAHSI will establish and operate a hydrologic information technology program that will provide hydrologic scientists with user-friendly access to the data generated by the CUAHSI observatories as well as user-friendly interfaces with the complementary data sets generated by others. Staff of the information technology program will work closely with the data generators to assure the quality of said data for the purposes for which



*Rick Hooper (CUAHSI) and Pierre Julien (CSU CE) discuss research opportunities at the June meeting.*

they are intended. The information technology program also will be a repository of computer routines that can facilitate visualization and analysis of the data.

3. Measurement Technology - CUAHSI will establish and operate a hydrologic measurement technology program that will provide a clearinghouse for instrumentation to support data collection at the Long-Term Hydrologic Observatories, to support research projects both at and away from the observatories, and will provide the university research community with advice on the proper use and maintenance of the instrumentation. In this latter aspect, the measurement technology program will work closely with the observatories and the information technology program to assure that the data derived from the instruments are of a quality needed for the intended purposes. The measurement technology program also will house instrument development facilities to fill instrumentation needs that cannot be satisfied otherwise.
4. Education and Outreach - CUAHSI will establish a program of education and outreach

that will foster knowledge about hydrologic sciences in the general public by interaction with science educators in the intermediate and secondary levels of public and private education. This program also will introduce hydrology to potential scientists through a program of summer traineeships for outstanding undergraduate students to participate in the ongoing activities of CUAHSI and will develop support for graduate students in the hydrologic sciences in the early stage of their thesis development. Such activities not only will develop a higher level of public understanding, but also will nourish the supply of hydrologic scientists that will be required to perpetuate the CUAHSI mission into the future.

5. Research Applications - CUAHSI will establish a program of technology transfer that will assure that the hydrologic knowledge that is generated in the other CUAHSI programs will be converted to tools useful in the solution of the identified problems. These tools will be conveyed to those responsible for the definition and implementation of solutions to the problems by means of understandable manuals, demonstration projects, and short courses.

During the meeting on June 22, Rick elaborated on the details of the upcoming national competition for two hydrologic observatories (HO) to be awarded in 2005. He noted the need be bold in identifying the scientific challenges that can be addressed in a HO proposal. Faculty from Colorado universities are considering submitting the South Platte Basin as an outstanding place to host a hydrologic observatory. Reasons for this conclusion include the existence of two NSF funded Long Term Ecologic Research sites in the South Platte Basin (Niwot Ridge and Pawnee Grasslands); the NSF funded CHILL radar located at Greeley (cutting edge technology that provides detailed data on precipitation events); and the existence of data sets collected as part of the USGS's National Water Quality Assessment Program.

There is also thought that a South Platte HO, while addressing the South Platte as its main focus, would also study the hydrologic properties of the interface between the east face of the Rocky Mountains and the Great Plains (from Montana to Texas and New Mexico). Such a strategy permits a number of scientific hypotheses to be addressed that are of great interest to water managers, such as the ET gradients across the great plains (which connects with Colorado's development of large weighing lysimeters in the Arkansas Valley – described elsewhere in this issue of *Colorado Water*); the interface between surface water hydrology and ground water recharge in key plains aquifers; and the interplay between urban/recreation development along the front range and local

climate, water quality, and ecosystem trends. The more expansive scale also brings into play large data sets collected by the USGS, ARS, NPS, USFS, and CSU faculty (e.g. forest fire and salinity impacts on water resources) while also taking advantage of more specific research facilities, such as the new large weighing lysimeters being installed at the Rocky Ford Experiment Station (described elsewhere in this issue of *Colorado Water*); the NSF funded Long-Term Ecological Research sites at Niwot Ridge and the Pawnee Grasslands; and the NSF funded CHILL radar operated at Greeley.

Rick also pointed out the need of researchers to define 'Core Data' and 'Investigator Data' as part of an HO. The goal of each HO is to make the core data readily available to the broad hydrologic research community while realizing the need to 'protect' investigator data that complements the core data as part of a highly specific research effort. There is also a need to spell out how the data collection for the broader hydrologic community (put in a form that they will want to use) must be managed relative to the data collection for individual research scientists associated with specific 'investigator' studies. Each HO proposal will be judged by how well it engages the wider hydrologic community with core data while also serving the more specific data needs of scientists performing studies as part of the HO.

UCAR is a nonprofit corporation formed in 1959 by research institutions with doctoral programs in the atmospheric and related sciences. UCAR was formed to enhance the computing and observational capabilities of the universities, and to focus on scientific problems that are beyond the scale of a single university. Representatives from UCAR's 68 Member and 20 Academic Affiliate institutions govern UCAR research and service activities through the Board of Trustees, Member committees and a number of advisory committees. UCAR carries out its mission through two organizations: The National Center for Atmospheric Research (NCAR) and the UCAR Office of Programs (UOP).

In addition, to conducting a robust research program, NCAR maintains resources such as state-of-the-art weather and climate models, radars, and aircraft that are used by scientists around the world. The UCAR Office of Programs supplies real-time weather data to colleges and universities for use in the classroom, trains weather forecasters in the latest research results and technologies, and helps organize international experiments in remote areas of the world, among other services. The principal sponsor is the National Science Foundation.

CUAHSI is sponsoring a workshop August 24-25, 2004, at Utah State University to engage hydrologists interested in submitting HO proposals in broader dialogue leading to new paradigms in hydrologic research. During the Utah State workshop, each team of scientists hoping to submit a HO proposal will prepare a 10-page HO prospectus. The prospectus will address the following key points/questions:

- Marketing document to attract other scientists to the site
- What are unique characteristics of site?
- Existing data and proposed data?
- Sample science issues
- Focus on what is proposed, not why

Thus, Colorado higher education faculty are actively engaged in conversations regarding the design of a hydrologic observatory for the South Platte Basin that will engage scientists from across the U.S. and around the world.

If you are interested in learning more about a South Platte Hydrologic Observatory and the role your organization might play in its development, please contact Jorge Ramirez Jorge.Ramirez@colostate.edu or Robert Ward at Robert.Ward@colostate.edu.



## Gloria Blumanhourst Joins CWRRI

**G**loria Blumanhourst joins the Water Center and Colorado Water Resources Research Institute as Program Assistant after the retirement of Shirley Miller. Gloria has been a Colorado State University employee for twelve years, spending seven of those years in Cooperative Extension -- first as assistant to the specialists in Soil and Crop Sciences, and then as assistant to the Associate Director for Programs.

Her interest in a variety of communication processes is evidenced by her educational background, work experience, and community service. She studied community journalism at community college before earning her B.A. (1983) and M.A. (1986) in communication from Colorado State University in rhetoric and public address. She edited and produced the Soil and Crop Sciences extension newsletter for five years. As a certified trainer/volunteer for Girl Scouts of the U.S.A., she conducts girl and adult workshops throughout Mountain

Prairie Council. She tutors literacy and facilitates book clubs at elementary and middle schools in Loveland and Fort Collins.

She lives in Fort Collins with her husband Phil Doak, and children Katherine and Jeffrey Doak. Gloria is a voracious reader/writer, and takes classes at CSU regularly. She enjoys handiwork and gardening—although these days gardening mostly means keeping the deer away from the landscape material until it is mature enough to survive unprotected!



*Gloria Blumanhourst*

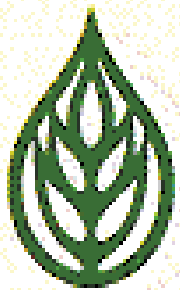
## United States Committee on Irrigation and Drainage *Water Rights and Related Water Supply Issues*

### A USCID Water Management Conference

**October 13-16, 2004**

**Salt Lake City, Utah**

For complete program and registration form go to: [www.uscid.org](http://www.uscid.org)



CWRRI



-NRC Report

## Confronting the Nation's Water Problems: The Role of Research

**O**n June 17, 2004, the Committee on Assessment of Water Resources Research, National Research Council (NRC), released a congressionally mandated report on the role of water research in addressing the nation's water problems. The Committee, chaired by Henry Vaux, retired Associate Vice President of the University of California, Berkeley, and former director of the University of California's Center for Water Resources, examined:

- The current and historical patterns and magnitudes of investment in water resources research at the federal level, and generally assess its adequacy; and,
- The need to better coordinate the nation's water resources research enterprise as well as identify institutional options to implement better coordination.

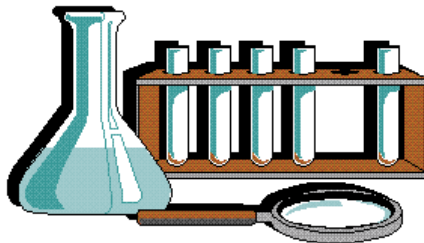
The committee noted that overall federal funding for water research has been stagnant in real terms for the past 30 years, and that the portion dedicated to research on water use and related social science topics has declined considerably. For example, while other fields such as the health sciences have seen large funding increases over the last three decades, per capita spending on water-resources research has dropped from \$3.33 to \$2.44, despite the growing number of water conflicts around the country.

Given the competition for water among farmers, environmental advocates, recreational users, and other interests -- as well as emerging challenges such as climate change and the threat of waterborne diseases -- the committee concluded that an additional \$70 million in federal funding should go annually to water research, with the aim of improving the decision-making of institutions that control water resources and better understanding the water-use challenges that lie ahead.

The committee also concluded that a new entity is needed to coordinate water research at the national level because no structure is in place now that adequately prioritizes research for funding purposes, evaluates progress, or shifts priorities as new challenges arise. Either an existing inter-

agency body, a neutral organization authorized by Congress, or a public-private group led by the Office of Management and Budget (OMB) could serve as the coordinating mechanism, the committee said. The coordinating group should regularly advise Congress and OMB, and provide guidance on the establishment of a new competitive grants program.

During the course of its work, the committee noted that Federal agencies and the states -- to which the federal government has deferred much water-resources research in recent decades -- have tended to focus on short-term water research likely to yield more immediate results. But it is long-term, basic research that will provide a solid foundation for applied science a decade from now, the committee said. It urged the federal government to commit one-third to one-half of its water research portfolio to long-term studies.



The government should improve monitoring of water conditions and levels over the long term, and archive this data, the committee added. In recent years, there have been substantial declines in the measurement of stream flow, groundwater levels,

water quality, and water use, the committee found; in some areas measurements have been completely eliminated.

The report was sponsored by the U.S. Geological Survey. The National Research Council is the principal operating arm of the National Academy of Sciences and the National Academy of Engineering. It is a private, nonprofit institution that provides science and technology advice under a congressional charter. Copies of report, entitled *Confronting the Nation's Water Problems: The Role of Research* will be available later this summer from the National Academies Press; tel. 202-334-3313 or 1-800-624-6242 or on the Internet at <http://www.nap.edu>.

The National Research Council has released "Confronting the Nation's Water Problems: The Role of Research," a congressionally mandated report which analyzes federal water research investments and coordination. The report is available online at <http://www.nap.edu/books/0309092582.html>.

