



# COLORADO WATER

Newsletter of the Water Center at Colorado State University

**AUGUST 2002**

**CSU FACULTY AND STUDENTS STUDY  
THE AFTEREFFECTS OF WILDFIRES  
ON COLORADO'S FRONT RANGE**  
*See page 7.*



*In September, Lee MacDonald and John Stednick, Department of Earth Resources, Colorado State University, will begin 3rd year of research on erosion, rehabilitation, and water quality of wildfire-affected areas.*



*Butch Knowlton, La Plata County's director of emergency services, stands in a heavily eroded wash below an area that was burned by the Missionary Ridge fire. (Photo by Jerry McBride, Courtesy of Durango Herald.)*

Co Sponsored by:  
Colorado Water Resources Research Institute  
Colorado State University Agricultural Experiment Station  
Colorado State University Cooperative Extension  
Colorado State Forest Service

**Colorado  
State  
University**

*Knowledge to Go Places*

## WATER ITEMS AND ISSUES . . .

— Editorial by Robert C. Ward, Director .....	3
FY2003 Request for Proposals .....	4
USGS Announces Awards .....	5
CSU Faculty and Students Study Aftereffects of Wildfires on Colorado's Front Range .....	7
NSF Award Will Fund Study of Condition and Security Indicators for Roads, Electric Utilities and Water Utilities .....	10
Applications Invited for CSREES Doctoral Fellows Program .....	11
<b>COOPERATIVE EXTENSION</b>	
WELL - Water Efficient Leaders in Landscape .....	12
Assessment of Irrigation Water Management and Demonstration of Irrigation Scheduling Tools in the Full Service Area of the Dolores Project .....	13
Mapping of Center Pivot Irrigation in Colorado .....	16
<b>COLORADO STATE FOREST SERVICE</b>	
Colorado State Forest Service Develops Firewise Program for the Eastern Plains .....	18
CU Water News .....	20
CSM Water News .....	23
Research Awards .....	24
Water Supply .....	26
Water News Digest .....	27
Water Resources Seminar .....	32
Water Education .....	33
Meetings .....	34
Calls for Posters/Papers .....	38
Calendar .....	40



### COLORADO WATER

Vol. 18, No. 4

August 2002

Editor: Shirley Miller

Writers: Marian Flanagan and Michael Blackledge

*COLORADO WATER* is a publication of the Colorado Water Resources Research Institute. The scope of the newsletter is devoted to enhancing communication between Colorado water users and managers and faculty at the research universities in the state. This newsletter is financed in part by the U.S. Department of the Interior, Geological Survey, through the Colorado Water Resources Research Institute. The contents of this publication do not necessarily reflect the views and policies of the U.S. Department of the Interior, nor does mention of trade names or commercial products constitute their endorsement by the United States Government.

Published by the

Colorado Water Resources Research Institute  
Colorado State University, Fort Collins, CO 80523  
Phone: 970/491-6308 FAX: 970/491-1636  
E-mail: CWRRI@ColoState.EDU

#### INTERNET SITES

Colorado Water Resources Research Institute <http://cwrri.colostate.edu>  
CSU Water Center <http://watercenter.colostate.edu>  
South Platte Forum <http://southplatteforum.colostate.edu>  
Colorado Water Knowledge <http://Waterknowledge.colostate.edu>  
Hydrology Days <http://hydrologydays.colostate.edu/>  
Student Water Symposium <http://watersym.colostate.edu/>  
Water REU <http://waterreu.colostate.edu/>

## EDITORIAL



## WATER EDUCATION IN COLORADO

by Robert C. Ward, Director

Water education in Colorado occurs in many segments of society and is sponsored by a diverse array of organizations. Soon there will be a new player in the arena of water education in Colorado: The Colorado Alliance for Water Education (CAWE). As the name implies, the new organization hopes to foster, among the public, a broader understanding of water challenges facing Colorado. More detail on the new water education effort in Colorado can be found on page 27 of this issue of *Colorado Water*.

A Colorado Water Education workshop (a 'water education summit' if you will) is announced on page 28. The workshop is being held August 29, 2002, on the campus of the University of Southern Colorado in Pueblo. This meeting will be an excellent chance for the many participants in water education in Colorado to learn more about CAWE, particularly its organizational development and start up plans.

All of us involved in water education in Colorado, at all levels (K-12, higher education, and adult education), fervently hope CAWE is a huge success. However, it is helpful to realize that CAWE is not the first effort to develop a water education foundation in Colorado. Earlier efforts were not successful for a variety of reasons.

There are successful water education 'foundations' in the U.S. that provide us in Colorado with helpful 'lessons

learned'. The July/August 2002 issue of *Western Water*, published by the Water Education Foundation located in Sacramento, California, contains an editorial by the Foundation's Executive Director, Rita Schmidt Sudman, describing a dinner celebrating the 25<sup>th</sup> anniversary of The Water Education Foundation. Quoting from the editorial:

*There were other memories shared by participants at the dinner. Some called themselves former adversaries who didn't believe that the new Foundation could live up to its goal of becoming an impartial organization. They are now supporters and were pleased to join us in this celebration.*

With a strong commitment from water managers and educators, hopefully CAWE will be able to convince adversaries in Colorado that it is possible to create an impartial water education organization. I hope a similar statement to that above can be written in a 2027 newsletter of the CAWE, describing 25 years of successful, impartial water education efforts in Colorado.

Rita Schmidt Sudman will present the keynote address at the August 29, 2002, Colorado Water Education Workshop. With 25 years of success, her talk will be extremely relevant to the initiation of CAWE.

During the past several years, Colorado school children have participated in River of Words," a nationwide poetry contest sponsored by the Library of Congress. U.S. Poet Laureate Robert Hass started this program to help children learn to respect nature and how to write poetry. The Colorado Center for the Book (state affiliate of the Library of Congress) conducts this contest for Colorado entrants. Colorado poets judge the entries, which may be selected for national publication. This year, Katie Post and Megan MacGregor, 6th graders at the Logan School in Denver, shared first-place honors.

Megan MacGregor describes how waters dance:

*Water, light dancing  
Forever duet  
Remember the time  
Long ago  
When they met*

Katie Post speaks of the power of rivers:

*I am the headwaters plunging,  
and racing down rocky walls,  
I am the river foaming, rushing  
over rocks worn smooth at my touch.*

Denver Post, 6/30/02



**Colorado Water Resources Research Institute**  
**FY 2003 Request for Proposals<sup>1</sup>**  
**CLOSING DATE: SEPTEMBER 27, 2002**

Proposals are invited for the Colorado Water Resources Research Institute FY 2003 water research program. For the FY 2003 competition, the CWRRRI Advisory Committee for Water Research Policy has identified needs for new water knowledge that will assist in answering the following seven questions.

- What are the 'best' ways to mitigate the impact of excess salinity on irrigated agriculture in the Lower Arkansas Valley?
- How could Colorado better integrate its water supply infrastructure to enhance drought protection?
- What changes in return flow patterns should be expected due to a steady shift from surface irrigation to center pivot irrigation along the lower South Platte River?
- How cost effective are the BMPs employed to satisfy non-point source TMDL requirements in Colorado?
- Setting water quality standards in Colorado involves balancing many factors, including human and ecosystem risk and economics. What standard setting procedures might be considered in the future that would yield a more balanced and, yet, protective approach?
- What are the ecosystem impacts of selenium in Colorado? How should the impacts be measured and evaluated?
- What are the economic benefits and costs associated with transbasin diversions, broken down for both the gaining and losing basins, under historic Colorado conditions?

**Funds Available:** The CWRRRI Request for Proposals is partially supported by the U.S. Geological Survey. It is anticipated that approximately \$50,000 in federal funds will be available for this competition. Federal funds must be matched 2:1 by non-federal funds (resulting in a total of approximately \$150,000 for this competition). Matching funds come from the university submitting the proposal and/or from local and/or state agencies via agreements arranged during preparation of the proposal. CWRRRI research funds are awarded through a competitive process guided by the CWRRRI Advisory Committee on Water Research Policy. Proposals that contain matching funds from Colorado water and water-related organizations are strongly encouraged. *Awards are contingent upon Congressional approval of FY 2003 funding for the national water institute program.*

**Proposal Review Process:** All proposals are due in the CWRRRI offices by September 27, 2002. Proposals will be peer reviewed before final review and ranking by the CWRRRI Advisory Committee for Water Research Policy. The general criteria used for proposal evaluation include: (1) scientific merit; (2) responsiveness to RFP; (3) qualifications of investigators; (4) originality of approach; (5) budget; and (6) extent to which Colorado water managers and users are collaborating. Proposal reviews should be completed by December 2002 with March 1, 2003, start dates. [Once projects are selected for funding by the Advisory Committee, CWRRRI submits a formal funding request to the U.S. Geological Survey, including each accepted proposal.]

**Eligibility:** The competition is open to regular, full-time faculty at Colorado's research universities.

**Project Duration:** Awards will be made for one year beginning March 1, 2003. Multiple year projects will be considered; however, funding for additional years must be obtained through the annual CWRRRI research competition.

**Proposal Submission:** Proposals, in both hard and electronic copy, are to be submitted by 5:00 p.m., September 27, 2002, to:

Director, Colorado Water Resources Research Institute  
 E-102 Engineering Building  
 Colorado State University  
 Fort Collins, Colorado 80523

Send electronic copy via e-mail, if you wish, to: [Shirley.Miller@Colostate.edu](mailto:Shirley.Miller@Colostate.edu). To obtain a copy of the guidelines, contact Shirley Miller or Marian Flanagan at 970/491-6308 or E-mail [shirley.miller@research.colostate.edu](mailto:shirley.miller@research.colostate.edu).

<sup>1</sup> Solicitation is dependent upon Congressional approval of FY 2002 funding for Section 104(b) of the Water Resources Research Act.



**USGS ANNOUNCES AWARDS UNDER FY2002  
NIWR AND USGS COMPETITIVE GRANTS PROGRAM**

Eight proposals have been recommended for funding under the fiscal year 2002 National Institutes for Water Resources (NIWR) and U.S. Geological Survey (USGS) National Competitive Grants Program. Robert Siegrist, Professor and Division Director of Environmental Science and Engineering at the Colorado School of Mines, received the only Colorado award. James P. Hurley, NIWR Review Coordinator, said the selection panel had a difficult task in selecting the eight proposals from the 75 proposals received. Many excellent proposals could not be funded, he said. Hurley is Assistant Director for Research and Outreach at the University of Wisconsin's Aquatic Sciences Center. The list of awards follows. Abstracts of these proposals will be made available at <http://water.usgs.gov/wrri/2002.html>.