*Water is the most common substance found on earth.  
Water is the only substance found naturally in true element forms: solid, liquid, and gas.*





## Homeowners' Willingness-to-Pay Estimates for Maintaining Water Levels in Residential Lakes: The Lake Sherwood Area in Fort Collins

John Loomis, Adam Smith and Paul Huszar  
Department of Agricultural and Resource Economics  
Colorado State University

The recent series of droughts have highlighted the fact that city, county and state agencies frequently are in need of information on the economic consequences of using water in competing ways. During a drought, retaining water for amenity uses such as urban lakes, rivers, and landscaping directly competes with more traditional commodity uses of water. Research undertaken at Colorado State University provides information on the economic value of water to citizens of Colorado from maintaining water levels in a residential lake. This information can help homeowners' associations decide whether it is worthwhile to rent or purchase water to maintain lake levels, as well as quantifying for water managers the monetary value of this beneficial use.

But how can one estimate the value that nearby homeowners place on maintaining lake levels in former irrigation reservoirs? One approach is to look at the house price differentials for living on the lake versus off the lake. This approach has been applied extensively, and was applied to our case study lake, Lake Sherwood in Fort Collins, Colorado by Bridget Abraham in her thesis. This thesis established that the presence of Lake Sherwood has a large positive and statistically significant effect on house prices.

However, just looking at property value differentials with and without the lake does not answer the question of what maintaining a higher lake level is worth. Specifically, higher

lake levels reduce unsightly mudflats that often emerge with low water levels at some reservoirs. To investigate what value higher lake levels have to homeowners, and whether they would pay the higher cost of renting water to fill the lake, a simulated market or simulated voter referendum approach is required. This approach is known as the contingent valuation method (Loomis and Walsh, 1997).

### Results of the Homeowner Willingness to Pay Survey

A contingent valuation survey was designed and pretested with residents on and off Lake Sherwood in Fort Collins, Colorado. The survey posed the key question as whether a household would vote to increase their homeowners association (HOA) fees to rent water to have the lake at a higher level during the summer months of July and August. If they voted for the increase in HOA fees, they were told in the survey the lake would have a surface area of 35 acres during the summer. If they did not vote in favor the lake would be at 28 acres during the summer. This difference in lake elevation was illustrated with a color map insert showing the two different lake levels. The dollar amount a household was asked to pay varied across households, and households living on the lake were told they would pay twice this amount. There were 15 different dollar amounts randomly, but evenly distributed across all 433 households living in the area. The bid amount ranged from \$5 to \$150 for off lake residents and \$10 to \$300 for on lake residents.

*Table 1. Reasons Why Respondent Would Not Be Willing To Pay the Bid Amount Assigned to Their Household*

Reason	On Lake Resident	Off Lake Resident	Percent of Total
Gets No Benefit From the Lake	0	51	15.7
Can't Afford a Higher Fee	0	44	13.5
Only Residents That Live in the Lake Should Pay	0	52	16.0
Other	1	18	5.5
<b>Total Responses</b>	<b>1</b>	<b>58</b>	<b>17.8</b>

**Table 2. Amount of Water that can be Rented Based on Median Percent Yes Votes and Water Cost at \$400/ Acre Foot**

	<b>Percent of yes votes</b>	<b>Median Fee</b>	<b>Total Dollars</b>	<b>Acre-Feet of Water Rented</b>	<b>Lake Surface Acres</b>
<b>On Lake Residents</b>	50%	\$335	\$16,750	41.875	
<b>Off Lake Residents</b>	50%	\$70	\$29,610	74.025	
<b>Total</b>			\$46,360	115.9	33

During the summer of 2003, a total of 433 surveys were handed out with 325 returned, reaching a 75% response rate. The results indicate that 79% of the residents visit Lake Sherwood on a regular basis. With regard to willingness to pay, 56% of the total residents would vote yes for the homeowner association (HOA) fee increase specified in the survey. Nearly three-fourths were willing to pay at least some increased fee devoted to acquiring more water to maintain the lake level. A logit statistical model was estimated to calculate the amount that 50% of the on-lake and off-lake residents would vote in favor of paying. This 50% amount represents the median willingness to pay.

Of course not everyone would pay or is uniform in their support. As shown in Table 1, homeowners not living directly on the lake were more likely to oppose raising homeowners' association fees to maintain high water levels in the lake, than homeowners whose houses backed to the lake. Note, a given household could choose more than one reason for refusing to pay, to the totals do not add up to the overall total or overall percentage. That is, overall, just 17.8% of respondents would not pay for additional water in Lake Sherwood.

Table 2 presents the results of estimating separate logistic regression equations for Yes or No votes to increase HOA fees to rent water. Fifty percent of "On Lake Residents" would pay a fee increase of \$335, while 50% of the "Off Lake Residents" would pay \$70. The differential reflects the difference in perceived benefits each group receives from the higher lake level. There are 50 homeowners living around the lake, and 423 that live off the lake but within one of the six homeowners associations with rights to use the lake. Using the number of on and off lake homeowners and the median willingness to pay of each group yields an estimated annual willingness to pay higher HOA fees for the higher lake level of \$46,360. During drought periods renting water has cost \$400 an acre foot in northern Colorado. Using this cost, nearly 116 acre feet of water can be rented for increasing the lake level. Using the official state hydrograph for Lake Sherwood indicates that 116 acre feet of water would translate into maintaining Lake Sherwood at 33 surface acres—close to the Lake Level shown in the survey.

Of course, with water costs closer to historic levels, the \$46,360 would buy slightly more than 400 acre feet, more than enough to keep Sherwood Lake full throughout the entire summer period.

### Conclusion

This research indicates the usefulness of the contingent valuation method voter referendum format to estimate the economic values of water to homeowners for maintaining aesthetics and wildlife habitat at residential lakes. This information can be used by homeowners associations to determine how much members would be willing to pay to maintain a specific lake level. The method also allows quantification of the monetary value of this beneficial use.

These values can be compared to rental prices of water and competing uses of water to determine if maintaining water for residential lakes has a comparable economic value to traditional uses. Given that one's home is fixed in location relative to a lake, and that many homeowners may have paid significantly higher prices for their house due to its proximity to the lake, renting water may be an economically viable option to them. There are few cost-effective substitutes for the amenities around one's home.

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## Lysimeter Weighs In on Evapotranspiration Rates in Arkansas Valley

By Dale Straw  
Colorado State Engineer's Office

Several recent "Colorado Water" articles have addressed two subjects that have become increasingly interrelated during the last few years. The first subject is the ongoing effort to refine or improve evapotranspiration (ET) estimates in Colorado. The second subject is the progress toward resolution of the Kansas v Colorado case concerning Colorado's compliance with the Arkansas River Compact in the U. S. Supreme Court. Dennis Montgomery (December 2003) discussed how the Special Master in Kansas v Colorado has accepted the Penman-Monteith equation to replace the modified Blaney-Criddle method to determine potential evapotranspiration (PET) for crops. The PET is then used in the Hydrologic-Institutional (H-I) model to verify compact compliance.

Colorado experts testified (see sidebar) that the Penman-Monteith method needs to be adjusted in order to provide an accurate assessment of consumptive use. The Special Master noted that these adjustments were not "sufficiently supported by the evidence and should not be made" at this time, but allowed that with additional information "adjustments made in accordance with recognized professional procedures may be appropriate."

Three projects to improve the information used with the Penman-Monteith method to estimate crop ET more accurately have begun. These projects are

- to design and construct two large weighing lysimeters in the Arkansas River Valley
- to upgrade and expand the network of Colorado Agriculture Meteorological (CoAgMet) weather stations located in the Arkansas River Valley
- and to conduct studies to determine the impacts of salinity and irrigation management practices on crop ET.

Funding for these projects is being provided by the Colorado Water Conservation Board (CWCB).

### Lysimeter design and construction

In order to determine how accurately current versions of the Penman-Monteith equation predict reference crop ET in the Arkansas River Valley and to determine accurate crop coefficients for the various crops grown in the Arkansas River Valley, members of the Colorado State Engineer's staff and of the Colorado State University (CSU) faculty and staff initiated a project to design and construct two large weighing lysimeters (measurement devices used to study the use



*Tour participants discuss lysimeter design at the entrance to a Bushland, TX unit.*



*Interior of lysimeter facility at Bushland, TX.*

of water by crops and leaching in a soil profile) at the CSU Agricultural Experiment Station at Rocky Ford, Colorado.

To insure that sound science is employed in all phases of the design, construction, installation, operation and maintenance of the new lysimeter facility at Rocky Ford, leading scientists and technicians in the area of lysimeters and ET estimates are engaged in the process. The lysimeters will accurately measure ET of reference crops and of production crops under a variety of field conditions typical of the lower Arkansas River Valley in Colorado. This research team is headed by Tim Gates and Luis Garcia. Funding for the design phase of the lysimeter construction project comes from the Colorado State Engineer's Office, under the guidance of Tom Ley and Dale Straw. Thomas Marek, Texas A&M University, will design the lysimeter facility.

### CoAgMet enhancement

Accurate weather data from representative locations in the Arkansas River Valley is also required in order to properly use the Penman-Monteith method. Currently, there are too few weather stations for this purpose and their locations are not representative of the agricultural areas from Pueblo to the Stateline.

The Colorado Climate Center at CSU started a project headed by Roger Pieke and Nolan Doesken to develop the dependable collection of electronic weather station data using existing and new CoAgMet weather stations in the Arkansas River Valley. To ensure that the most accurate crop consumptive use estimates are obtained, several issues regarding the location, siting, operation, and maintenance of the CoAgMet weather stations in the Arkansas River Valley are being addressed as part of the project. These issues include the determining of the minimum number and proper location of weather stations to provide usable data for the Penman-Monteith method, establishing and maintaining prescribed vegetation conditions at each of the weather station locations, and improving periodic equipment maintenance and calibration operations performed on weather station equipment.

### Irrigation management study

Colorado's experts testified that the results produced using the Penman-Monteith method need to be adjusted for actual agricultural conditions in order to obtain accurate PET data using the Penman-Monteith method. The Penman-Monteith method uses data collected in the controlled and pristine conditions of an agricultural experiment station. Colorado's experts proposed the use of an irrigation management factor and a salinity adjustment to modify the results obtained using the Penman-Monteith method with accurately determined crop coefficients. The Special Master found that the adjustments recommended by the Colorado experts were not sufficiently supported but did not rule out future adjustments as more information is developed on conditions in the Arkansas River Valley.

In order to determine any impacts on crop consumptive use caused by salinity conditions and farmers' irrigation management practices, Luis Garcia and Tim Gates will augment their on-going research. In addition to determining salinity impacts, their new project is designed:

- to determine a baseline for irrigation application practices and efficiency for the irrigated alluvial lands of the Arkansas River Valley,
- to document various water and agronomic factors that may be contributing to less than potential crop growth and production conditions,
- and to estimate the impacts of these factors on crop water use and crop yield.

For this study, fields irrigated using different irrigation methods have been selected. Irrigation timing, amount of water

applied, amount of surface runoff, amount of water stored for crop consumptive use, and the amount of water percolating downward to recharge the shallow water table will be measured or determined. Soil moisture is being monitored to determine any water stress in conjunction with the on-going studies to evaluate soil salinity and associated osmotic stress. Agronomic production practices are being documented on selected fields. Crop samples are being collected and biomass recorded to determine impacts of water and/or salt stress on crop water use and crop growth. At the end of the growing season, crop samples will be taken to determine total plant growth and marketable yield. A number of fields in an area around Rocky Ford and an area downstream of Lamar will be studied as a part of this project over the next three to five years.

In addition, information on planting and harvest date(s), crop variety, plant density, and fertilizer practices (timing, amounts and types) will be estimated based upon interviews with the farmers. At the end of the season, each farmer will be contacted and asked if insect and disease problems could have affected yield. In addition, a survey of the county crop statistics will document crop yields in each of the counties where fields are located, and potential crop yields for the various crops will be obtained from the CSU Arkansas Valley Research Center at Rocky Ford. All of these factors will then be evaluated to determine any impacts on crop water usage and crop yields.

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### Background on the Transition from Modified Blaney-Criddle to ASCE Penman-Monteith

Based on evidence presented to the Special Master concerning work in the scientific and engineering communities to develop more physically based equations to determine PET, he accepted the Kansas position that Penman-Monteith is the most accurate method to determine reference crop ET, replacing the Blaney-Criddle method then commonly used. In the Fourth Report (October, 2003) of the Special Master, he presented his findings or recommendations to the U.S. Supreme Court. In anticipation of the Supreme Court affirming the findings in the Fourth Report, the State of Colorado has determined the tasks necessary to implement the Special Master's findings and started work to execute these tasks. The purpose of this article is to briefly describe the work that has already been initiated to implement the Special Master's recommendation concerning the use of the Penman-Monteith method. His recommendation is "That in the H-I (Hydrologic-Institutional) model, potential evapotranspiration (PET) shall be determined through the use of the Penman-Monteith methodology; that adjustments recommended by Colorado experts are not sufficiently supported by the evidence and should not be made; that as more information may be developed on conditions in the Arkansas River Valley, adjust-



ments made in accordance with recognized professional procedures may be appropriate.”

The importance of this recommended transition to the Penman-Monteith method, with the crop coefficients and limited weather data used by the Kansas experts, is that the method calculates higher crop consumptive use for many crops and its proper use requires more data and information than the Blaney-Criddle method. Much of the required weather data and other information is not available for many locations in the Arkansas River Valley and has been inferred from data available at other locations and from studies performed in Idaho and Texas on agricultural experiment station projects. This lack of sufficient data that is specific to the Arkansas River Valley can have a significant impact on the amount of replacement water that will be required from well users in order to comply with the Arkansas River Compact. Colorado's experts testified that without certain adjustments to the Penman-Monteith method to account for salinity conditions and irrigation management practices, calculated crop water use would be overestimated. As stated in the Special Master's finding that is quoted above, he has left room for making adjustments to the results of the Penman-

Monteith method based on the conduct of further studies and the acquisition of additional data and information with which to further test the hypothesis of the Colorado experts that the use of the Penman-Monteith method with currently available parameters and data tends to overestimate the consumption of water by crops and therefore also overestimates the depletions which Colorado well users must replace in order to comply with the Arkansas River Compact.

The impact of the use of the Penman-Monteith method is not limited to the well owners in the Arkansas River Valley or the calculation of crop water use in the H-I model. Now that the Special Master has accepted the Penman-Monteith method as more accurate to calculate crop consumptive use, others will want to use the Penman-Monteith method to determine transferable historic consumptive use in discussions of water rights and compact compliance within the state and in interstate agreements. Therefore, water users throughout the state have an interest in determining whether the Penman-Monteith method, using accurate and site-specific crop coefficients, is suitable to determine crop consumptive use in Colorado.

## Civil Engineering Faculty Honored with World Water and Environmental Congress Awards



*Pierre Julien*

Colorado State University Civil Engineering faculty members were recently honored with prestigious awards at the World Water & Environmental Congress 2004 in Salt Lake City.

Professor **Pierre Julien** received the Hans Albert Einstein Award. This national award is given annually to an individual who has made significant contributions to the engineering profession in the areas of erosion control, sedimentation and/or waterway development in teaching, research, planning, design, or management. Julien is the fourth Colorado State civil engineering faculty member to receive this annual award since it was first presented in 1990.

**David A. Woolhiser**, civil engineering faculty affiliate, received the 2004 Ven Te Chow Hydrologic Engineering Award and presented the award lecture during the conference. The Ven Te Chow award recognizes lifetime achievement in the field of hydrologic engineering distinguished by exceptional achievement

and significant contributions in research, education or practice. Since it was first awarded in 1996, one other Colorado State faculty member and one civil engineering alumnus have received the award.

The Best Paper Award was presented to Professor **Jorge Ramirez**, civil engineering alumni Fritz Fiedler, civil engineering alumni Gary Frasier and civil engineering advisory board member Laj Ahuja. The team received the American Society of Civil Engineers Journal of Hydrologic Engineering Best Paper Award in recognition of their paper, "Hydrologic Response of Grasslands: Effects of Grazing, Interactive Infiltration, and Scale," published in July/August 2002.



*Jorge Ramirez*

Water  
Resources  
Archive



## “Father of Colorado River Treaties” Documents Now in the Water Resources Archive

By Patricia J. Rettig

Head Archivist for Water and Agriculture Archives  
Colorado State University Libraries

**W**hat were they thinking?

Some version of this question usually arises in discussions about the West’s interstate river compacts, especially the one governing the Colorado River. The data used for decision making, the politics behind the outcome and the motives of the negotiators are inevitably questioned. This type of “behind-the-scenes” information about Colorado’s river compacts is now being preserved at Colorado State University’s Water Resources Archive in the papers that document the work of Delph E. Carpenter.

A water lawyer born in Greeley in 1877, Carpenter is known as the “Father of Colorado River Treaties,” having originated the idea of states appropriating the waters of shared rivers through compacts instead of ongoing legal battles. Referred to as “Colorado’s most valuable citizen of all time” by *Denver Post* columnist Roscoe Fleming, Carpenter is best known for negotiating the Colorado River Compact of 1922, an agreement which divides the waters of the Colorado River among seven western states.

Up until his death in 1951, Carpenter saved a multitude of materials related to his work on the compacts, including correspondence, telegrams, drafts, reports and newspaper articles. He also kept diaries in which he recorded personal thoughts about the negotiations. These materials and more now comprise the Papers of Delph E. Carpenter and Family, the newest donation to the Water Resources Archive in Morgan Library.

The ninety boxes of papers, photographs and objects (including his briefcase and billfold) and two containers of rolled maps were donated in May by Carpenter’s grandsons, Ward Carpenter of Ridgefield, Connecticut, and William Carpenter of Thornton, Colorado. The donors were recognized with certificates of appreciation at the CSU Libraries’ annual fundraiser in June. Doris Carpenter, widow of Delph’s son Judge Donald Carpenter, accepted on behalf of William who could not attend. Dean of Libraries Catherine Murray-Rust remarked, “We present these certificates to them to acknowledge this important gift and to thank them for their role in helping to document Colorado’s water history.”

The family deserves an immense amount of credit for saving these important documents over so many years, especially

after a flood in the family home in Greeley. Irony of ironies, an irrigation ditch near the house overflowed in September 1992, and the basement where the papers were stored was soaked with three inches of water. Doris Carpenter rounded up a team to remove the water and dry the papers, which took several weeks. Family connections led to storage of the papers at the Northern Colorado Water Conservancy District in January 1993 for safekeeping.

CSU professor emeritus and historian Dan Tyler was permitted to use the materials to write his recently published biography, *The Silver Fox of the Rockies: Delphus E. Carpenter and Western Water Compacts*. Tyler composed a readable, well-informed book from the documentation, despite its state of disarray. Though students of CSU history professor Jim Hansen created a listing of the materials, Tyler states in his acknowledgements section, “Much work remains to be done to make the Carpenter Papers fully accessible to future scholars.” Our challenge is to organize a varied and large quantity of important materials so researchers have easy access.

The primary interest in the collection is the illumination of thoughts, feelings and actions of Delph Carpenter as he engaged in compact negotiations. However, additional aspects of Carpenter’s career documented include his involvement in the *Wyoming v. Colorado* case, his service as a state senator, his cattle breeding endeavors and many other activities, including his defense of an accused murderer.

Carpenter’s ancestors and offspring are chronicled as well. His ancestors were early settlers in the Union Colony in Greeley, and important original artifacts related to the colony exist in the collection. His son, Donald Carpenter, served as a Weld County judge for a number of years, and a selection of his papers is in the collection as well. The collection spans back into the 1860s and as far forward as the 1990s, providing information about a family and region for over a century.

The collection, in documenting significant water issues of the past, will continue to be important in the future. In a state where the availability of water is a perpetually crucial issue, Carpenter’s actions in the early twentieth century to save Colorado’s water for development within the state continue to effect the West even today. “The multi-year drought that currently grips the West focuses considerable attention

upon interstate agreements which divide limited water resources among western states," said Robert Ward, Director of the Colorado Water Resources Research Institute.

"The Carpenter Papers will be available for use by current and future water managers to learn how men of great insight led the West out of previous difficulties in managing limited water resources. Colorado and the West will need people with similar vision and leadership skills if we are to successfully confront the water management issues of the 21st century," Ward said.

The 1992 flood triggered a series of events that brought these materials to the Water Resources Archive, but also keeps us from providing immediate access to them. As a result of being wet for a period of time, mold began to grow on some of the papers and spread through nearly two-thirds of the boxes. Though dormant now, the mold could grow again given the proper conditions. The Archive is committed to fully preserving these papers, which means removing the mold so it will not have a chance to re-grow. As mold spores are easily spread throughout a building by ventilation systems and since some types of

#### Other Water Archive News:

Three new finding aids are available now available on-line:

- Records of the Colorado Water Resources Research Institute
- Records of the Iliff and Platte Valley Ditch Company
- Groundwater Data Collection

Go to <http://lib.colostate.edu/water/collections/index.html> to access these guides.

mold are allergens or even toxins, special precautions have to be taken for the cleaning. This cleaning is necessarily a slow process, but we will implement it as quickly as possible.

The collection will be open to all researchers after review, cleaning and reorganization. Digitized portions will also be available on the Internet in due time. Contact the Patty Rettig (970-491-1939, [prettig@manta.colostate.edu](mailto:prettig@manta.colostate.edu)) for more information.

#### Nonpoint Source Forum 2004 Watershed Planning: Blueprint for Action!

September 8, 2004  
Hotel Colorado, Glenwood Springs, CO

For registration materials go to  
[www.npscolorado.com](http://www.npscolorado.com)

#### Colorado Watershed Assembly Planning for the Future

September 9 and 10th, 2004  
Hotel Colorado, Glenwood Springs, CO

For registration materials go to  
[www.coloradowater.org](http://www.coloradowater.org)  
or call 970-259-3583 or 970-513-8340, extension 221.

#### Meeting Schedule -- Open to the Public Rocky Mountain AWWA Water Conservation Committee Colorado Water Wise Council

Date	Time	Location	Speaker(s)	Topic
Thurs., Sept. 9	11:30 a.m.- 2:00 p.m.	Aurora Municipal Bldg., 15151 E. Alameda Pkwy., Aspen Conference Room (2nd floor)	Natalie Brower-Kirton, City of Aurora	City of Aurora's Xeriscape Demonstration Garden
Thurs., Nov. 4	11:30 a.m.- 2:00 p.m.	Denver Water Board Room (3rd Floor)	Larry Keesen, Keesen Irrigation	New Irrigation Technology: Benefits and Chal- lenges (surface irrigation, ET-Controllers, soil moisture sensors)

For information contact: Laurie D'Audney at [ldaudney@fcgov.com](mailto:ldaudney@fcgov.com)

## Water Served at the Table of Contents

The CSU Morgan Library hosted over 100 people for its third 'Table of Contents' fundraiser on June 5, 2004. The CSU Water Archives, housed in Morgan Library, benefits from the funds raised for the library.