TITLE	P.I.	UNIVERSITY	COLLABORATOR
Development and Validation of a 3D Coupled Hydro-logic-Biogeochemical Model for Evaluation of the Impact of Water-Table Management on Nitrate Loads from Tile-Drained Agricultural Fields	Robert Hudson and Albert J. Valocchi	University of Illinois at Urbana-Champaign	Illinois District, USGS
Using Environmental Tracers to Improve Prediction of Nonpoint Pollutant Loadings from Fields to Streams at Multiple Watershed Scales	C. Kent Keller and Richelle Allen-King	Washington State University	Central Columbia Plateau and Yakima NAWQA
Mid Infrared Water Quality Sensors for the Detection of Organic Pollutants	Boris Mizaikoff	Georgia Institute of Technology	Appalachicola-Chattahoochee-Flint NAWQA
Relationship of Nitroso Compound Formation Potential to Drinking Source Water Quality and Organic Nitrogen Precursor Source Characteristics	Richard Valentine	University of Iowa	Eastern Iowa Basins NAWQA
Occurrence and Fate of Emerging Organic Chemicals in Onsite Wastewater Systems and Implications on Water Quality Management in the Rocky Mountain Region	Robert L. Siegrist, John E. McCray and Kathryn S. Lowe	Colorado School of Mines	USGS Nat'l. Research Program, Central Region
Agricultural Chemicals as a Major Non-Point Source of Arsenic: Microbial Transformation of Organic Arsenicals	James Field, Jay Galdolfi and Reyes Sierra	University of Arizona	USGS Nat'l. Research Program, Central Region, Nat'l. Water Quality Laboratory, Lakewood, CO
Hydraulic and Geomorphic Controls on the Evolution of Cluster Bedforms in Gravel-Bed Streams	Thanos N. Papanicolaou, and Lisa L. Ely	Washington State Univ., Central Washington University	California District, USGS
An Integrated Immunological-GIS Approach for Biomonitoring of Ecological Impacts of Swine Manure Pollutants in Streams	James A. Roth, Bruce W. Menzel and Dusan Palic	Iowa State University	Biological Resources Division, USGS

**OCCURRENCE AND FATE OF EMERGING ORGANIC CHEMICALS IN ONSITE WASTEWATER SYSTEMS  
AND IMPLICATIONS ON WATER QUALITY MANAGEMENT IN THE ROCKY MOUNTAIN REGION**

*Robert L. Siegrist, John E. McCray and Kathryn S. Lowe  
Colorado School of Mines*

The Rocky Mountain region has experienced significant development during the past decade, much of which is occurring in suburban fringe and mountain resort settings. In these areas, wastewater management is commonly achieved by onsite wastewater treatment systems. In Colorado there are over 600,000 onsite systems in operation, serving about 25

percent of the state's population, and 7,000 to 10,000 new systems are installed each year. Annually, this amounts to over 30 billion gallons of wastewater effluent discharged to the environment. The situation is similar in Wyoming, Montana and Utah. Issues have been raised regarding potential water quality impacts from onsite systems and the adequacy of

current management practices to minimize such impacts. While concerns have focused on nutrients and pathogens, emerging organic chemicals (EOCs) such as pharmaceuticals and personal care products, have received increasing attention. Several studies point to wastewater as a primary contributing source of EOCs in the water environment.

To address this issue, in 2001 the Executive Director of the Colorado Department of Public Health and Environment established the Individual Sewage Disposal System (ISDS) Steering Committee. The committee found that water quality impacts are occurring, but their nature and magnitude have not been documented, because completed studies had focused on nutrient loading and bacterial levels.

This NIWR/USGS Competitive Grants project will consist of field monitoring and experimental studies in Colorado to determine the occurrence and fate of EOCs in onsite wastewater systems and assess the potential for EOCs to reach receiving waters in mountain watersheds. The research will include field monitoring of approximately 30 residen-



*Robert Siegrist*

tial and 10 commercial sites, including collection of three to five samples at separate times from their onsite wastewater systems as well as their private drinking water wells. Laboratory analyses will be completed in the field and at CSM for conventional water quality parameters and at USGS for a suite of emerging organic chemicals. Field monitoring will be completed in the Lake Dillon watershed in Summit County, Colorado (and potentially at one or two other watersheds) where onsite wastewater systems represent the primary source of any EOCs that might reach and persist in the ground water and surface waters. Field testing will also be completed at an onsite system test site located on the CSM campus to determine the capability of conventional and alternative onsite systems to remove EOCs during treatment in septic tank and foam filter units and during infiltration and percolation of these effluents through 0.5 to 1.0 m of natural sandy soil. Monitoring and experimentation results will be used to complete an assessment of the occurrence and fate of EOCs in onsite wastewater systems and receiving waters and to make recommendations for appropriate management practices to mitigate potential adverse effects.

### **Henry P. Caulfield, Jr.**

We are sad to report that Professor Henry P. Caulfield, Jr. died Tuesday, June 11, 2002, at his home of Fort Collins. Professor Caulfield was a graduate of Harvard College and Harvard University Graduate School of Public Administration, with concentration in the fields of public policy, public administration, and natural resources policy. He held several government positions over the years, and in all spent 25 years in military and civilian government service. He was appointed Executive Director of the U.S. Water Resources Council of the Department of Interior under Stewart Udall, when a decision was made to increase emphasis on the politics of national resources and the environment. Professor Caulfield received a Citation for Distinguished Service from the U.S. Department of the Interior in 1968.

In 1969 Professor Caulfield joined the faculty of the Political Science Department at CSU and taught for 17 years, retiring in 1987. He was a member of the Fort Collins Water Board for 12 years.

The American Water Resources Association, a national organization of over 2800 members, annually awards its Henry P. Caulfield, Jr. Medal for Exemplary Contributions to National Water Policy to an individual who has achieved a status of eminence in shaping national water policy.





## CSU FACULTY AND STUDENTS STUDY THE AFTEREFFECTS OF WILDFIRES ON COLORADO'S FRONT RANGE

Research in progress by faculty of the Earth Resources Department at Colorado State University could help provide timely answers about the aftereffects of the wildfires Colorado has experienced this summer, especially questions about erosion and water quality. Professor Lee MacDonald and his graduate students have gathered two full years of data that examine the post-fire effects on runoff, erosion, and the effectiveness of rehabilitation treatments. A new group of graduate students has already begun their research and are initiating a third year of studies to see how long it takes for runoff and erosion rates to return to "background levels."

Professor John Stednick and his graduate student have focused on measuring runoff and water quality at the watershed scale, and they also are collecting a third year of data following the June 2000 Bobcat Fire.

Both professors and their students will present the results of their studies at a special session on fire and geomorphic processes that will be held at the Geological Society of America's annual meeting in Denver on 27-30 October 2002. Brief summaries of the ongoing projects are presented below.

### **Effectiveness of Contour-felling, Mulching, and Seeding after Wildfires in the Colorado Front Range**

— Mulching was found to be the only treatment that resulted in significantly lower sediment production rates. Contributing area and percent bare soil explained nearly 70 percent of the variability in sediment yields in the second summer after burning. The relative effectiveness of the mulch treatment declines as the mulch decays and percent cover increases in the other treatments and controls. Sediment production and percent cover continue to be monitored, and results from the third summer after burning will be presented.

**Post-fire Soil Water Repellency in the Northern Colorado Front Range** – Soil water repellency was assessed using the well-known water drop penetration test (WDPT) and measurements of the critical surface tension (CST). In the CST test increasing concentrations of ethanol are mixed with water to generate solutions with



progressively lower surface tensions. The CST is determined by the minimum concentration of ethanol needed for the solution to be readily absorbed by the soil. Sites burned at moderate or high severity were typically water repellent at the mineral soil surface with progressively weaker water repellency to a depth of 6 cm. Unburned sites and sites burned at low severity were typically

water repellent only at the soil surface. At higher soil moisture contents water repellency is largely eliminated, and this transition appears to increase from approximately 10 percent in unburned sites to at least 26 percent in sites burned at moderate and high severity. Repeated sampling and comparisons between fires suggest that post-fire water repellency is greatly weakened, but not necessarily eliminated, by the second summer after burning. This implies that post-fire water repellency may not be the dominant cause of the observed post-fire increases in runoff and erosion.

### **Measuring and Predicting Post-fire Erosion Rates at the Hillslope Scale, Colorado Front Range.**

– Sediment production rates are much higher for sites burned at high severity than for sites burned at moderate or low severity range. Summer convective storms generated about 90 percent of the annual erosion, with most of the sediment resulting from only a few of the most intense storms. In the case of the

intensively-monitored Bobcat fire, similar erosion rates were observed for the first and second summers after burning, but rainfall erosivity in the second summer was 60 percent higher. Sediment production rates the first year after burning were approximately 40 times larger in sites burned at high severity than for sites burned at moderate or low severity; this difference increased to about 100-fold in the second year. Percent cover is the dominant control on sediment production rates. Data from all sites indicate that approximately 4 to 5 years are required for erosion rates to return to background levels.

**Use of a Rainfall Simulator to Assess Changes in Runoff and Sediment Production Over Time, Colorado Front Range** – Wildfires in the Colorado Front Range

cause large increases in runoff and erosion, but the variability in rainfall inputs makes it difficult to determine the role of individual site factors and the rate of recovery over time. Use of a rainfall simulator allows a more uniform means for comparing post-fire runoff and erosion rates. In this study, 26 rainfall simulations were conducted in 2000 and 23 simulations in 2001 at the sites of the June 2000 Bobcat fire and the November 1999 Lower Flowers prescribed fire. A third year of data is now being collected. For each simulation, rainfall is applied at 70-80 mm hr<sup>-1</sup> for 60 minutes. Researchers found that fire severity does not significantly affect the runoff rate, and this presumably is due to the relatively high rainfall rate. The runoff ratio for sites burned at high severity in the Bobcat fire declined from 66 percent in 2000 to 46 percent in 2001. Runoff ratios for sites burned at moderate severity decreased from 58 percent in 2000 to 40 percent in 2001. In contrast, there was no significant difference in runoff ratios with fire severity or between years for the simulations at Lower Flowers. Runoff ratios in both years were significantly related to soil water repellency and soil moisture. Sediment yields varied significantly with fire severity, but did not significantly decrease from 2000 to 2001. For the Bobcat fire, sediment yields from high-severity sites were seven times the value for sites burned at moderate severity, and 24 times the value for sites burned at low severity and unburned plots. Preliminary results from 2002 suggest similar runoff rates to 2001 and increasing variability in sediment yields.



*Studies...in the Colorado Front Range have shown that the largest runoff events and approximately 90 percent of the annual erosion are caused by convective storms from mid-July to early September.*

**Runoff, Erosion, and Effectiveness of Rehabilitation Treatments After the 2002 Hayman Fire, Colorado Front Range** —In May-June 2002 the Schoonover and Hayman fires collectively burned over 500 km<sup>2</sup> in the Colorado Front Range southwest of Denver. Post-fire effects on runoff and erosion are of tremendous public concern, because runoff directly affects Denver's water supply and the people in and adjacent to the burned area. The primary goals of this study are: (1) to evaluate the effects of these fires on runoff, erosion, and aquatic

resources at both the hillslope and small-catchment scales; and (2) to evaluate the effectiveness of the post-fire rehabilitation treatments.

At the hillslope scale we are using sediment fences in 17 paired swales to measure post-fire erosion rates and the effects of different post-fire rehabilitation treatments. Within each pair one swale is an untreated control and the other is being subjected to one of four treatments: hydromulching, raking and seeding, application of a polyacrylamide, or dry mulching. Rainfall is being recorded with tipping bucket rain gages, and for each swale we are measuring the independent variables of percent cover, soil water repellency, hillslope and swale axis gradients, and contributing area.