The evening consisted of 15 tables where a particular topic was discussed – thus the 'Tables of Content' theme. For example, Tom Sutherland hosted a table where the U.S. role in global affairs was discussed, and Holmes Rolston, III, led a discussion on environmental ethics at another table.

Two tables were devoted to water discussions. Dan Tyler led a discussion entitled: Delph Carpenter, Western water rights and the 'culture of location'.



*Doris Carpenter, Ward Carpenter, and Robert Ward attended Table of Contents in the Morgan Library on June 5.*

Ward Carpenter, grandson of Delph, and Doris Carpenter, wife of Judge Don Carpenter (Delph's son), joined the discussion at Dan Tyler's table.

At his table, Robert Ward led a discussion of the evolving concept of 'limits' to water use. He recounted the trials and tribulations of early efforts to discuss 'limits' to water availability and use in the West such as those by John Wesley Powell. He then described situations developing in the Republican River, stemming from the Compact settlement, where reductions in water use must be implemented, and in the San Luis Valley, where the drought is causing people to reflect upon the extent ground water resources are available for continued use at current rates. As would be expected, there is a range of opinions regarding the availability of water for future use in the West. Thus, the conversation was, at times, quite lively and animated, but always informative and educational.

The Morgan Library is planning an event this fall that will celebrate the donation of the Carpenter Papers to the CSU Water Archives by the Carpenter family. The event will be held on November 11, 2004. Watch the Morgan Library (<http://manta.library.colostate.edu/>) or CWRRRI (<http://cwrrri.colostate.edu/>) websites for announcements of details for the event and make plans to join us in celebrating the life of Delph Carpenter and the Carpenter family in the settlement of Colorado.



*Tables await their "contents" at the gala.*

*See cover photo.*



## MEETING BRIEFS

## Groundwater in the West: Natural Resources Law Center Conference Highlights

by Kathryn Mutz  
Natural Resources Law Center  
University of Colorado, Boulder

**O**n June 16 – 18, 2004, the Natural Resources Law Center at the University of Colorado in Boulder sponsored its 25th summer conference. While essentially all outdoor receptions, breaks and meals of “Groundwater in the West” were moved indoors to avoid the copious mid-June surface water (Rain! Rain! Rain!), conference sponsors and participants enjoyed the nearly constant precipitation! (Collectively the Center and conference participants claim credit -- without firm scientific data, legal analysis or proper citation -- for significant improvement in the 2004 water year, however, we are not claiming an end to the drought!) Over 200 registrants, speakers and staff from 17 states enjoyed three days of scientific, legal and policy discussions on western groundwater resources, an evening program by Robert Glennon with highlights from his book “Water Follies,” and a lunch-time discussion with Justice Gregory Hobbs.

The program started Wednesday morning with three speakers introducing the audience to groundwater supply and depletion, groundwater quality, and surface water – groundwater interactions. After defining some of the basic terms and concepts that listeners would grapple with over the next few days, Alan Burns of the USGS used examples from several aquifers throughout the West to illustrate aquifer depletion, public knowledge of groundwater use, and surface impacts of depletion. Mike Wireman of Region 8 EPA followed with a survey of natural groundwater quality, groundwater contamination, and groundwater management issues. He concluded by outlining the key issues in groundwater management – including lack of appreciation of the groundwater-surface water interactions and insuf-

ficient data and monitoring. Tom Maddock of Arizona State University brought the audience back to science basics with a focus on the concept of capture and how it relates to groundwater-surface water interactions.

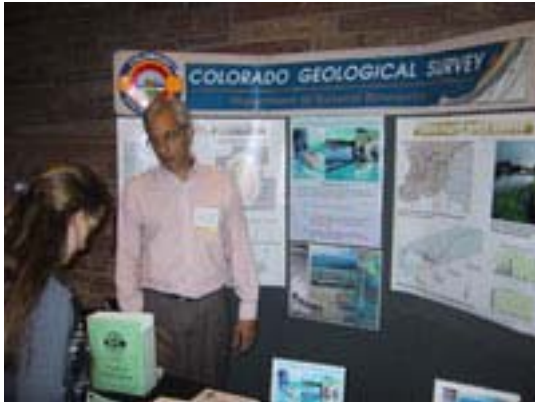
Wednesday’s afternoon session, presided over by Justice Gregory Hobbs, left the concrete – but relatively unknown – world of science to introduce the basics of groundwater law. Gary Bryner of the NRLC and BYU provided an overview of groundwater laws in the western states based on a publication he authored at the NRLC. Bryner highlighted the four different legal doctrines that govern groundwater (the common law rule of capture, the “reasonable use” American rule, correlative rights, and prior appropriation) as well as some of the promising management practices and legal challenges of the western states. John Leshy of Hastings College of Law and



*Gary Bryner and John Leshy discuss the improvement in the 2004 water year.*

Rodney Lewis, who represents (but was not speaking for) the Gila River Indian Community, discussed federal and Indian rights in groundwater. Leshy and Lewis agreed that the Winters Doctrine extends to groundwater and Lewis focused his remarks on settlement negotiations for water rights of the Gila River Community. Leshy focused on non-Indian federal rights in groundwater and the federal role (carrots, sticks and persuasion) in groundwater policy. Arthur Littleworth of Best, Best and Krieger and the Special Master for *Kansas v Colorado* brought the practicality of the courtroom to his discussion of the role of modeling in litigation – particularly over the controversial Arkansas River.

Thursday brought speakers from across the West to highlight specific controversies in groundwater and to address various legal and policy approaches to local and regional issues. Harris Sherman of Arnold and Porter discussed use



*Colorado Geological display provides information for visitors.*

of Hopi groundwater on Black Mesa to slurry coal; Tom Darin of the Jackson Hole Conservation Alliance described use and abuse of produced water from coalbed methane development. Rachael Paschal Osborn and Tom Ring used the Yakima and Spokane aquifers to illustrate critical issues of groundwater in interstate compacts. Steve Mumme of Colorado State University expanded the discussion across international borders discussing binational cooperation in transboundary aquifer management on the U.S. - Mexico border. The final session of the day included presentations by Ron Kaiser of Texas A&M and Ray Supalla of the University of Nebraska, on the High Plains aquifers (Ogallala and Edwards), and three on the Lower Colorado River region. In the final panel, Michael Fife of Hatch and Parent, John Entsminger of the Southern Nevada Water Authority and Tim Henley of the Arizona Water Banking Authority provided examples from the three lower basin states to probe issues of safe yield, overdraft, recharge, and sustainable and environmentally responsible water development.

The third day of the conference focused on Colorado groundwater with important lessons for the broader West. Matt Sares of the Colorado Geological Survey started the day with a stunning, whirlwind visual tour of Colorado's aquifers based on the Survey's "Groundwater Atlas of Colorado." David Harrison of Moses, Wittemyer, Harrison and Woodruff followed with a comprehensive introduction to the mosaic of Colorado groundwater law in which he explained (and justified!) the groundwater classification system, designated basins, and management districts. Harrison also provided a survey of the basins and their applicable rules and controversies. Steve Sims of the Colorado Attorney General's Office followed with details of the surface-groundwater conflicts on the South Platte; David Robbins

of Hill and Robbins provided lessons from Colorado v Kansas; and Patti Wells from the Denver Water Board provided a comprehensive look at the South Metro Water Supply study.

The Colorado day concluded with thoughtful remarks by Jim Lochhead on the future of groundwater in the West. In his keynote presentation, Lochhead drew upon his extensive work in Colorado as well as his work on the Pecos, the Snake and the lower Colorado River. His presentation probed the shifting balance between surface and groundwater, describing it in three phases – with the final phase (integration of ground and surface water use and administration) both in-progress and uncertain. With a very hard act to follow, Russ George of the Colorado Department of Natural Resources and Tom Cech from the Central Colorado Water Conservancy District admirably brought the program to a close with perspectives from the state, including a call to work together in efforts like the South Metro Study, and a delightful, melodramatic look at the long history of groundwater conflicts on Colorado's eastern plains.



*Participants mingle during social hour.*

Conference materials, including PowerPoint presentations, background papers, and the Center's "Groundwater Law Sourcebook of the Western United States" are available in CD form for \$10 from the Natural Resources Law Center and for free on the Center's website publications page at

<http://www.colorado.edu/law/centers/nrlc/pubs/htm> .



*Afternoon breaks were a hit with participants.*



## Upper Colorado River Basin Tour Mixes Fun and Fact for 85 Participants

**M**ore than 85 water professionals, educators and decision-makers attended the Colorado Foundation for Water Education's first Upper Colorado River Basin Tour, June 23–25. The tour, one of CFWE's main events, offered attendees a firsthand look at the Upper Colorado River Basin and related water issues.

"The tour was informative, educational and a whole lot of fun," said Lori Oz-zello, CFWE Board Member and tour participant. "I thought that [CFWE] did a great job in setting up speakers who showed the multiple facets of the various Colorado River issues. The tour was balanced and not a one-sided view."

Tour sites and topics included transmountain diversion projects, a private tour of the Farr Pump Plant (Colorado-Big Thompson Project), water quality, recreational in-channel diversions, snowmaking, agricultural water use, noxious weeds and more. In addition to the informational sessions, the tour also provided time for networking and socializing. The raft trip of the Colorado River through Glenwood Canyon was a tour highlight.

CFWE may offer educational tours of other river basins in the state.

For tour highlights, comments from attendees, and photos, visit CFWE's Web site, [www.cfwe.org](http://www.cfwe.org).

The Colorado Foundation for Water Education was created in 2002 to promote better understanding of water resources through education and information. The Foundation does not take an advocacy position on any water issue.



(Photo credit: Joe Mollica)

*Carl Zimmerman explains his watershed model to tour participants.*



*The tour, seen here at Clinton Reservoir, included participants from a wide range of professions and interests.*



*A panel of local farmers discuss current water issues.*

*Transmountain diversion is a form of trans-basin diversion. The Colorado Decision Support System defines trans-basin diversion as "The removal of water of a natural stream from its natural basin into the natural basin of another stream. Source: <http://cdss.state.co.us/glossary.asp>*

## Robert A. Young 2004 Warren A. Hall Medal Honoree

by Susanne M. Scheierling  
Department of Agricultural and Resource Economics  
Colorado State University

**R**obert A. Young, Professor Emeritus of the Department of Agricultural and Resource Economics at Colorado State University, has been awarded the 2004 Warren A. Hall Medal at the annual conference of the Universities Council on Water Resources (UCOWR) in Portland, OR on July 21, 2004.

Robert A. Young is recognized and respected as a leader in the advancement of water resource economics and policy worldwide. During the last 40 years he has made outstanding contributions to the field of water resources through sustained research efforts. Dr. Young has covered a broad range of topics in water resource economics, often in partnership with colleagues from different disciplines and especially his students. His work has particularly focused on developing enhanced methods for assessing water policy proposals, such as water supply investment proposals, reallocation to higher valued uses, ground water management, pricing reform, and water quality management. Equally important has been complementary work on the methods for non-market valuation of water-related goods and services. He has worked on valuation methods for both the private good (crop irrigation, industries, and households) and public good (instream flows, water quality) aspects of water use. Throughout his career, he anticipated and addressed the emerging research and policy issues of the day concerning water resources. For his achievements he has received several awards, including from the American Agricultural Economics Association, the Western Agricultural Economics Association, and the American Water Resources Association.