Runoff, water quality, and channel characteristics are being assessed in catchments that are 3.0 and 6.2 km<sup>2</sup>, respectively. Approximately the upper two-thirds of each catchment was burned at high severity, and the larger catchment will be treated by aerial mulching with the other being left as a control. Runoff is being monitored with 0.76-m H-flumes that were installed prior to or just after the fire. Water quality samples had been collected approximately monthly for one year prior to the fire, and will be collected on a more frequent basis after burning. Study reaches were established in these

two catchments as well as two other catchments that were burned in June 2002, and these are being remeasured in early and late summer 2002.

Studies on other fires in the Colorado Front Range have shown that the largest runoff events and approximately 90 percent of the annual erosion are caused by convective storms from mid-July to early September. Hence, the results from the first four months after burning should represent most of the hydrologic and geomorphic effects expected for the first year after burning.

**Watershed-level monitoring** looks at the effects of the restoration efforts on runoff and sediment production. A paired watershed approach uses Bobcat Gulch with BAER (burned area emergency rehabilitation) as the treatment watershed. Jug Gulch, a similar watershed, is burned but with no treatments. Professor Stednick and his graduate student, Matt Kunze, are measuring precipitation, runoff,





and sediment delivery at the watershed level. Sediment and water quality issues are important in the area, Stednick says, since the Big Thompson River is a drinking water source for the cities of Loveland and Greeley.

The summer convective storms measured in 2000 and 2001 resulted in variable watershed-level responses, but on occasion generated very large runoff events with high sediment concentrations. Immediately after the fire in the summer of 2000, rainfall and streamflow measurements started. Summer storms are variable in space and time, and characterization of precipitation intensities and depths required additional instrumentation. A network of ten rain gages in or near the watersheds was in place by summer 2001. During that summer, there were 72 rainfall events in Bobcat and 85 in Jug Gulch. Storms with maximum 30-minute intensities of 23 and 32 mm hr<sup>-1</sup> generated peak

runoff rates of 4.7 and 6.3 mm hr<sup>-1</sup> in the treated and untreated watersheds, respectively. Maximum 30-min rainfall intensities explained > 87 percent of the variability in the peak discharges.

Suspended sediment concentrations approached 42,000 mg L<sup>-1</sup> and turbidity approached 28,000 NTU. Maximum storm-specific suspended sediment yields were 670 and 1,200 kg ha<sup>-1</sup> for the treated and untreated watersheds, respectively. Sediment yields were correlated with rainfall intensity and storm erosivity. Although sediment yields were generally greater in the untreated watershed, with variability in rainfall and no precipitation events from summer 2002 no conclusions about the effectiveness of rehabilitation treatments at the watershed-scale can be made yet.



#### *Call for Papers: Small Flows Quarterly*

Papers are being accepted for the juried article section of Small Flows Quarterly, a magazine published by the National Small Flows Clearinghouse (NSFC). Nearly 43,000 subscribers receive Small Flows Quarterly, which is written for wastewater industry professionals, community leaders, engineers, researchers, and educators.

The technical and research papers included in the magazine are devoted specifically to small community wastewater topics. Papers in the following categories will be considered for peer review:

\*technology/research, \*operation and maintenance, \*regulations, \*management, \*finance, and \*public education.

For additional information about Small Flows Quarterly, manuscript submission guidelines, and publication deadlines, contact Cathleen Falvey at (800) 624-8301 or (304) 293-4191 or e-mail to [cfalvey@wvu.edu](mailto:cfalvey@wvu.edu).

.....  
The NSFC is a nonprofit organization funded by the U.S. Environmental Protection Agency to provide free and low-cost information about small community wastewater treatment. For more information about how the NSFC can serve you, visit our Web site at <http://www.nsf.wvu.edu>.

#### **A New Target**

The Nation's water utilities are preparing to defend themselves against possible terrorist attacks on pumping stations and pipes that serve its cities and suburbs. Water officials say the discovery of documents in Afghanistan indicate al-Qaeda terrorists have been investigating ways to disrupt the U.S. water supply on a massive scale. An FBI warning was confirmed in July by Tom Curtis of the American Water Works Association. He said that while no specific plans were found, al-Qaeda strategists were reported to have acquired "manuals on how water treatment works and how utilities operate – materials that could be used to plan an attack."

-----  
*Time Magazine, 7/22/02*



## NSF AWARD WILL FUND STUDY OF CONDITION AND SECURITY INDICATORS FOR ROADS, ELECTRIC UTILITIES AND WATER UTILITIES

The transportation infrastructure and electric and water utilities, whether government owned or investor owned, provide the basic support functions of our society. However, few data have been provided about the condition and security of these three interdependent infrastructures. While data about condition and security measures are available, they are detail-oriented and used mainly in budget processes. The public generally lacks information about these public/investor owned infrastructure systems.

Two CSU professors, Evan Vlachos of the Sociology Department and Neil Grigg of the Civil Engineering Department, have received a three-year National Science Foundation grant of \$269,000 to study this problem and provide recommendations to rectify it. Their goal is to create performance indicators of condition and security for three interdependent infrastructures – road transportation, electricity, and water supply — using emerging databases and software systems. These indicators would be used to detect problems and inefficiencies, improve coordination and cooperation, enhance condition and security, and provide better system information that will lead to more robust systems that operate better and last longer.

In the study, a few indicators will be selected from the large number available and from past failure incidents. This set of indicators will be refined in a case of infrastructure systems in the Northern Colorado study region, including a workshop of agency managers to learn how to use them. The workshop will show why indicators are not used more often or more effectively. Then, the project team will synthesize multi-attribute indicators, prepare a pilot version of an infrastructure report, and test the indicators on a stakeholder and public audience at a second workshop. This will show whether the public judges the information to be relevant for decision making and test the theory that management of public infrastructure can be improved if the public has more relevant and easily-understood information about condition and security. The project reports will provide a comprehensive review of infrastructure indicators, evaluate indicators and discuss how to synthesize fewer and more meaningful ones; evaluate the actual status of the use of indicators by managers; evaluate public acceptance of the indicators for their decision-making; and present reports with state-of-the-art assessments of use of performance indicators to improve independent and interdependent management of infrastructure systems.

*For additional information about the study, contact either Neil Grigg at E-mail [neilg@engr.colostate.edu](mailto:neilg@engr.colostate.edu), phone 970/491-3369, or Evan Vlachos at E-mail [evlachos@engr.colostate.edu](mailto:evlachos@engr.colostate.edu) or phone 970/491-6089.*

### THE U.S. EPA ON WATER-SUPPLY SECURITY

A frequently asked question of the EPA's Office of Water is: What is EPA doing to protect the drinking water supply?

EPA is working in partnership with state and local governments to protect the nation's drinking water supply from terrorist attack. Under Presidential Decision Directive (PDD) 63, issued in May 1998, EPA was designated as the lead agency for the water supply sector. The following is a brief description of the activities that have taken place since that directive:

- \* In September 1998, the agency established a public/private partnership with water-related organizations and subsequently appointed Diane Van de Hei, executive director of Association of Metropolitan Water Agencies (AMWA), as the water sector liaison to the federal government on critical infrastructure.
- \* Over the past several years, EPA and its partners have developed training for utilities on how to assess vulnerabilities, determine what actions need to be taken to guard against attack and develop emergency response plans.
- \* In October 2001, the Water Protection Task Force was established to ensure that activities to protect and secure water supply infrastructure are comprehensive and are carried out expeditiously.
- \* In October 2001, EPA Disseminated to America's water utilities useful information about steps they can take to protect their sources of supply and their infrastructure. Working with the FBI, EPA also sent notice to local law enforcement agencies asking them to work closely with their local water utilities to provide extra security.

For more information: Safe Drinking Water Web Site [www.epa.gov/safewater/](http://www.epa.gov/safewater/).

Drinking Water Basics [www.epa.gov/safewater/dwhealth.html](http://www.epa.gov/safewater/dwhealth.html), <<http://www.epa.gov/safewater/dwhealth.html>>

Local Drinking Water information [www.epa.gov/safewater/dwinfo.htm](http://www.epa.gov/safewater/dwinfo.htm)

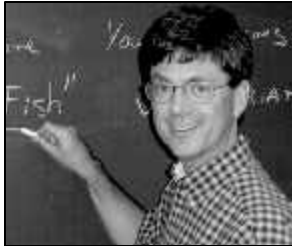
Centers for Disease Control and Prevention [www.cdc.gov/](http://www.cdc.gov/) <<http://www.cdc.gov/>>

-----  
 Extracted from the April 2002 University of Nebraska Water Center Newsletter: <<http://watercenter.unl.edu/watercurrent.htm>



## APPLICATIONS INVITED FOR CSREES DOCTORAL FELLOWS PROGRAM

Three additional Doctoral Fellows in Natural Resources and Environmental Science will be funded through a second grant award to Colorado State by the Cooperative State Research, Education, and Extension Service (CSREES) under its Higher Education Programs' (HEP) Food and Agricultural Sciences National Needs Graduate Fellowships Program. The award was announced in the April issue of *Colorado Water*.



*Jim Loftis*  
Bioresource and Agricultural  
Engineering  
[loftis@enr.colostate.edu](mailto:loftis@enr.colostate.edu)

The first grant by CSREES funded doctoral students Gary Fox, who is specializing in modeling the interactions of surface water and ground water resources; Marci Koski, whose project concerns food web relationships, tropic dynamics and how they relate to water quality and other aspects of aquatic ecology in western reservoirs; and Colleen Green, whose research topic involves runoff and leaching studies. The Principal Investigator and Project Director is Jim C. Loftis, Civil Engineering Department, and co-Principal Investigator is Jessica G. Davis, Department of Soil and Crop Sciences. The invitation for fellowship applications follows.



*Jessica Davis*  
Soil and Crop Sciences  
[jgdavis@lamar.colostate.edu](mailto:jgdavis@lamar.colostate.edu)

**Ph.D. Fellowships in Natural Resources and Environment.** Colorado State University invites applications for three USDA National Needs Fellowships in Natural Resources and Environment to begin either spring or fall 2003. Fellows may pursue the Ph.D. in any of six academic disciplines including Bioresource and Agricultural Engineering, Civil Engineering, Earth Resources, Fishery and Wildlife Biology, Soil and Crop Sciences, and Agriculture and Resource Economics. The six programs are located in three different colleges: Agriculture, Engineering, and Natural Resources.

The fellowships are administered through the Water Center at Colorado State University (<http://watercenter.colostate.edu/>), and carry a stipend of \$22,000 per year for three years plus a travel allowance to attend two national meetings. Fellows must be U.S. citizens and must have completed an M.S. degree. Awards will be made as soon as outstanding candidates have been identified. The Natural Resources and Environment Fellowship program at Colorado State supports research related to the increasing pressures on water and land resources in the rapidly developing "New West" and to conflicts between competing uses of natural resources, including agriculture, urban areas, and recreation.



*Deanna Durnford*  
Civil Engineering  
[durnford@enr.colostate.edu](mailto:durnford@enr.colostate.edu)

Potential research advisers include over twenty participating faculty. Fellows must be U.S. citizens and must have completed an M.S. degree. Awards will be made as soon as outstanding candidates have been identified.



*Brett Johnson*  
Fishery and Wildlife Biology  
[brett@cnr.colostate.edu](mailto:brett@cnr.colostate.edu)



*John Stednick*  
Earth Resources  
[jds@cnr.colostate.edu](mailto:jds@cnr.colostate.edu)

For more information and application materials contact one of the CSU faculty at left.

Colorado State University is  
an EEO/AA employer.



WELL - WATER EFFICIENT LEADERS IN LANDSCAPE

by Carl Wilson

CSU Cooperative Extension Horticulturist  
Denver, Colorado

Water study and discussions can take time to reach an action stage. In 1996, the Colorado landscape industry formed a task force to consider its position in relation to the state's water situation and decide what could be done proactively to improve it. This is an innovative idea in an industry that has historically become energized only when faced with water shortages and restrictions.

Representatives of Colorado State University Cooperative Extension, various water providers and other interested professionals partnered with GreenCO in this effort under the acronym WELL, Water Efficient Leaders in Landscape. The Green Industries of Colorado (GreenCO) is an umbrella group comprised of nine member organizations representing nursery, greenhouse, landscape and design professionals in the state.

With the droughts in California in the early '90s and later in northern New Mexico, the industry had heard first-hand reports of business and job losses. The question was not only what could be done, but whether individual businesses were willing to financially support an organized effort to take action. In early 2001, a plan was finally approved by the various boards. Goals of the effort are to:

1. Provide improved water management tools and resources for GreenCO members and their customers,
2. Partner with water providers to address supply and demand issues,
3. Develop a unified industry effort to ensure the health of the industry and environment,
4. Develop accurate information and make it easily accessible, and
5. Establish a commonly agreed upon standard for landscape water conservation practices.

These goals are aimed at both reducing non-point source pollution (water quality) and decreasing landscape water use (water conservation).

Work began on establishing industry-wide best management practices (BMPs) in 2001. This involved inventory more than the need for research. Colorado State University Extension and Research specialists played key roles in guiding this process to make sure BMPs were grounded in research wherever possible. Now compiled and valued, formal adoption by industry members is imminent. These landscape BMPs can be accessed at [www.greenco.org](http://www.greenco.org), the GreenCO website.



A simultaneous effort at industry outreach and marketing has been underway. Goals include offering information to industry members about proactive water conservation practices and technologies and clearly explain why it is in their competitive interest to move toward these goals. Another goal is to provide a unified, industry-led effort to engage GreenCO member-businesses in supporting and implementing wise water practices.



Part of this outreach effort has involved the services of a public relations firm to convene focus groups and develop communications products. In early 2002, key findings and a communications plan were developed and media outreach began. Simultaneous internal-industry and external-public outreach were deemed necessary to elevate the importance of landscape water conservation as an issue.

As with many well-laid plans, real-life events can rapidly overtake the planned efforts of years. The sleeping drought conditions in Colorado escalated into severe water shortages in many parts of the state by the summer of 2002. Daily news of low reservoir levels and municipal water restrictions have caused a shift of focus in WELL efforts.



Homeowner watering classes will kickoff in Denver in September and presentations by industry, Extension, water utility professionals and others are expected to be in demand throughout the upcoming winter and spring months. This effort is a prime example of community-centered work by Colorado State Extension and Research professionals.

While drought conditions have forced the pace at which the green industry must work to reach its goals, as in any crisis there is opportunity. It is hoped that the focus on landscape watering issues and WELL's outreach efforts



will lead to better, long-term water management by home, commercial and municipal landscape managers.



### ASSESSMENT OF IRRIGATION WATER MANAGEMENT AND DEMONSTRATION OF IRRIGATION SCHEDULING TOOLS IN THE FULL SERVICE AREA OF THE DOLORES PROJECT

by

*Abdel Berrada, Thomas M. Hooten and Mark W. Stack, SW Colorado Research Center  
Grant E. Cardon, Associate Professor of Soil and Crop Sciences, and  
Israel Broner, Associate Professor of Agricultural Engineering*

The Dolores Project was built in the 1980s to provide a dependable supply of water for irrigation, municipal and industrial use, recreation, fish and wildlife, and for the production of hydroelectric power. Dolores Project water is stored in McPhee reservoir, located near the town of Dolores in southwestern Colorado.

Irrigation water was delivered for the first time to farmers in the Full Service Area (Fairview, Pleasant View, Cahone, Hovenweep, Dove Creek, and Ruin Canyon) in 1987. The Full Service Area (FSA) total irrigation water allocation is 55,200 acre-feet, corresponding to 28,000 acres of irrigable land. The allocation was based on an ideal crop rotation of 55 percent alfalfa, 20 percent small grains, 15 percent dry bean, 3 percent pasture, and 7 percent corn (U.S. Department of the Interior, 1977). The diversion requirement is for this allocation is 1.97 acre-feet/acre, and the farm delivery requirement is 1.72 acre-feet/acre, based on a weighted crop consumptive use of 1.76 acre-feet/acre and farm irrigation efficiency of 70 percent. Conveyance and operational losses have been lower than expected, in effect raising the on-farm allocation to approximately 1.90 acre-feet/acre.

The number of FSA irrigated acres jumped from less than 2,000 acres in 1987 to approximately 24,500 acres in 2000, while the amount of irrigation water released at the Great Cut dike increased from 2,116 acre-feet to 57,284 acre-feet during the same period. The average farm delivery was 1.74 acre-feet/acre from 1987 to 2000, which exceeded the original allotment of 1.72 acre-feet/acre eight out of 14 years. The average farm delivery only exceeded the current allotment of 1.90 acre-feet/acre in 1989, 1996, and 2000, which were exceptionally dry years. In 2000, excess Municipal and Industrial (M&I) water was used to supplement the FSA allocation. This raises the concern that when most or all the allotted acres in the FSA are irrigated (only 87 percent were irrigated in 2000), there may not be enough water to irrigate at current usage rates, particularly in dry years. Fortunately, the irrigated acreage has not varied much since 1996 and may never reach the full allotment of 28,000 acres.

The relatively high water usage in the FSA is partly due to the much higher than anticipated acreage in alfalfa (90 percent in 2000), since alfalfa uses more water than small grains or pinto beans. Water management practices may

also be to blame, as evidenced by the results of a 1996 survey and field monitoring in 1997-1999.

### **Part I: Survey results**

Twenty-one percent of the respondents to the survey reported using sprinkler nozzles of nine gallons per minute (gpm) or larger, which far exceeded the FSA system capacity and could lead to significant runoff if not carefully managed (In fact, water runoff was observed by 63 percent of the respondents.) Runoff can be minimized through proper irrigation-system design, management, and maintenance. This is particularly important in the FSA, due to the erosive nature of the soils. Several respondents suggested using deep tillage and catch basins to increase soil water infiltration.

Seventy-four percent of the respondents reported using more than their water allocation in 1996, which was a particularly dry year. About half of the respondents reported using a shovel or soil probe to check soil moisture before irrigating, but it is not clear how this information was used to schedule irrigations. Only two of the respondents reported using crop consumptive-use (ET) information to schedule irrigation.

An encouraging outcome of the survey was the large number of respondents who indicated the need for information on irrigation equipment innovations, irrigation scheduling, and other information that could help them conserve water and get the most out of their water allocation. Several workshops and field demonstrations have been organized since 1997 to provide such information.

### **Part II: Calibration of the Watermark Soil Moisture Sensor and ETgage Atmometer.**

As a follow up to the first survey, Watermark moisture sensors and ETgage atmometers were used in 1997, 1998, and 1999 in the FSA to demonstrate and encourage the use of sound irrigation scheduling methods. Watermark sensors were installed in 13 crop fields in 1997 and 12



*Siderroll irrigation of alfalfa in the Dolores Project FSA.*

alfalfa fields in 1998. ETgage atmometers were used to monitor evapotranspiration at five locations. Irrigation and rainfall amounts were measured with rain gauges. Water balance tables were then constructed for each alfalfa field and year. Generally, the water balance was positive to near zero at the first alfalfa cutting and negative at the second and third cuttings. There was good to partial agreement between the Watermark-sensor readings and the water balance computations in 11 out of 17 alfalfa-field-by-year sites. Where there were large discrepancies between the two methods, Watermark sensor readings appeared to better reflect water availability to the crop than did the water balance computations.

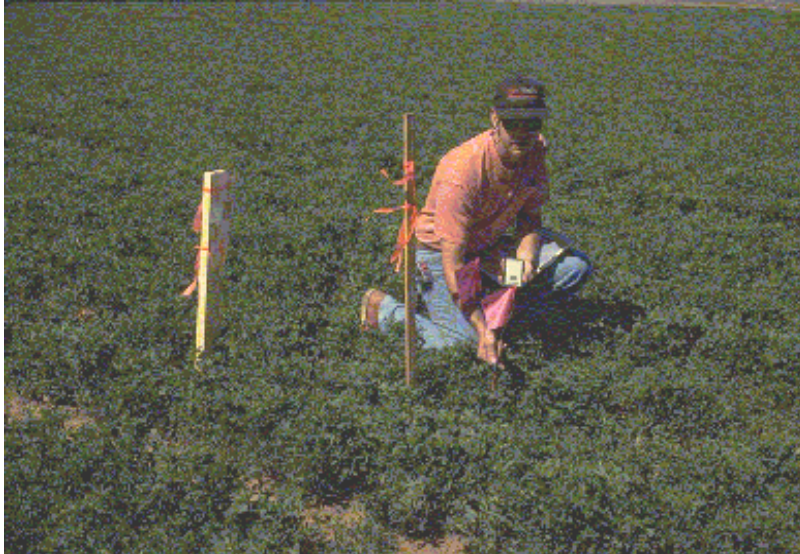
The water supply in most fields was not enough to keep up with crop evapotranspiration and maintain adequate soil moisture. It is important to perform the alfalfa haying operations as quickly as possible to begin resupplying irrigation water as soon as possible. The root zone should be filled early in the irrigation season, and attention should be paid to the design, operation, and maintenance of the irrigation system equipment. Watermark moisture sensors and ETgage atmometers are most useful for irrigation scheduling when used together.

A strong correlation was found between the Watermark sensor Model 200SS readings and water content of the FSA predominant soil type. Slow Watermark response to soil drying was observed at readings of approximately 0 to 10 kPa and above 150 kPa. Close agreement between alfalfa reference-evapotranspiration (ET<sub>r</sub>) values measured with ETgage Model A or computed using the 1982 Kimberly-Penman equation was achieved at Yellow Jacket

***Q: How many gallons of water does it take to produce a bushel of wheat?***

***Answer on page 22.***

during the growing season (May-Sept.) in 1997, 1998, and 1999. The highest correlation was obtained when ETr values were averaged over three and seven-day periods. The linear regression of weekly ETr averages for all three years was  $ET_{\text{gage}} ETr \text{ (inches)} = 1.014 \text{ Kimberly Penman } ETr$  ( $r^2 = 0.98$ ).  $ET_{\text{gage}}$  appears to underestimate ETr values during rainy days, possibly due to the saturation of the canvas cover with rainwater.