Dr. Young has also substantially contributed to the public good by participating in major policy debates on controversial water issues in the western U.S., and by reaching out to nonspecialists and the public. In addition, he has been a respected teacher and mentor to his many students and professionals worldwide, and provided dedicated service to the profession. Furthermore, Dr. Young was active in studying options for improving water management policy in developing countries. He served as a consultant/adviser in a number

of developing countries with, among others, the World Bank, USAID, the UN Food and Agriculture Organization, the International Water Management Institute, and the Asian Development Bank.

Dr. Young has a long, continuous, and impressive record of research, teaching and service contributions. He received

degrees in agriculture (1954) and agricultural economics (1958) from the University of California, Davis, and a doctorate in agricultural economics from Michigan State University (1963). From 1963-68 he was on the faculty at the University of Arizona, and then joined the nonprofit research organization Resources for the Future in Washington, DC. Dr. Young was an agricultural economics faculty member at Colorado State University from 1970 until his retirement in 1992.



*Gary Johnson congratulates Bob Young at COWR.*

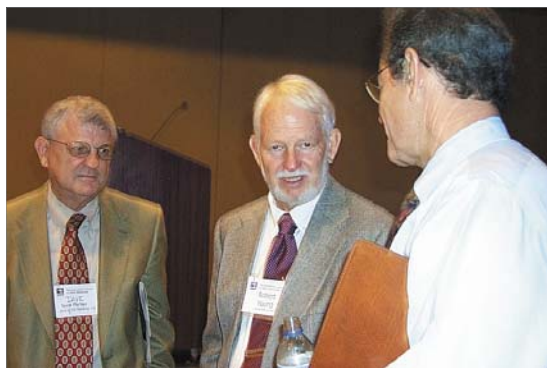
Since then Dr. Young has continued an active contract and grant research program at Colorado State University, along with domestic and international consulting on water resource economics and policy. Currently he is working on a World Bank assignment on improving water resources management in Mexico, and finalizing a book on the concepts and methods for determining the economic value of water, to be published by Resources for the Future.

Dr. Young's many long-term contributions to the field of water resource economics make him uniquely qualified to receive the prestigious Warren A. Hall Medal.

The Warren A. Hall Medal is a memorial established by friends and family of Warren A. Hall, and is presented by UCOWR to recognize unusual accomplishments and distinction of an individual in the field of water resources. The selection committee consisted of previous Medal honorees,



including Chuck Howe, Miguel A. Marino, Daniel P. Loucks, and Vernon Snoeyink. Dr. Hall had earned his doctorate from UCLA in 1952, and later was selected as Director of the Water Resources Center for all campuses of the University of California. The center approached water resource management by merging the social and physical sciences. In 1962 Dr. Hall created UCOWR, now recognized as the authoritative voice on matters of water resources research and education. In 1975 he joined the Engineering faculty at Colorado State University and became Director of the International School of Water Resources. Dr. Hall retired from CSU in 1986. In his capacity as co-chair of the UCOWR conference, Ari Michelsen, Professor and Director at the Texas A&M University Agricultural Research and Extension Center at El Paso, made the Medal presentation.



*David Murrow and Robert Young speak with a colleague at the July meeting.*



*Robert Young's family and friends join him at a celebratory dinner.*



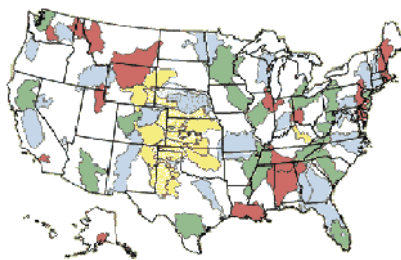
*Norm Middlesee, Robert Young, and Joel Hamilton reminisce during a more relaxed moment at COWR.*

## USGS Announces Online Access to Nationwide Invertebrate Community Data

Invertebrate community data from 1,700 stream sites in more than 50 major river basins across the Nation can be downloaded from the NAWQA Data Warehouse at <http://water.usgs.gov/nawqu/data>. Data are from more than 5,000 invertebrate community samples that were collected from 1993 through 2002 by the USGS National Water-Quality Assessment (NAWQA) Program.

Invertebrate community samples document the presence of invertebrate taxa and their relative abundances within designated stream reaches. Data are added after quality-assurance reviews are completed, so if your geographic areas of interest are not represented, revisit the Data Warehouse periodically.

The NAWQA Data Warehouse also provides online access to data on fish communities from more than 1,000 stream locations (see inset map), as well as data from thousands of water-quality samples from about 6,400 stream sites and 7,000 wells, and from streambed sediment and aquatic animal tissue. Water-quality samples are



analyzed for pesticides, trace elements, volatile organic compounds, and nutrients; sediment and tissue samples are analyzed for organic compounds, such as DDT, and trace elements, such as mercury.

For information on biological sampling protocols, refer to "Revised protocols for sampling algal, invertebrate, and fish communities as part of the National Water-Quality Assessment Program" at <http://water.usgs.gov/nawqa/protocols/OFR02-150/index.html>.

For questions regarding biological collection methods and taxonomy, contact Dr. Steve Moulton, [smoulto@usgs.gov](mailto:smoulto@usgs.gov), 703-648-6874. Additional information about NAWQA ecological studies is available at <http://water.usgs.gov/nawqa/ecology>.

For questions regarding online data retrievals from the NAWQA Data Warehouse, contact [gs.nawqa.data@usgs.gov](mailto:gs.nawqa.data@usgs.gov) or Mr. Sandy Williamson, 253-428-3600, ext. 2683.

## NIWR/USGS National Competitive Grant Program Awards for FY 2004

The eight proposals listed below have been selected for funding under the Fiscal Year 2004 National Institutes for Water Resources (NIWR) and U.S. Geological Survey (USGS) National Competitive Grants Program. Abstracts of the proposals are available at <http://water.usgs.gov/wrri/04grants/national/nationalindex.html>.

<b>Title</b>	<b>Proposal submitted by</b>	<b>Institute</b>	<b>Collaborator(s)</b>	<b>Federal \$ (years)</b>
Forward and Inverse Transient Analytic Element Models of Groundwater Flow	Shlomo Neuman, University of Arizona	Water Resources Research Center, The University of Arizona	Paul Hsieh, U. S. Geological Survey, Branch of Regional Research, Western Region	\$131,976 (3 years)
Pharmaceutically Active Compounds: Fate in Sludges and Biosolids Derived from Wastewater Treatment	David Quanrud, Wendell Ela, and Jon Chorover, University of Arizona	Water Resources Research Center, The University of Arizona	Ed Furlong, National Water Quality Laboratory, and Gail Cordy, Hydrologic Investigations and Research Program, Arizona District Office, U.S. Geological Survey	\$152,926 (3 years)
Institutional Re-arrangements: forging smart use water policy coalitions at the intersection of geo-technical engineering with urban open space	Helen Ingram, University of California, Irvine	Center for Water Resources, University of California, Riverside	---	\$70,767 (2 years)
Space-Based Monitoring of Wetland Surface Flow	Shimon Wdowinski, Falk Amelung, and Timothy Dixon, University of Miami	Florida Water Resources Research Center, University of Florida	Roy Sonenshien, Florida Integrated Science Center, U.S. Geological Survey	\$158,687 (2 years)
Estimating Shallow Recharge and Discharge in Northeastern Illinois Using GIS and Pattern Recognition Procedure	Yu-Feng Lin, University of Illinois at Urbana-Champaign and Illinois State Water Survey; and Albert Valocchi, University of Illinois at Urbana-Champaign	Illinois Water Resources Center, University of Illinois at Urbana-Champaign	Randall Hunt, Wisconsin District, U.S. Geological Survey	\$91,197 (2 years)
Carbonaceous Material Fractions in Sediments and Their Effect on the Sorption and Persistence of Organic Pollutants in Small Urban Watershed	Charles Werth, University of Illinois at Urbana-Champaign	Illinois Water Resources Center, University of Illinois at Urbana-Champaign	Peter Van Metre and Barbara Mahler, Texas District, U.S. Geological Survey	\$170,956 (3 years)
Development of Water Use Benchmarks for Thermoelectric Power Generation in the United States	Ben Dziegielewski and Tom Bik, Southern Illinois University	Illinois Water Resources Center, University of Illinois at Urbana-Champaign	---	\$94,245 (2 years)
Groundwater sustainability in a humid climate: Groundwater pumping, groundwater consumption, and land use change	Madeline Gotkowitz and David Hart, Wisconsin Geological and Natural History Survey	Water Resources Institute, The University of Wisconsin	Charles Dunning, Wisconsin District, U.S. Geological Survey	\$69,246 (2 years)

**NEWS DIGEST****Summer rain hasn't ended state drought**

Rain falls routinely on the Colorado plains in June and July, resulting in the coolest, wettest Colorado summer since 1997. After six years of drought, aquifers and reservoirs are still low. Rain doesn't refill reservoirs or recharge aquifers, but it does reduce demand for water. Colorado gets the vast majority of its water from snowpack. Next winter will determine whether the drought is back or broken. A weather system with the potential to become an El Nino is building in the Pacific. El Nino triggers monsoonal weather which delivers moisture to the West.

*Denver Post – July 28, 2004*

**A river reborn changes Denver**

During much of the 20th century, trash littered the South Platte River, its slow current unable to rejuvenate itself. Turning away from the Platte became a way of life. In 1972, the Environmental Protection Agency declared the South Platte an ecological disaster. From south Denver through Adams County, the Platte was gray and foamy, and sludge lined its bed in places. Spurred by former state Sen. Joe Shoemaker's committee created to clean up the Platte, public policy and development transformed the river and the area around it. Parks, gardens and trails now surround the Platte's banks.

*Denver Post July 19, 2004*

**Ruling damages potential for sales of water**

Water speculators cannot seek to reclassify water rights from agricultural to municipal unless they have a contract to sell those rights according to a ruling by state Water Judge Dennis Maes. Maes ruled that the reclassification would violate Colorado's anti-speculation doctrine.

*AP in the Denver Post July 08, 2004*

**Water project moves forward**

Two contractors were hired this week to help build a \$130 million project that would bring water from the South Platte River to the southeastern metro area by 2006. The Northern Water Project, also called H2'06, calls for a treatment plant to be built near Barr Lake in Adams County that will send water via a 28-mile pipeline to the East Cherry Creek Valley Water and Sanitation District.

*Rocky Mountain News July 23, 2004*

**Recent rainfall not nearly enough**

Recent rain storms have eased fire restrictions in the Rio Grande Forest. Roberto Martinez, district ranger for Rio Grande Forest and BLM line office, said the Forest Service was concerned after the spring, when heavy rainfall created more growth, which could dry out and become fuel for a forest fire. "A lot of that danger has been abated," Martinez said. "We're still going to have fires, but they're going to be much smaller in size."