*Chuck Lawler reads the Watermark soil moisture sensor in an alfalfa field.*

**This study was initiated in 1996 and completed in 2000 to:**

**Assess irrigation water management in the Full Service Area (FSA) of the Dolores Project.**

**Demonstrate the use of the Watermark moisture sensor and the ETgage atmometer for irrigation scheduling purposes.**

**Initiate research and educational programs to address specific constraints.**

**Study results are compiled in three technical reports (Berrada et al., 2001a, b, and c).**

### *References cited*

- Berrada, A., M.W. Stack, and G.E. Cardon. 2001a. Assessment of Irrigation Water Management and Demonstration of Irrigation Scheduling Tools in the Full Service Area of the Dolores Project: 1996-2000. Part I: Survey results. Tech. Rep. TR 01-6, Agric. Exp. Stn., Colorado State Univ., Ft. Collins.
- Berrada, A., T.M. Hooten, G.E. Cardon, and I. Broner. 2001b. Assessment of Irrigation Water Management and Demonstration of Irrigation Scheduling Tools in the Full Service Area of the Dolores Project: 1996-2000. Part II: Calibration of the Watermark Soil Moisture Sensor and ETgage Atmometer. Agric. Exp. Stn. Tech. Rep. TR01-7, Colorado State Univ., Ft. Collins, CO.
- Berrada, A., T.M. Hooten, I. Broner, and G.E. Cardon. 2001c. Assessment of Irrigation Water Management and Demonstration of Irrigation Scheduling Tools in the Full Service Area of the Dolores Project: 1996-2000. Part III: Monitoring of Irrigated Alfalfa Fields Using the Watermark Moisture Sensor and ETgage Atmometer. Agric. Exp. Stn. Tech. Rep. TR01-8, Colorado State Univ., Ft. Collins, CO.
- U.S. Department of the Interior. 1977. Dolores Project Colorado. Definite Plan Report. April 1977. Appendix B: Water Supply. U.S. Department of the Interior. Bureau of Reclamation. Upper Colorado Region.



For additional information contact **Abdel Berrada** at E-mail [aberrada@coop.ext.colostate.edu](mailto:aberrada@coop.ext.colostate.edu) or phone 970/562-4255.



### MAPPING OF CENTER PIVOT IRRIGATION IN COLORADO

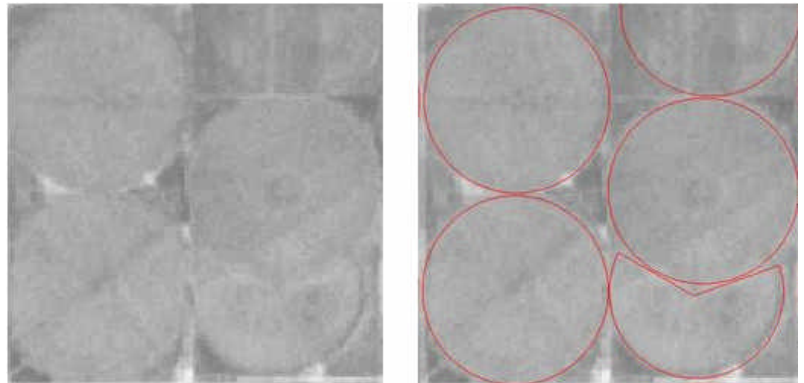
*by Jan Cipra Associate Professor, Department of Soil and Crop Sciences, CSU  
Reagan Waskom, CWRRI Water Resource Specialist, CSU*

*Troy Bauder, Extension Specialist, CSU*

*Michael Gossenauer, Pedology & Soil Information Systems, CSU*

*John Norman, Research Associate, Department of Soil and Crop Sciences, CSU  
and Susannah Geer, Pedology & Soil Information Systems, CSU*

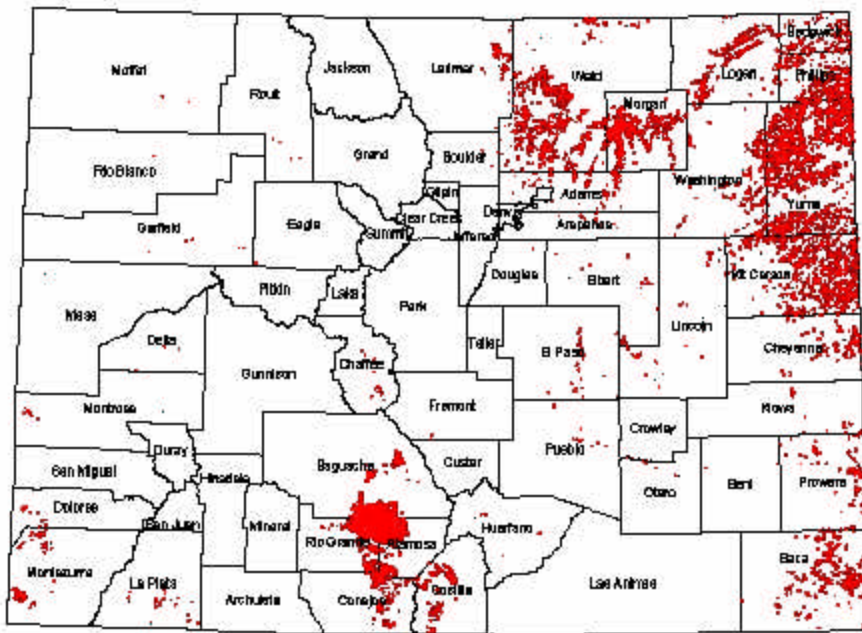
An accurate estimate of the number, acreage, and location of irrigated fields in Colorado would be valuable input in various irrigation, land use, and water quality studies. Several state maps and numerous regional irrigation maps currently exist, but they vary widely in scale, accuracy and methodology. Recent efforts to map the vulnerability of Colorado ground water to contamination from pesticides and nitrate-nitrogen (see Bauder et al, Colo. Water, April 2002) prompted the need to differentiate areas of the state that are predominately irrigated with center pivot irrigation systems. The higher efficiency of these systems generally results in enhanced water conservation and reduced potential for leaching of agricultural chemicals. A current map of center pivot irrigation may be useful for a number of water and land use investigations.



*Figure 1. This image displays a portion of the satellite imagery (on left) and the digitized pivots (on right).*

We developed an accurate center pivot map of Colorado from satellite imagery at high (15 meter) resolution. The data, obtained from DigitalGlobe imaging company, was captured by satellite from July 1 to November 4, 1999. Center pivots that were visible on the satellite image were digitized on-screen and saved as a pivots file (Figure 1).

After the entire state was digitized, the accuracy of the method was evaluated by ground checking portions of the pivot map. Three sampling units within the state (Yuma County, the San Luis Valley, and the lower Platte River basin) were delineated with contiguous sampling blocks drawn throughout each sampling unit. The sampling region represented 60% of the number of actual pivots digitized for the entire state (10,179 pivots). A field crew verified that pivots on the map matched actual pivots in the field. Based on the statistical sample of



*Figure 2. Center pivot irrigation distribution in Colorado (as mapped from 1999 satellite imagery).*

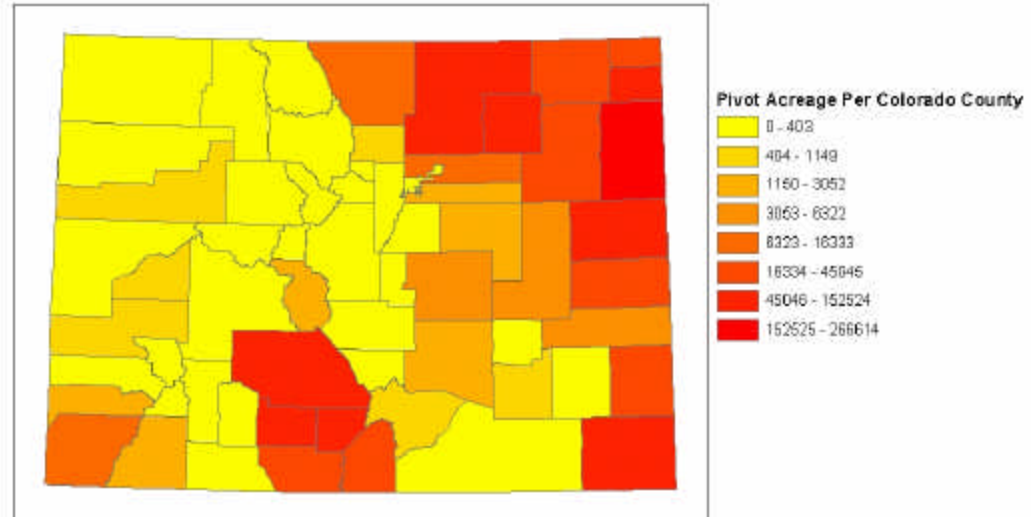




the field observations, the map was accurate within 1.5 percent.

The pivot map was summarized by the number of pivots in each county in Colorado (Figure 2) and the total acreage under pivot irrigation (Figure 3). In Colorado, 16 out of 62 total counties do not have any center pivots and 2 percent total land area in Colorado is covered by center pivot irrigation. Approximately 80 percent of the total number of center pivots are in ten counties: Yuma, Kit Carson, Weld, Morgan, Saguache, Rio Grande, Alamosa, Baca, Phillips, and Logan counties.

High-resolution satellite imagery proved very effective in producing an accurate center pivot irrigation map of Colo-



rado. This map has the potential to improve existing estimates of irrigated acreage in Colorado and can be used to aid water research at Colorado State University, including predicting aquifer vulnerability to nitrate leaching and to pesticide contamination. High-resolution imagery aids in both visual determination of pivot location and accurate acreage estimates. A follow-up project to develop a GIS map of all irrigated lands in Colorado is currently in progress.

Footnote: This study was funded by the Agricultural Chemicals and Groundwater Protection Program at CDA with assistance from USEPA Region 8, Pesticide Section.



### Alumnus Establishes Faoro Professorship in Water Resources

Established through a series of gifts made by Abraham B. and Jean M. Faoro since 1993, the Faoro Professorship in Water Resources was completed in 2001. Interest generated by the \$875,000 endowment will provide funds to establish a faculty position devoted to teaching and research in water. During 2002, the Department of Civil Engineering expects to recruit and hire a new faculty member to hold the Faoro Professorship.

Abraham Faoro, who passed away in 2001, graduated from Colorado A&M in 1932 with a bachelor of science in Civil Engineering. Faoro grew up in a coal mining camp in Rockvale, Colorado, where his father was a coal miner. He attended school in Florence and was one of the first Rockvale residents to attend college. Faoro worked in the oil industry in California and was employed for 35 years by the Shell Oil Company.

*The Department of Civil Engineering Newsletter, Spring 2002, Vol. 8, No. 1*



## COLORADO STATE FOREST SERVICE DEVELOPS FIREWISE PROGRAM FOR THE EASTERN PLAINS

by Katherine Timm, Colorado State Forest Service

The sight of smoke in Colorado's foothills and mountains is common this year. Though they seldom make the headlines, wildfires on the plains are also common — and they can be every bit as dangerous and devastating as forest fires.

Farmers and ranchers on Colorado's eastern plains often burn ditches and fields to control the spread of weeds, rid fields of stubble and promote growth of desirable plants. But a sudden shift in the wind can create a dangerous situation not only for the people monitoring the burn, but also for homes, crops, livestock and watersheds. When combined with Mother Nature's unpredictability, human influences such as sparks from mechanical equipment, welding, downed power lines, hunting and camping can significantly increase the risk of catastrophic wildland fire.

The occurrence of grass fires depends largely on the weather. Colder, wetter winters mean the ground is less likely to support large fires in the springtime, and most grass fires occur in the spring and fall. In general, wildfires are becoming larger and more severe on rangelands in the western United States; the primary cause is the arrangement of fuels such as grass and shrubs. The loss of native plants allow non-native annual plants to dominate the landscape, which means loss of wildlife habitat, an increase in noxious weeds and potential for rapid erosion and soil loss — which affect water quality and quantity in ecosystems that are

already hard-pressed to meet public demand for this essential resource.

The drought conditions in the state prompted many fire management agencies to prepare for an early and active fire season that they knew would stretch resources. The most important tool in their arsenal is public education and information that provides agencies, fire departments and landowners with strategies to prevent and mitigate large, dangerous fires.

In an effort to help Eastern Plains residents understand how to protect their families, homes, farms, ranches, wildlife, watersheds and wetlands from being devastated by catastrophic wildland fire, the Colorado State Forest Service (CSFS) is developing FireWise for the Plains. The Are You FireWise? program that was developed for Colorado's wildland-urban interface will serve as the model.

“Due in large part to media exposure, most Coloradans are familiar with what can happen when a wildfire occurs in densely forested areas where homes have been built, but they don't often hear about the risks associated with wildland fires on the plains,” said Damon Lange, CSFS district forester, Fort Morgan. “The goal of the plains FireWise program is to give eastern Colorado residents and visitors the knowledge they need to help prevent and mitigate catastrophic wildfires and protect the area's natural resources.”

“Rural communities rely on watersheds to provide the moisture needed to grow crops and raise livestock, and riparian areas to provide essential buffer strips

for water quality and wildlife habitat. It becomes critical to support resident and visitor understanding about their role in wildfire prevention. They are our first line of defense in our vast resource landscape with multiple ownerships and boundaries,” said Donna Davis, CSFS district forester, LaJunta.

The LaJunta and Fort Morgan district foresters — who live and work in plains communities — are providing the leadership to develop and implement the plains FireWise program, which will be piloted later this year and implemented in 2003.

### *FireWise for the Plains will focus on the following:*

*Fire History* — includes pre-settlement and current conditions of the plains, grassland/shrubland species and riparian ecosystems.

*Prevention/Ignition/Fire Behavior* — addresses fire behavior issues such as flame lengths for various plant/grass species; distance a grass fire can travel in 15 minutes (the length of time it may take for fire department personnel to respond); ignition impacts of railroad, haystacks, burning trash and ditches, unattended and smoldering piles of debris, power lines, welding, vehicles and equipment; and the impact of wildfires on fencing, livestock, Conservation Reserve Program (CRP) grasses, riparian areas and watersheds.

*Creating Defensible Space* — explains how to protect homes, barns and feedlots by creating windbreaks,

cutting tall grasses and manipulating vegetation where vehicles and equipment are parked.

*After the Fire* — talks about the aftermath of fire, which often causes erosion, promotes blowouts on sandy soil and increases invasive species.

*Property Access/Water Availability* — looks at issues that can affect firefighter safety and access to property including soft shoulders on roads, narrow bridges, blowing sand and inadequately marked or obscure addresses. This section also addresses accessibility to water sources necessary to fight fire, such as cisterns, ponds and stock tanks.

*Prescribed Fire on the Plains* — discusses how to prepare for and safely conduct a prescribed fire to

reduce tall grasses and other vegetation that increases risk of catastrophic fire.

*Construction* — addresses the use of construction materials that reduce the risk of losing a home and outbuildings to a wildfire; places special emphasis on mobile and modular homes.

*General Interior Safety* — examines what homeowners can do to protect and prepare their families in the event that a fire occurs; for example, installing fire detectors, developing an escape plan, purchasing fire extinguishers.

*What to Do When* — provides advice on what to do to protect people and possessions during the various stages of a wildfire from the time smoke is first seen to the time flames are licking the

siding of a home or barn (including evacuation procedures).

*Resources* — provides a list of resources to contact to learn more about any of the previous topics.

“We know from experience that the FireWise concept is an effective way to help raise awareness of how and why wildland fires spread so quickly. It’s also an important tool for fire management agencies, fire departments, county sheriffs and others to inform and teach landowners how to prevent a wildfire from robbing them of their livelihood and compromising important natural resources,” said Judy Serby, conservation education division, CSFS.

### *FireWise Tips for the Plains*



- Reduce flammable vegetation within 30 feet around your house to make it easily accessible to firefighters.
  - Carefully space the trees you plant.
  - Remove “ladder fuels” that link the grasses and treetops.
  - Create a “fuelbreak” with driveways, gravel walkways or lawns.
  - Regularly maintain irrigation systems.
  - Prune tree limbs so the lowest is between 6 feet-10 feet from the ground.
  - Remove tree leaves and needles from the roof and yard.
  - Mow regularly to a height of 6 inches or less.
  - Remove dead or overhanging branches and trim live branches so they are at least 10 feet away from structures.
- Store firewood away from the house and outbuildings.
  - Carefully refuel gas-powered equipment.
  - Regularly maintain garden and agricultural equipment.
  - If you smoke, use an ashtray.
  - Properly store and use flammable liquids.
  - Promptly dispose of cuttings and debris according to local regulations.
  - Observe local regulations regarding vegetative clearances and fire safety equipment requirements.
  - Check generators and hoses to be sure they are in good repair.
  - Don’t keep combustible materials under decks or elevated porches.
  - Make trellises of non-flammable metal.
  - Have at least two ground-level doors as safety exits.
  - Keep at least two means of escape (doors and windows) in each room.
  - Clearly mark driveway and access roads.
  - Check with your local fire department to determine the amount of space firefighters need to turn around fire equipment near homes and livestock buildings.
  - Cover vents with wire mesh no larger than 1/8-inch to prevent sparks from entering the house.
  - When possible, use construction materials that are fire-resistant or non-combustible.
  - Do not park motorized equipment in tall grass.
- Install propane tanks a minimum of 30 feet away from homes, livestock buildings and other structures.



## NATURAL RESOURCES LAW CENTER

### Living With The Endangered Species Act in Colorado A Workshop/Discussion Series in 2002

The series concludes with a look at emerging approaches for species and habitat protection in Colorado. *Instructor: Larry MacDonnell.* To register contact Jeannie Patton by phone at (303) 492-1288 or by e-mail: [jpatton@spot.colorado.edu](mailto:jpatton@spot.colorado.edu). You may also fax in your registration form to (303) 492-1297.

<http://www.colorado.edu/Law/NRLC/>

Session Five, Sept. 19, 2002

#### Living With the Endangered Species Act in Colorado

8:30 a.m. - 4:30 p.m., 5 CLE credits

Cost: \$100 with CLE, \$75 without CLE

Renaissance Hotel, 3801 Quebec, Denver



### ENERGY FELLOWSHIP OFFERED AT NATURAL RESOURCES LAW CENTER

The Natural Resources Law Center at the University of Colorado in Boulder invites applications for the El Paso Energy Corporation Law Fellowship for the spring semester (January-May) 2003. The El Paso Energy Foundation funds the fellowship. The chosen Fellow will spend the spring 2003 semester in residence at C.U. in order to work on a research project on oil and gas, mineral, energy, air and water resources, public lands, or other areas of environmental or natural resource law and policy. The emphasis is on legal research, but applicants from law-related disciplines such as economics, engineering, and the natural and social sciences, are invited to apply. Candidates may come from business, government, legal practice, or universities.

The Fellow will have opportunities to exchange ideas with faculty and students at the Law School, as well as the broader university and legal and policy-making community in the Denver-Boulder area. The fellowship includes a stipend of \$25,000, administrative and part-time research assistance, office space in the Law School, and use of University libraries and other facilities. Fellows are expected to produce a written project suitable for publication in a professional journal, present at least two lectures or seminars on their research, and participate with Center staff on projects and activities at the Center relevant to their research.

Candidates should submit a proposal in the form of a letter or statement describing the candidate's proposed research project, along with a resume. Candidates should arrange for two or three letters of support to be sent directly to the Center on their behalf. Criteria for evaluation of proposals include the applicant's professional and educational qualifications, demonstrated research and writing ability, importance and relevance of the proposed project, and the likelihood the project will result in publishable research that will contribute to better understanding of issues and improved policy making.

In addition to the El Paso Energy Corporation Law Fellowship, the Center invites, on an ongoing basis, applications for fellowships without stipends in all areas of natural resource law and policy. The application process is the same as for the El Paso Fellowship.

Submit application materials to Jim Martin, Director, Natural Resources Law Center, 401 UCB, Boulder CO 80309-0401. The Center will begin reviewing applications on August 31, 2002. No phone calls, please.





## CONFERENCE BRINGS INTERNATIONAL WATER EXPERTS TO BOULDER

by Doug Kenney  
Natural Resources Law Center

One of the most ambitious water conferences in Colorado's history was held in June on the University of Colorado campus. Sponsored by the Natural Resources Law Center (NRLC), *Allocating and Managing Water for a Sustainable Future: Lessons from Around the World*, drew upon the insights of approximately 70 domestic and international presenters and roughly 200 attendees to address water issues of concern in the American West. By casting a global net in search of solutions to local water problems, the focus of the event was clearly atypical—a sentiment captured eloquently by Professor Wang Xi, Wuhan University (China), who fondly described the conference organizers as a “different group” of Americans.

The ambitious 5-day program kicked off on Monday, June 11, with field trips exploring the Colorado-Big Thompson Project and water management activities in the Boulder Valley. Formal presentations began the following day with a variety of free events open to the public. Presentations by Patricia Wouters, Director of the International Water Law Research Institute (Dundee, Scotland), and Peter Gleick, Director of the Pacific Institute for Studies in Development, Environment and Security (Oakland, California), provided bookends to a day of 45 contributed papers covering an extremely diverse range of domestic and international water issues. Some of the nation's featured in these presentations included Australia, Bolivia, Brazil, Canada, Chile, China, Costa Rica, Cuba, Germany, India, Japan, Mexico, Nepal, Thailand, Turkey, and Vietnam. Like the field trips, the day of contributed papers was a new and much appreciated addition to the typical format of NRLC water conferences, held every June.