*Alamosa Valley Courier July 23, 2004*

**Water tie that binds Valley**

The San Luis Valley's history and economy are tied together with a liquid thread. In an ongoing attempt to keep that thread from unraveling, Adams State College hosted a day-long symposium on Valley water issues. Presenters included Steve Vandiver, Allen Davey, Tom Magnuson, Judge Robert Ogburn and Dr. Pete Magee. They spoke about the Valley's hydrology, water supply, weather as it relates to water, water history and water economics.

*Alamosa Valley Courier July 7, 2004*

*These articles were accessed from the Colorado NPS site at <http://www.npscolorado.com/news.html>.*

**AMERICAN WATER RESOURCES ASSOCIATION  
COLORADO SECTION**

**Presents:**

*Tamarisk Eradication in the Arkansas Basin;  
Biological and Mechanical Control Methods*

**Field Trip**

**Thursday, September 2, 2004**

**Southeastern Colorado Water Conservancy District  
31717 United Avenue, Pueblo, Co 81001**

**Program Overview at 10 a.m.**

**Lunch at noon**

**Tour from 1 - 3 p.m.**

**\$20 for lunch and tour**

**which includes van transportation to view  
biological control area near Pueblo Reservoir  
and mechanical control efforts near Pueblo.**

**Speakers:**

**Tim Carlson**, Tamarisk Coalition

**Debbie Eberts**, Bureau of Reclamation

**Bob Hamilton and Jean Van Pelt**, Southeastern Colorado Water Conservancy District

To register please contact AWRA-Colorado Section by email at [awracosection@bbawater.com](mailto:awracosection@bbawater.com) or call Kim Albright at Denver Water (303-628-6516) before noon on August 20, 2004.

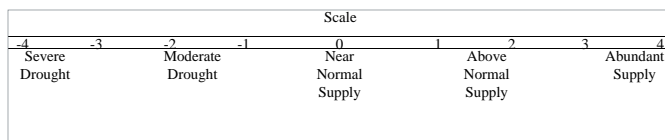
## UNIVERSITY OF COLORADO AT DENVER COURSES

University of Colorado at Denver  
 College of Engineering and Applied Science  
 Continuing Engineering Education Program  
 Schedule of Courses  
 Fall Semester, 2004

For more information regarding course schedules, fees, and instructors, visit the website at [www.cudenver.edu/engineer/cont](http://www.cudenver.edu/engineer/cont). If you have any questions or would like to register over the phone, contact the Continuing Education Program at 303/556-4907 or toll free 800/859-7304.

Street/Inlet Hydraulics and Storm Sewer System Design (NCES 8223)  
 Thursday and Friday, November 11 and 12, 2004. 8:30 to 4:30 p.m.

## WATER SUPPLY



Basin	July 1, 2004 SWSI Value	Change From Previous Month	Change From Previous Year
South Platte	-0.6	-0.4	-1.0
Arkansas	-2.2	+0.2	-1.3
Rio Grande	-1.4	-2.2	+2.0
Gunnison	-2.2	-2.2	+0.2
Colorado	-3.0	-1.2	-1.4
Yampa/White	-3.3	-0.1	-3.3
San Juan/Dolores	-1.4	-2.1	+1.2

The state water supplies are generally in a poorer condition than they were in last month's report. The lowest water supply index values were found in the northwest. The Yampa-White Basin and the Colorado Basin index values were computed at -3.3 and -3.0. However, the most significant changes from last month are found in the southwest. The Gunnison Basin, San Juan-Dolores Basin, and the Rio Grande Basin all have a substantially lower index value. Those southwest basins had much lower reservoir storage and stream flow values than the previous month. Precipitation values increased in all areas of the state, but the precipitation component has a low weighting value compared to stream flow and reservoir storage in the final index computation.

The Surface Water Supply Index (SWSI) developed by this office and the U.S.D.A. Natural Resources Conservation Service is used as an indicator of mountain-based water supply conditions in the major river basins of the state. It is based on stream flow, reservoir storage, and precipitation for the summer period (May through October). During the summer period, stream flow is the primary component in all basins except the South Platte basin where reservoir storage is given the most weight. The following SWSI values were computed for each of the seven major basins for July 1, 2004, and reflect the conditions during the month of June. For this and all archived updates, go to [www.water.state.co.us](http://www.water.state.co.us) and select "surface Water" and then "Water Supply Index."



## COLORADO SCHOOL OF MINES COURSES

### The International Ground Water Modeling Center Colorado School of Mines Fall, 2004

#### Less Than Obvious: Statistical Methods For Data Below Detection Limits

Course Instructor(s): Dennis Helsel  
Course Date: August 18-19, 8 a.m. to 5 p.m.  
Location: Colorado School of Mines, Berthoud Hall Room 201  
Course Cost: \$895, \$995 after August 5<sup>th</sup>  
Description: Values below detection or reporting limits result from measuring trace amounts of a variety of organic and inorganic chemicals. This course presents up-to-date methods for computing summary statistics, hypothesis test, and regression for data with one or more detection limits.

#### MODLOW: Introduction to Numerical Modeling

Course Instructor(s): Eileen Poeter  
Course Date: November 4-6, 8 a.m. to 5 p.m.  
Location: Colorado School of Mines, Berthoud Hall Room 201  
Course Cost: \$995, \$115 after October 21<sup>st</sup>  
Description: Introduces ground water professionals to numerical modeling. Basic modeling concepts: conceptual model development, definition of boundary and initial conditions, parameter specification, finite differencing, grid-ding, time stepping, and solution control using MODLOW-2000 and UCODE, concepts explained and reinforced with hands on exercises.

#### Polishing Your Ground-Water Modeling Skills

Course Instructor(s): Peter Andersen and Robert Greenwald  
Course Date: November 4-6, 8:30 a.m. to 5:30 p.m.  
Location: Colorado School of Mines, Green Center Room 297  
Course Cost: \$995, \$1195 after October 21<sup>st</sup>  
Description: Designed to provide significant detail on practical ground-water flow modeling concepts and techniques. Takes the user beyond topics covered in introductory modeling courses and beyond courses that teach the mechanics of applying various pre-and post-processing software. Revolves around a series of realistic problem sets to highlight and compare alternative methods of ground water flow modeling.

#### Modeling Water Flow and Contaminant Transport in Soils and Groundwater

##### Using the HYDRUS Computer Software Packages

Course Instructor(s): Rien van Genuchten and Jirka Simunek  
Course Date: November 5-6, 8 a.m. to 5 p.m.  
Location: Colorado School of Mines, Green Center Room 257  
Course Cost: \$495, \$595 after October 21<sup>st</sup>  
Description: Most subsurface pollution problems stem from activities involving the unsaturated (vadose) zone between the soil surface and the groundwater table. This course is designed to familiarize participants with the principles and mathematical analysis of variably saturated flow and transport processes and application of state of the art numerical codes to site specific subsurface flow and transport problems.

#### UCODE: Universal Inversion Code for Automated Calibration

Course Instructor(s): Eileen Poeter  
Course Date: November 11-12, 8 a.m. to 5 p.m.  
Location: Colorado School of Mines, Berthoud Hall Room 201  
Course Cost: \$795, \$995 after October 28<sup>th</sup>  
Description: We begin with a brief review of calibration concepts and introduction to inversion theory and description of inputs, outputs, and special topics associated with UCODE. Soon we move on to hands-on exercises demonstrating the application of UCODE. Each exercise involves more complex issues such that the attendees will be exposed to all available features of UCODE.

Please join us as we explore and expand the use of established technologies and methodologies for understanding and evaluating our ground water resources. If you have questions or comments, please call 303/273-3103, fax at 303/384-2037 or email at [igwmc@mines.edu](mailto:igwmc@mines.edu). For more information go to <http://typhoon.mines.edu/short-course/>.

**CSU SEMINARS****WATER RESOURCES SEMINAR****4:10pm, Tuesday****Room C-142 Clark Building****The Changing Role of 'Planning' in Navigating the Future of Water Management in the West**

The Fall 2004 offering of the Water Resources Seminar (GS 592) will introduce students to modern concepts of water resources planning: a key water management tool that explores and navigates the future of water management decision making.

Date	Topic/Speaker
Aug. 24	Student Introductions, and Description of Seminar Operations - <b>Dan Smith</b> , Soil and Crop Sciences, <b>Freeman Smith</b> , Earth Resources, <b>David Freeman</b> , Sociology, and <b>Robert Ward</b> , Director, Colorado Water Resources Research Institute and CSU Water Center.
Aug. 31	"Planning as a Water Resource Management Tool" – <b>Neil Grigg</b> , Professor, Department of Civil Engineering, CSU
Sept. 7	"Colorado's Use of Planning in Managing Water Resources" – <b>Eric Wilkinson</b> , General Manager, Northern Colorado Water Conservancy District, and Past-Chair of the Colorado Water Conservation Board (Background information on the Colorado Water Conservation Board can be viewed at the URL: <a href="http://cwcb.state.co.us/">http://cwcb.state.co.us/</a> .
Sept. 14	"The Northern Integrated Water Supply Project: Planning in Action in Northern Colorado" - <b>Carl Brouwer</b> , Project Manager, or <b>Nicole Seltzer</b> , Water Resources Planning/Environmental Liaison, Northern Colorado Water Conservancy District (Background information on NISP can be viewed at the URL: <a href="http://www.ncwcd.org/project&amp;features/nisp_main.asp">http://www.ncwcd.org/project&amp;features/nisp_main.asp</a> .
Sept. 28	"Water Planning as Viewed from Experiences with the Corp of Engineers and in the practice of Colorado Water Law" – <b>John Hill</b> , Attorney, Bratton & McClow, LLP, Gunnison, Colorado
Oct. 5	"Economic Analysis and Water Resources Planning" – <b>Bob Hamilton</b> , Manager, Economics Group, Bureau of Reclamation, Denver
Oct. 12	"Decision Support Systems in Colorado: Role in Planning and Management" – <b>Larry Brazil</b> , CEO, Riverside Technology, Fort Collins (Overview of DSS development in Colorado: <a href="http://www.cwcb.state.co.us/dss.htm">http://www.cwcb.state.co.us/dss.htm</a> .
Oct. 26	"Water 2025: Preventing Crisis and Conflict in the West" – <b>Brian Person</b> , Area Manager, Eastern Colorado Area Office, Bureau of Reclamation, Loveland, Colorado (Water 2025 Information: <a href="http://www.doi.gov/water2025/">http://www.doi.gov/water2025/</a> .
Nov. 2	"Water Resources Planning for a System that Needs a Quick Fix and Double Capacity" – <b>Peter Binney</b> , Director, City of Aurora Utilities Department.
Nov. 9	"The Future of Water Resources Planning" – <b>Leo Eisel</b> , Managing Engineer, Brown and Caldwell, Denver
Nov. 30	"Colorado Statewide Water Supply Investigation Results" – <b>Rick Brown</b> , Scientists, Water Supply Protection, Colorado Water Conservation Board (Statewide Water Supply Initiative description can be at the following URL: <a href="http://www.cwcb.state.co.us/SWSI/Table of Contents.htm">http://www.cwcb.state.co.us/SWSI/Table of Contents.htm</a>

Interested faculty, students and off-campus water professionals are encouraged to attend and participate.

**RESEARCH AWARDS**

A summary of research awards and projects is given below for those who would like to contact investigators. Direct inquiries to investigators c/o indicated department and university. The list includes new projects and supplements to existing awards. The new projects are highlighted in bold type.

**COLORADO STATE UNIVERSITY, FORT COLLINS, COLORADO**  
**Water Related Awards for May 26, 2004 to July 23, 2004**

PI	DEPT	SPONSOR	TITLE
Myrick, Christopher A	FWB	CDWL	Measuring & Mitigating the Impacts of Instream Drop-structures on Fishes from Colorado's Eastern Plains
Fausch, Kurt D	FWB	CDWL	Effect of Agricultural Water Use & Drought on Groundwater that Sustains Critical Habitats for State-Listed Fish...
<b>Garcia, Luis</b>	CE	CO State Water Cons Brd	<b>Monitoring of Irrigation Amount, Timing, and Crop Yield in the Arkansas River Basin, Colorado</b>
<b>Pielke, Roger A</b>	Atmos Sci	CSWCB	<b>Enhancement of the CoAgMet Electronic Weather Station Network in the Arkansas River Valley in Colorado</b>
Panjabi, Susan Spackman	FWB	CDOT	Noxious Weed Mapping Project - Year 4
<b>Winkelman, Dana</b>	CRWR	CDWL	<b>04/05 1:24,000 Scale Hydrographic Coverage for the State of Colorado (Exhibit I)</b>
Annable, William Kenneth	CE	SCVWD- Santa Clara Valley Water District	Urban Stream Characterization of Berryessa Creek
<b>Rondeau, Renee</b>	FWB	NatureServe	<b>NatureServe Task Order #CO-002-FY04</b>
Stohlgren, Thomas J	NREL	DOI-NPS	Perform Field Evaluations of Various Remote... Sensing Techniques in Identifying Tamarisk
Cooper, David Jonathan	FRWS	DOI-BOR	Riparian Vegetation Studies on the Colorado River & its Tributaries
<b>Newman, Peter</b>	NRRT	DOI-NPS	<b>Developing Sampling and Data Analysis Methodology for Merced River Monitoring Field Guide (Yosemite National Park)</b>
<b>Cooper, David Jonathan</b>	FRWS	DOI-NPS	<b>Assessing Hydrologic, Geochemical and Sediment Flux Impacts to Puccinellia Howelii</b>

**FEDERAL SPONSORS:** BLM-Bureau of Land Management, COE-Corps of Engineers, DOA-Dept. of the Army, DOD-Dept. of Defense, DOE-Dept. of Energy, DON-Dept. of the Navy, DOT-Dept. of Transportation, EPA-Environmental Protection Agency, HHS-PHS-Public Health Service, NASA-National Aeronautics & Space Administration, NBS-National Biological Survey, NOAA-National Oceanic & Atmospheric Admin., NPS-National Park Service, NRCS-Natural Resources Conservation Service, NSF-National Science Foundation, , USAID-US Agency for International Development, USBR-US Bureau of Reclamation, USDA/ARS-Dept. of Agriculture, Agricultural Research Service, USDA/NRS-Dept. of Agriculture, Natural Resources Service, USFS-US Forest Service, USDA-USFS-RMRS-Rocky Mountain Research Station, USFWS-US Fish & Wildlife Service.

**STATE/LOCAL SPONSORS:** CDA-Colorado Department of Agriculture, CDNR-Colorado Dept. of Natural Resources, CDPHE-Colorado Dept. of Public Health and the Environment, CDWL-Colorado Division of Wildlife, NCWCD-Northern Colorado Water Conservancy District. **OTHER SPONSORS:** AWWA-American Water Works Assn., CID-Consortium for International Development

**UNIVERSITY DEPARTMENTS, INSTITUTES AND CENTERS:** Colorado State: BSPM-Bioagricultural Sciences & Pest Management, CBE-Chemical & Bioresource Engr., CFWLU-Cooperative Fish & Wildlife Unit, CSMTE-Center For Science, Mathematics & Technical Education, CIRA-Cooperative Inst. for Research in the Atmosphere, DARE-Dept. of Agric. & Resource Economics, ECE-Electrical & Computer Engineering, ERHS-Environment & Rad. Health Sciences, FWB-Fishery & Wildlife Biology, HLA-Horticulture & Landscape Architecture, NREL-Natural Resource Ecology Lab, NRRT-Nat. Resources Recreation & Tourism, RES-Rangeland Ecosystem Science, SCS-Soil & Crop Sciences. University of Colorado: ACAR-Aero-Colorado Center for Astrodynamics Research, AOS-Atmospheric & Oceanic Sciences, CADSWES-Center for Advanced Decision Support for Water and Environmental Systems, CEAE-Civil, Environmental, and Architectural Engineering, CIRES-Cooperative Institute for Research in Environmental Sciences, CRCMAST-Cooperative Research Center for Membrane Applied Science & Technology, EPOB-Environmental, Population & Organismic Biology, IAAR-Institute for Arctic & Alpine Research, IBS-Institute of Behavioral Science, ITP-Interdisciplinary Telecommunication Program, LASP-Lab. For Atmos. And Space Physics, PAOS-Program in Atmospheric and Oceanic Sciences.

<b>Kalkhan,Mohammed</b>	NREL	DOI-USGS	<b>Development of the NBII Invasive Species Information Node (ISIN)</b>
<b>Hoag,Dana Loyd</b>	DARE	DOI-USGS	<b>The Role of Indices in Natural Resource Policy</b>
Niemann,Jeffrey D	CE	Penn State U	Scaling Properties & Spatial Interpolation of Soil Moisture
<b>Anderson,David G</b>	FWB	NatureServe	<b>Round-Leaf Four-O'Clock Management Plan</b>
Vukicevic,Tomislava	CIRA	U of New Hampshire	Fast Fluxes Slow Pools: Integrating Eddy Covariance, Remote Sensing & Ecosystem Processes Data within...
Wilkins-Wells,John Reese	Soc	DOI-BOR	Management Practice Study II - County Land Use Impacts on Irrigation Districts
Kreidenweis-Dandy,Sonia M	Atmos Sci	NSF	Collaborative Research: Physical & Chemical Impacts on the Ice Nucleating Properties of Atmospheric Particles ...
Cotton,William R	Atmos Sci	NSF	Urban Influences on Clouds, Precipitation & Lightning
Rutledge,Steven A	Atmos Sci	NSF	The Colorado State University - CHILL Radar Facility
James,Keith	Psych	NSF	Developing Approaches to Climate Change and Native Communities
<b>Smith,Freeman M</b>	FRWS	NSF	<b>The Effects of a Buried Ice Lens on Snow Microstructure</b>
Lee,Chun Man	Stat	UCAR-NCAR	Statistical Research for Weather Prediction & Climate Change
Wall,Diana H	NREL	Ohio State U	Soil Biodiversity & Response to Climate Change: A Regional Comparison of Cape Hallett & Taylor Valley, Antarctica
<b>Poff,N LeRoy</b>	BSPM	CUAHSI	<b>Hydrologic Information Systems Proposal</b>
<b>Wall,Diana H</b>	NREL	Ohio State U	<b>McMurdo Long Term Ecological Research - REU</b>
Collett,Jeffrey L Jr	Atmos Sci	NSF	Investigation of the Organic Composition of Fogs & Clouds
Pielke,Roger A	Atmos Sci	NSF-Polar Programs	Winter Precipitation, Sublimation, & Snow-Depth in the Pan-Arctic: Critical Processes & a Half Century of Change
<b>Clements,William H</b>	FWB	DOI-NPS	<b>Aquatic and water quality Phase III planning in the Greater Yellowstone Network</b>
<b>Brown,Cynthia S</b>	BSPM	DOI-NPS	<b>Cheatgrass Control &amp; Community Restoration</b>
<b>Jacobi,William R</b>	BSPM	Larimer County	<b>Effects of Chloride Salts on Roadside Vegetation &amp; Water</b>
<b>Hellmund,Paul A</b>	HLA	Pikes Peak Comm Found	<b>Chatfield Basin Conservation Network Pre-planning Study</b>
<b>Ramirez,Jorge A</b>	CE	KOWACO-Korean Water Resources Corp.	<b>Development of bias-correction techniques for numerical weather forecasts</b>
<b>Ippolito,James</b>	SCS	EPA	<b>The Effects of Long-Term Composted Biosolids &amp; Biosolids-Alum Water Treatment Residuals Reapplications on Native...</b>
<b>Bruyere,Brett L</b>	NRRT	National Fish and Wildlife Foundation	<b>Poudre River Restoration</b>
Thornton,Christopher I	CE	McLaughlin Water Engineering, LTD	American River Model Study
Oad,Ramchand	CE	S. S. Papadopoulos & Associates, Inc.	Decision-Support for Improving Water Management in the Middle Rio Grande Irrigation System
<b>Pielke,Roger A</b>	Atmos sci	NASA -	<b>Integrated Regional Climate Study with a Focus on Land-Use-Land-Cover Change &amp; Associated Changes in Hydrological ...</b>
<b>Duda,Joseph A</b>	CSFS	USDA-USFS-For-est Research	<b>Conservation Reserve Program</b>
Cifelli,Robert C	Atmos sci	Various Non-Profit" Sponsors"	CoCoRaHS Charter Members Cost Share
Ramirez,Jorge A	CE	USDA-USFS	Water Yields in the United States under Climate Change
Fausch,Kurt D	FWB	USDA-USFS-For-est Research	Recruitment Bottlenecks Hampering Restoration of Native Cutthroat Trout



Macdonald, Lee H	FRWS	USDA-USFS-Forest Research	Monitoring, Assessing, & Predicting Sediment Production, Sediment Deliver, & Cumulative Watershed Efforts in...
Stednick, John D	FRWS	USDA-USFS	<b>Biogeochemical fluxes at the Glacier Lakes, Snowy Range, Wyoming</b>
Wohl, Ellen E	Geo	USDA-USFS-Forest Research	<b>Assessment of land-use impacts on forced-pool characteristics in constrictor-dominated channels</b>
Cheng, Antony S	FRWS	USDA-Forest Service	Enhancing the Integration of Diverse Perspectives on Conserving Natural Resource Values Across Multiple Landscape Scales
Lefsky, Michael A	FRWS	USDA-USFS-Forest Research	<b>Terrestrial Stereo Photography for Natural Resources</b>
Binkley, Daniel E	FRWS	USDA-USFS	<b>Biogeochemistry of Riparian Wetlands on Rocky Mountain Headwater Streams</b>

**UNIVERSITY OF COLORADO, BOULDER COLORADO**  
Water Related Awards for April and June, 2004

PI	DEPT	SPONSOR	TITLE
Zagona, Edit	Civil, Env. And Arch Eng	Dept of the Army	<b>Riverware enhancements to support CDE-SW modeling needs</b>
Williams, Mark	Inst of Arctic and Alpine Res Geo	DOI-NPS	<b>Developing screening procedures and sampling protocols for assessment of deposition-sensitive surface waters in the Rocky Mountains</b>
Barry, Roger	CIRIES	NASA	<b>Twentieth century sea ice conditions in the Eurasian Arctic from a comprehensive reconstitution and synthesis of Russian data sources with modern satellite data</b>
Lynch, Amanda	CIRIES	NASA	<b>Integrated analyses of the freshwater cycle in the Arctic terrestrial, cryospheric, atmospheric, and oceanic systems</b>
Frodeman, Robert	CIRIES	NSF	<b>U.S. - Russian workshop: cities and rivers; interdisciplinary and international perspectives</b>
Nevison, Cynthia	Inst of Arctic and Alpine Res Geo	NSF	<b>SGER: Modeling river nitrogen export to coastal zones in the community climate system MODD</b>
Peckham, Scott	Inst of Arctic and Alpine Research	U of Alaska	Conversion of hydrologic model from Fortran to Gui
Zagona, Edit	Civil, Env, and Arch Engineering	DOI - BOR	<b>USBR Truckee Basin S&amp;T</b>
Zagona, Edit	Civil, Env, and Arch Engineering	DOI - BOR	<b>USBR Columbia Basin S&amp;T</b>
Nerem, R. Steven	AERO	NASA	<b>A Multidisciplinary investigation of present-day sea level change</b>
Leben, Robert	AERO	NASA	<b>Test of ocean monitoring with ICESAT altimetry</b>