The formal (registration only) conference began on Wednesday with a presentation by University of Colorado geographer Jim Wescoat, who showed that the importation of water management lessons to the United States was rare, but not completely without precedent. The remainder of the day was led by Professors Chuck



**Wang Xi (Research Institute of Environmental Law, Wuhan University, China), David Getches (University of Colorado), and Sarah Van Derwesterling (writer/attorney, Montana) discuss “Water Wars or Water Peace” in Thursday’s session.**

Howe, University of Colorado, and Helen Ingram, University of California-Irvine, and explored the use of markets and governmental mechanisms to allocate water. Panelist presentations highlighted experiences throughout South America, Australia, Asia, and Europe, and emphasized the importance of nesting market mechanisms within well-designed governmental structures, and of ensuring that the full spectrum of water values and distributional concerns are addressed in allocation frameworks.

On Thursday, the focus shifted to the protection of environmental interests in water, and to the challenge of honoring indigenous rights in modern water management regimes. These twin topics were balanced admirably by David Getches, University of Colorado School of Law, and Sarah Van de Wetering, a Missoula writer and attorney and former Associate Director of the NRLC. International panelists provided lessons from South Africa, Brazil, China, and Australia. As expected, the theme of protecting public values in water management was shown to be a nearly universal concern, pursued worldwide through a variety of imperfect strategies.

On Friday, transboundary issues took center stage in a lively discussion lead by University of Oregon professor

Wolf. Both international and interstate issues were addressed, as well as disputes between sectors, values, cultures, and management approaches. Presentations focused on conflict resolution and cooperative management in several international basins, including the Mekong, Okavango (in southern Africa), the West Bank, Ganges and Danube, as well as the Colorado and Columbia basins in North America. This broadly focused discussion provided a natural segue to the event's final session chaired by Dan Tarlock, Chicago-Kent School of Law, and Lakshman Guruswamy, University of Colorado School of Law. Returning the conference to the central theme of sustainability, this closing discussion helped to provide a context for evaluating the merits of the lessons identified.

Tucked within this formidable agenda were luncheon presentations by Deborah Moore, former Commissioner to the World Commission on Dams, and David Hayes, former Deputy Secretary, U.S. Department of the Interior. Other activities included "brown bag" discussions led by Colorado Supreme Court Justice Gregory Hobbs and Colorado Water Judge Jonathan Hays. Equally valuable were the festivities occurring "under the tent," at the Flagstaff cookout, and the Hydrosphere-sponsored reception, where new friendships blossomed and collaborations were pondered.

Despite the scale of the event and the diversity of the presenters and presentations, most attendees left with a



*David Farrier, Professor at University of Wollongong, Australia, makes a point about indigenous water rights.*

greater appreciation of the common threads that challenge water managers across the world and, similarly, across the West. Finding the best balance between private and public interests, and between different sectors and jurisdictions, are universal challenges. As demands on limited water resources grow, we would be wise to actively seek lessons and solutions from as many sources as possible.

*A collection of conference materials is currently being finalized, and will be available in CD form for \$10 from the Natural Resources Law Center (303-492-1272, <http://www.colorado.edu/Law/NRLC/2002Conference.htm>). A book based on the event is also under production.*

**A: It takes 20,000 gallons of water to produce a bushel of wheat.**

**Source:  
America's Clean Water  
Foundation**



*International guests enjoyed Rocky Mountain ambience at the outdoor dinner on Flagstaff Mountain.*



### International Ground-Water Modeling Center

## Plan to Learn More Modeling Skills from IGWMC Short Courses

**APPLIED ENVIRONMENTAL STATISTICS** — August 12-16, 2002 – By Dr. Dennis Helsel and Dr. Ed Gilroy

**PRACTICAL SIMULATION OF VARIABLE-DENSITY FLOW, SOLUTE TRANSPORT, AND SEAWATER INTRUSION** — October 21 - 25, 2002 – By Dr. Clifford Voss and Dr. Craig Simmons

**MODFLOW: INTRODUCTION TO NUMERICAL MODELING** — October 23 - 26, 2002 – By Dr. Eileen Poeter

**UCODE: UNIVERSAL INVERSION CODE FOR AUTOMATED CALIBRATION** — October 25 - 26, 2002 – By Dr. Eileen Poeter

**SUBSURFACE MULTIPHASE FLUID FLOW AND REMEDIATION MODELING** — October 31 - November 1, 2002 – By Dr. John McCray

**PHREEQC MODELING: THE BASICS** — October 31 - November 1, 2002 – By Dr. Geoffrey Thyne

**For more information, contact**

**International Ground-Water Modeling Center**

Colorado School of Mines, Golden, Colorado, 80401-1887

Telephone: (303) 273-3103 / Fax: (303) 384-2037

Email: [igwmc@mines.edu](mailto:igwmc@mines.edu)



### Call for Papers

## **MODFLOW and More 2003: Understanding through Modeling An International Ground Water Modeling Conference and Workshops**

**September 17-19, 2003**

**Co-sponsored by the US Geological Survey**

The MODFLOW conference series has become a tradition for the presentation of cutting-edge practical application of ground water models in all aspects of hydrologic work. MODFLOW, the USGS modular three-dimensional finite-difference, ground-water flow model, has become an international standard for ground-water modeling. MODFLOW serves as a centerpiece for the recurring conference, but only because of its widespread use and its status as a community model. The conference organizing committee needs and encourages participation by users of all types of models in all kinds of applications, so that the modeling capability of the profession will evolve. MODFLOW is a basis from which other models can be considered. The advantages and disadvantages of alternative codes can be reflected from MODFLOW with which nearly all modelers are familiar.

For conference topics, abstract submission, registration, and other information see the website

**<http://www.mines.edu/research/igwmc/>**

Organizing Committee

Eileen Poeter, *IGWMC, Colorado School of Mines*  
Mary Hill, *US Geological Survey*

John Doherty, *Watermark Computing, Australia*  
Chunmiao Zheng, *University of Alabama*



## 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 Awards for May 29, 2002 to July 12, 2002

Title	PI	Dept	Sponsor
Survey of Critical Wetlands & Riparian Areas in Mesa County	Culver, Denise	FWB	CDWL
Bedrock Channel Incision in the Colorado Front Range	Wohl, Ellen	Earth Res.	NSF
Water Vapor, Clouds & Surface Temperature: Empirical Analysis of Daily Data	Campbell, G. Garrett	CIRA	NSF
Characterizing & Modeling the Variability of Hourly Precipitation	Salas, Jose	Civil Engr.	NSF
Structure & Function of Northern Ecosystems & Their Response to Global Change	Binkley, Daniel	Forest Sci.	USGS
Information & Communications in Road, Water, & Electricity Infrastructures	Grigg, Neil	Civil Engr.	DOC
Assembly & Reliable Function of Food Webs: A Network Approach to Coastal, Tropical River	Covich, Alan	FWB	NSF
Comparison of Reclamation Treatments at the Buffalo Creek Wildfire Site	Barbarick, Ken	Soil & Crop Sci.	EPA
Wetland Project Design to the State for Wetland Conservation & Protection	Culver, Denise	FWB	CDWL
Virus Detection in Aqueous Streams Using Optical Detection of Binding to Protein Nanoarrays	Dandy, David	CBE	EPA
Statewide Boreal Toad Surveys & Monitoring	Lambert, Bradley	FWB	CDWL
Landscape-scale Fire Patterns in the Ponderosa Pine/Upland Shrub System	Savidge, Julie	FWB	USGS
Geomorphic Assessment of Fisheries Enhancement Features on the Big Sandy River, Wyoming	Bledsoe, Brian	Civil Engr.	USBR
Explaining Broad-scale Fire Patterns in the Western & Southern United States	Omi, Philip	Forest Sci.	USDA
Synthesis Documents on Infrastructure Integrity	Grigg, Neil	Civil Engr.	AWWA Res. Fdn.
Toward Understanding Lifecycle of Tropical Cirrus	Stephens, Graeme	Atmos. Sci.	NASA
Cumulominbus/Cirrus Interactions in the Subtropics	Cotton, William	Atmos. Sci.	NASA
Establishing the Status & Trends of Impaired, Threatened, & Outstanding National/State Resource Waters...	Loftis, Jim	Civil Engr.	NPS
Synthesis, Digitization, & Analysis of Clean Water Act Impairments & Use Designations for National Park System Water ...	Loftis, Jim	Civil Engr.	NPS
Zooplankton Monitoring Plan	Johnson, Brett	FWB	N. Fr. Range Water Qlty Plan. Assn.

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, 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 Astrodynamic 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.



UNIVERSITY OF COLORADO, BOULDER, COLORADO 80309  
Awards for April-June, 2002

Title	PI	Dept	Sponsor
Arctic Acoustics Monitoring for Ocean Climate Change	Naugolnykh, K.	CIRES	NATO
Investigation of Soil Aquifer Treatment for Sustainable Reuse: Characterization of Effluent Organic Matter (EFOM)	Amy, Gary	CEAE	Ariz. State Univ.
Width Adjustment in Mixed-Load Rivers	Pitlick, John	Geography	NSF
Spatial Analysis and Calibration of Glacier-Climate Relationships Across Alaska	Manley, William	IAAR	NSF
Carbon, Climate and Society	White, James	IAAR	NSF
<b>Characteristics of Snow Megadunes and Their Potential Effects on Ice Core Interpretation</b>	<b>Scambos, Theodore</b>	<b>CIRES</b>	<b>NSF</b>
Land-Atmosphere Interactions in Beringia Over the Last 21 KA: An Investigation of Climate Feedback Using the Arctic Regional Climate System Model	Lynch, Amanda	CIRES	NSF
The Dynamics of Water Vapor in the Tropics	Mapes, Brian	CIRES	NSF
Scaling and Allometry in River Networks-Coupling Rainfall, Topography, and Vegetation with Hydrological Extremes	Gupta, V.K.	CIRES	NSF
Global and Regional Impacts of Mesoscale Variability in Air-Sea Fluxes	Webster, Peter	ACAR	NASA
Global Land Ice Measurements from Space	Scharfen, Gregory	CIRES	NASA
Isotopic Characteristics of Precipitation Across the U.S. - Patterns and Processes	White, James	IAAR	NSF
Reconstructing the Past 20,000 Years of Glacial and Sea-Level History for Severnaya Zemla, Russia, 80 North	Lubinski, David	IAAR	NSF
History and Evolution of the Siple Coast Ice Stream as Recorded by Former Shear Margin Scars	Scambos, Theodore	CIRES	NSF
<b>Chemical Orientation in Turbulent Environments Above Natural Stream Substrates: The Role of Bed Roughness and Turbulence Structure on Search Mechanisms</b>	<b>Crimaldi, John</b>	<b>CEAE</b>	<b>NSF</b>
Applications of Aeronsondes to Long-Term Measurements of the Atmosphere and Sea Ice Surface in the Beaufort/Chukchi Sector of the Arctic Ocean	Curry, Judith	ACAR	NSF
<b>Assessment of Basal Melt of Petermann Gletscher in Northwestern Greenland</b>	<b>Steffen, Konran</b>	<b>CIRES</b>	<b>NASA</b>
Validation Studies and Sensitivity Analysis for Retrieval of Snow Albedo and Snow Covered Area from EOS AM-1 Instruments	Nolin, Anne	CIRES	NASA
Accounting for Spatial Variability of Clouds and Water Vapor in Large-Scale Models - Transfer of DOE DE-FG02-OOER62933	Pincus, Robert	CIRES	DOE
<b>Analysis and Implementation for Support for Various Water and Environmental Systems</b>	<b>Zagona, Edith</b>	<b>CADSWES</b>	<b>DOA</b>
<b>Aerosonde Observations of Storm Scale Processes in the Marginal Sea Ice Zone</b>	<b>Curry, Judith</b>	<b>AE program in AOS</b>	<b>DON</b>
<b>Removing Heavy Metals (Such as Arsenic and Chromium) Via Innovative Adsorption, Coagulation and Softening Technologies...</b>	<b>Sinha, Shahnawa</b>	<b>CEAE</b>	<b>U.S. Filter Eng. &amp; Cons.</b>
<b>Canyon Lands Integrated Ecological Assessment - Phase I: Ecosystem Characterization at the Canyon Country Ecological Research Site</b>	<b>Bourgeron, Patrick</b>	<b>IAAR</b>	<b>NC</b>
McMurdo Dry Valley Long-Term Ecological Research	McKnight, Diane	IAAR	Ohio State U.
An Investigation of Very Low Frequency Sea Level Change Using Satellite Altimeter Data	Nerem, Robert Steven	ACAR	Jet Propulsion Laboratory
Using Global Terrestrial GPS Measurements to Unravel the Emerging Altimetric Record of Global Sea-Level Change	Nerem, Robert Steven	ACAR	Jet Propulsion Laboratory
The Niwot Ridge Long-Term Ecological Research Program 1998-2004: Controls on the Structure, Function and Interactions of Alpine and Subalpine Ecosystems of the Colorado Front Range	McKnight, Diane	IAAR	NSF
Environmental Changes and Human Responses in the North Atlantic (Iceland and Greenland Sectors) During the Last 2000 Years	Ogilvie, Astrid	IAAR	NSF
Seasonal Differences in Air-Snow Chemical Relationships at Summit, Greenland	Steig, Eric	IAAR	NSF
<b>Scaling and Allometry in River Network; Coupling Rainfall, Topography, and Vegetation with Hydrological Extremes</b>	<b>Gupta, V.K.</b>	<b>CIRES</b>	<b>NASA</b>
Retrieval of Hydrometer Size Distributions from TRMM Field Campaign Profiler Doppler Velocity Spectra Observations	Williams, Christopher	CIRES	NASA