***El Nino - and What is the Southern Oscillation Anyway?!***

*El Nino, an abnormal warming of surface ocean waters in the eastern tropical Pacific, is one part of what's called the Southern Oscillation. The Southern Oscillation is the see-saw pattern of reversing surface air pressure between the eastern and western tropical Pacific; when the surface pressure is high in the eastern tropical Pacific it is low in the western tropical Pacific, and vice-versa. Because the ocean warming and pressure reversals are, for the most part, simultaneous, scientists call this phenomenon the El Nino/Southern Oscillation or ENSO for short. South American fishermen have given this phenomenon the name El Nino, which is Spanish for "The Christ Child," because it comes about the time of the celebration of the birth of the Christ Child or Christmas -- the end of December.*

*Source: <http://kids.earth.nasa.gov/archive/nino/intro.html>*

## CALL FOR PAPERS

The Association of Ground Water Scientists and Engineers  
of the National Ground Water Association  
announces the first annual

The Ground Water Summit  
San Antonio, Texas  
April 17-20, 2005

Call for Session Proposals : Due August 15

For more information go to <http://www.ngwa.org/e/conf/0504175095.shtml>

## MEETINGS



### COLORADO WATER CONGRESS Meeting & Workshop Notices

Aug. 26-27	<b>2004 Summer Convention of Colorado Water Congress.</b> Silver Tree Resort, Snowmass Village at Aspen, CO.
Sept. 20-21	<b>Colorado Water Law Seminar.</b>
Oct. 13	<b>Workshop on Water Quality.</b>
Oct. 14	<b>Endangered Species Conference.</b>
Oct. 20	<b>A Review of Federal Environmental Laws.</b>
Oct. 27	<b>Workshop on the Initiative Process.</b>
Oct. 29	<b>Leadership Workshop for Board Members of Water Conservancy and Conservation Districts.</b>
Nov. 1	<b>What You Should Know About The Legislative Process: The Law, The Rules, And The Practices.</b>
Nov. 3	<b>Legal Ethics In Water and Environmental Law.</b>
Nov. 10	<b>What You Should Know About the Nine Interstate Compacts that Colorado Is A Signatory.</b>
Jan. 27-28, 2005	<b>Colorado Water Congress 47<sup>th</sup> Annual Convention.</b> Denver International Airport Hotel and John Q. Hammons Convention Center, 15500 East 40 <sup>th</sup> Avenue, Denver, CO.
Jan. 26-27, 2006	<b>Colorado Water Congress 48<sup>th</sup> Annual Convention.</b> Denver International Airport Hotel and John Q. Hammons Convention Center, 15500 East 40 <sup>th</sup> Avenue, Denver, CO.
Jan. 25-26, 2007	<b>Colorado Water Congress 49<sup>th</sup> Annual Convention.</b> Denver International Airport Hotel and John Q. Hammons Convention Center, 15500 East 40 <sup>th</sup> Avenue, Denver, CO.

All meetings are held in CWC Conference room, 1580 Logan Street, Suite 400, Denver, Colorado unless otherwise noted. For more information go to: [www.cowatercongress.org](http://www.cowatercongress.org), or phone 303/837-0812, or email [macravey@cowatercongress.org](mailto:macravey@cowatercongress.org).

**American Water Resources Association  
Upcoming Conferences**

**For more information and registration materials, go to <http://www.awra.org/>**

2004 Annual Conference

November 1-4, 2004 -- Sheraton World Resort, Orlando, Florida

2nd National Water Resources Policy Dialogue

February 14-15, 2005 -- Loews Ventana Canyon Resort, Tucson, AZ

2005 Summer Specialty Conference

Institutions for Sustainable Watershed Management: Reconciling Physical and Management Ecology in the Asia-Pacific

June 27-29, 2005 -- Hyatt Regency Waikiki Resort & Spa, Honolulu, HI

## CALENDAR

Aug. 18-19	<b>Less Than Obvious: Statistical Methods For Data Below Detection Limits with Dennis Helsel.</b> Colorado School of Mines. More information in this newsletter or go to: <a href="http://typhoon.mines.edu/short-course/">http://typhoon.mines.edu/short-course/</a> or email <a href="mailto:igwmc@mines.edu">igwmc@mines.edu</a> .
Aug. 26-27	<b>2004 Summer Convention of Colorado Water Congress.</b> Aspen, CO. For more information go to: <a href="http://www.cowatercongress.org">http://www.cowatercongress.org</a> .
Sept. 2	<b>Tamarisk/Salt Cedar Eradication.</b> For more information go to: <a href="http://www.awra.org/state.colorado/">http://www.awra.org/state.colorado/</a> .
Sept. 8	<b>NPS Watershed Planning: Blueprint for Action!</b> Glenwood Springs, CO. In conjunction with the Colorado Watershed Assembly 5 <sup>th</sup> Annual Conference. More information in this newsletter or go to: <a href="http://www.npsc Colorado.com">www.npsc Colorado.com</a> .
Sept. 9-10	<b>Colorado Watershed Assembly 5<sup>th</sup> Annual Conference, Planning for the Future.</b> Glenwood Springs, CO. More information in this newsletter or go to: <a href="http://www.coloradowater.org">www.coloradowater.org</a> .
Sept. 9	<b>City of Aurora's Xeriscape Demonstration Garden.</b> Aurora Municipal Bldg., Aurora, CO. For more information contact Laurie D'Audney at <a href="mailto:ldaudney@fcgov.com">ldaudney@fcgov.com</a> .
Sept. 20-21	<b>Colorado Water Law Seminar.</b> Denver, CO. More information in this newsletter or go to: <a href="http://www.cowatercongress.org">http://www.cowatercongress.org</a> , phone 303/837-0812, or email <a href="mailto:macravery@cowatercongress.org">macravery@cowatercongress.org</a> .
Sept. 26-29	<b>Dam Safety 2004.</b> Phoenix, AZ. For more information contact: Assn. of State Dam Safety Officials, phone 859/257-5140, email <a href="mailto:info@damsafety.org">info@damsafety.org</a> , or go to website <a href="http://www.damsafety.org">www.damsafety.org</a> .
Sept. 25-30	<b>12<sup>th</sup> National Nonpointsource Monitoring Workshop: Managing Nutrient Inputs and Exports in the Rural Landscape.</b> Ocean City, MD. More information in this newsletter or go to: <a href="http://www.ctic.purdue.edu/NPSWorkshop/NPSworkshop.html">http://www.ctic.purdue.edu/NPSWorkshop/NPSworkshop.html</a> .
Sept. 28	<b>Supreme Court Decision Regarding Transmountain Diversions.</b> Denver, CO. For more information go to: <a href="http://www.awra.org/state.colorado/">http://www.awra.org/state.colorado/</a> .
Oct. 10-13	<b>Conference on Tailings and Mine Waste '04.</b> Fort Collins, CO. For more information contact: Linda Hinshaw, Dept of Civil Engr., CSU, phone 970-491-6081, fax 970/491-3584, or email <a href="mailto:lhinshaw@engr.colostate.edu">lhinshaw@engr.colostate.edu</a> .
Oct. 13	<b>Workshop on Water Quality.</b> Denver, CO. More information in this newsletter or go to: <a href="http://www.cowatercongress.org">http://www.cowatercongress.org</a> , phone 303/837-0812, or email <a href="mailto:macravery@cowatercongress.org">macravery@cowatercongress.org</a> .
Oct. 13-16	<b>Water Rights and Related Water Supply Issues.</b> Salt Lake City, UT. For more information go to: US-CID website at <a href="http://www.uscid.org/oridcall.html">www.uscid.org/oridcall.html</a> .
Oct. 14	<b>Endangered Species Conference.</b> Denver, CO. More information in this newsletter or go to: <a href="http://www.cowatercongress.org">http://www.cowatercongress.org</a> , phone 303/837-0812, or email <a href="mailto:macravery@cowatercongress.org">macravery@cowatercongress.org</a> .

Oct. 17-20	<b>2004 American Institute of Hydrology 2004 Annual Meeting and International Conference: Integrated Water Resources Management.</b> Las Vegas, NV. More information in this newsletter or go to: <a href="http://www.aihydro.org">www.aihydro.org</a> .
Oct. 20	<b>A Review of Federal Environmental Laws.</b> Denver, CO. More information in this newsletter or go to: <a href="http://www.cowatercongress.org">http://www.cowatercongress.org</a> , phone 303/837-0812, or email <a href="mailto:macravey@cowatercongress.org">macravey@cowatercongress.org</a> .
Oct. 26	<b>Centennial WSD's Water Use Rate Structure.</b> Denver, CO. For more information go to: <a href="http://www.awra.org/state/colorado/">http://www.awra.org/state/colorado/</a> .
Oct. 27-28	<b>Navigating the Future: Water Supplies in the South Platte.</b> Longmont, CO. More information in this newsletter or go to: <a href="http://www.southplatteforum.org">www.southplatteforum.org</a> or email <a href="mailto:jennifer@jbbrown.com">jennifer@jbbrown.com</a> .
Oct. 27	<b>Workshop on the Initiative Process.</b> Denver, CO. More information in this newsletter or go to: <a href="http://www.cowatercongress.org">http://www.cowatercongress.org</a> , phone 303/837-0812, or email <a href="mailto:macravey@cowatercongress.org">macravey@cowatercongress.org</a> .
Oct. 29	<b>Leadership Workshop for Board Members of Water Conservancy and Conservation Districts.</b> Denver, CO. More information in this newsletter or go to: <a href="http://www.cowatercongress.org">http://www.cowatercongress.org</a> , phone 303/837-0812, or email <a href="mailto:macravey@cowatercongress.org">macravey@cowatercongress.org</a> .
Nov. 1-4	<b>American Water Resources Association 2004 Annual Conference.</b> Orlando, FL. For more information go to: <a href="http://www.awra.org">http://www.awra.org</a> .
Nov. 1	<b>What You Should Know About The Legislative Process: The Law, The Rules, And The Practices.</b> Denver, CO. More information in this newsletter or go to: <a href="http://www.cowatercongress.org">http://www.cowatercongress.org</a> , phone 303/837-0812, or email <a href="mailto:macravey@cowatercongress.org">macravey@cowatercongress.org</a> .
Nov. 3	<b>Legal Ethics In Water and Environmental Law.</b> Denver, CO. More information in this newsletter or go to: <a href="http://www.cowatercongress.org">http://www.cowatercongress.org</a> , phone 303/837-0812, or email <a href="mailto:macravey@cowatercongress.org">macravey@cowatercongress.org</a> .

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