## WATER SUPPLY

The dismal July 1, 2002 SWSI values continue to convey the drought conditions that grip the entire state. The SWSI values for the Colorado, Yampa/White, and San Juan/Dolores River basins have essentially bottomed out at -4.1 (the lowest possible value that could be computed is -4.17). Conditions in the Arkansas River basin are worse than the SWSI value indicates, as that value is believed to be inappropriately elevated due to a statistical problem associated with the reservoir storage component of its make-up.

Record low stream flows are occurring around the state. Only the most very senior of water rights are able to divert from the rivers. Storage supplies in many irrigation reservoirs are expected to be gone by the end of the irrigation season, unless the users make a difficult decision to hold the water over to next year. Precipitation during June was well below normal across the state. Some areas received rain showers, but others received no precipitation at all during the month. Lack of precipitation and reduced deep percolation from the reduction

of irrigation diversions are adversely affecting wells through a lowering of ground water levels. A lack of required replacement water to make up for steam depletions is affecting the legal ability of some wells to pump. Many, if not most, water districts and municipalities are restricting water use, and water conservation is the name of the game.

The Surface Water Supply Index (SWSI) developed by the State Engineer's Office and the USDA 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 streamflow, reservoir storage, and precipitation for the summer period (May through October). During the summer period, streamflow 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, 2002, and reflect the conditions during the month of June.

Basin	7/1/02 SWSI Value	Change from the Previous Month	Change from the Previous Year
South Platte	-3.2	-1.7	-3.8
Arkansas	-1.7	-0.2	-1.8
Rio Grande	-3.9	-0.4	-2.3
Gunnison	-3.9	-1.4	-2.5
Colorado	-4.1	-0.4	-1.1
Yampa/White	-4.1	-0.1	-0.8
San Juan/Dolores	-4.1	0.0	-3.1

SCALE								
-4	-3	-2	-1	0	+1	+2	+3	+4
Severe Drought	Moderate Drought	Near Normal Supply	Above Normal Supply	Abundant Supply				



### NDWC Launches New Web Pages for Children

Located at <http://www.ndwc.wvu.edu>, the National Drinking Water Clearinghouse (NDWC) Web site has a new section devoted to teaching children about water. We've gathered a list of illustrated children's books with water themes. Here's a sampling: Excuse Me Sir, That's My Aquifer; The Raindrops' Adventure: From Raindrops to Rainbows; and The Water's Journey. In addition to the title, we include the author, year of publication, publisher's link, and price for each book.



We've also started a healthy list of Web sites that offer fun ways to learn about the water cycle, groundwater, and conservation. A few of those sites include: \* Give Water A Hand, \* Water Education for Teachers, \* U.S. Geological Survey Water Science for Schools, \* EEK! Environmental Education for Kids, \* Educating Young People About Water, \* The Groundwater Foundation, \* U.S. Environmental Protection Agency Kid's Pages.

The NDWC, a partner organization to the National Small Flows Clearinghouse, was established in 1991 and is funded by the U.S. Department of Agriculture Rural Utilities Service. Anyone interested in providing clean drinking water for small communities can benefit from the NDWC's free services, which include On Tap magazine, more than 250 educational products, a toll-free technical assistance hotline, and three computer databases.





## WATER NEWS DIGEST

by Marian Flanagan

### DROUGHT AND ITS EFFECTS

#### Colorado's Drought Chronology

This year's drought is one of the worst in 120 years, said climatologist Nolan Doesken with the Colorado Climate Center at Colorado State University in Fort Collins. The area is the driest it's been since 1952-1956 and the 1930s dust bowl days. Doesken said that the 1930s drought didn't really end until 1941. The next drought in Colorado occurred from 1952-56 and another in 1976-77. When Doesken talks about the historical record, he's talking about the last 150 years, when weather statistics began to be recorded. He acknowledged that there are researchers who look at an even bigger picture - the tree rings of elderly pine trees in Colorado that are nearly 300 years old. "Tree ring research shows that there have been periods of drought in the region during the last 300 years, and the 1930s wasn't the worst of them," he said. Doesken said he remains optimistic about the return of more normal rainfall in the near future. He noted that the hard drought of 1956 was followed by 1957 - one of the state's wettest years on record

*Aurora Daily Sentinel*, July 24, 2002; *The Pueblo Chieftain*, June 2, 2002

#### Dillon Reservoir not likely to hit normal level for 3 years

Even if normal precipitation resumes, Denver Water officials say it will take three years for Dillon Reservoir to get back to normal levels. "It all depends on the weather," said Marc Waage, Denver Water's manager of raw water supply. "It would take one of our best runoff years to have a chance of filling it back up in one year." Dillon Reservoir is now about 72 percent full. It has a capacity of 254,000 acre-feet of water and now is holding 183,000 acre-feet. Said Waage, a 16-year Denver Water employee, "We've never in our history gotten to the point where we would have to drain all our reservoirs. I don't think we'll ever get to the point where we drain all our reservoirs. But 2002, so far, is on pace to be the worst of any year we use in our planning models." In addition to Dillon Reservoir, Denver Water owns the Cheesman and Williams Fork reservoirs. Those bodies of water have been drained down farther than Dillon, with Cheesman now sitting at 43 percent of its capacity and Williams Fork at 56 percent of capacity.

*Summit Daily*, June 27, 2002

#### Water deal prevents a 'call' on the Gunnison

A hydropower facility and wardens of endangered fish have agreed to reduce their demands on the Gunnison River to preserve water for farms and ranches gripped by the lingering drought. The U.S. Bureau of Reclamation (USBR) agreed to release storage water from Blue Mesa Reservoir in exchange for reduced demands from the U.S. Fish and Wildlife Service (USFWS) and Redlands Water and Power. The agreement ensures the water is released from Blue Mesa Reservoir to fill the demands of Redlands Water and Power and USFWS. It also ensures that a call is not placed on the river, allowing junior water users access to what little water is available for irrigation this year. Redlands Water and Power Co. agreed to drop its normal demand for water by 20 percent, said Eric Kuhn, manager of the Colorado River Water Conservation District (CRWCD). The flow of water into its hydropower facility, normally 750 cubic feet per second, will drop to 600 cfs, he said. CRWCD will compensate the company for any lost revenues when water declines at its power plant. USFWS has also agreed to lower its demand for water flowing through its fish ladder on the Gunnison River. The ladder carries endangered fish around a dam that diverts river water into the hydropower facility. The deal included the Bureau of Reclamation, which controls water released from Blue Mesa Reservoir, and the Colorado Water Conservation Board. Blue Mesa Reservoir has a storage capacity of about 1 million acre-feet of water. Runoff into the reservoir was 71 percent of normal in April. The agreement may help sustain the reservoir through the coming winter, particularly if the weather remains as dry as last winter. It could save up to 40,000 acre-feet of water in the reservoir.

*The Grand Junction Daily Sentinel*, June 1, 2002

#### Colorado ranchers selling cattle they can no longer feed

Tens of thousands of cattle in eastern Colorado are being auctioned to out-of-state buyers and slaughterhouses because the parched range can't support them. Cattle being sold include some ranchers' best breeding stock, and that could have an effect on the state's cattle industry for years after the rain returns. If the drought persists, a million cattle will be sold by this time next year - about a third of the state's cattle, the Colorado Cattlemen's Association said. The price for a ton of hay has doubled because of the lack of supply and increased demand. Traditionally, ranchers sell only their least desirable cattle, keeping good breeders and young cows to improve stock over the years. At auction, high quality bloodlines that ranchers have worked on for decades, and sometimes generations, disappear as quick as the auctioneer can say "sold." Even if the drought ends tomorrow, it could take 20 years of selective breeding to rebuild to the same quality herds.

*The Colorado Springs Gazette*, July 22, 2002

#### Drought tough on beer barley

Climate has taken a toll on the malting barley crop in Colorado. Coors Brewing Co. of Golden contracts malting barley in Colorado,

Wyoming, Montana and Idaho. Standards set by Coors involve moisture in the barley kernels, which must be less than 13 percent; plumpness must be 80 percent or better; and color, measured by light reflection, must be better than 40 points. Barley is rejected if it does not meet any one of those criteria. It takes 24.7 pounds of barley to brew one barrel of beer; one bushel will make 64 gallons or about two barrels. One acre can produce 3,000 cases of beer. Barley will yield 105 bushels to the acre on average, but expect that to be off by 20 percent this year because of the drought.

*Greeley Tribune*, July 20, 2002

#### **Lack of water could delay home development**

Home developments in western La Plata County that try to use Lake Durango Water Co. as a water source could be halted by a county moratorium. If commissioners approve the moratorium, it appears it would be the first time in living memory that water has proved to be a formal limit to the county's growth. Planners contend new subdivisions trying to use Lake Durango cannot prove access to an adequate water supply. The Fire & Rescue Authority also has questions about Lake Durango and the adequacy of the water system and its capacity to deliver the required fire flow as well as the required domestic needs of its customers," Tom Kaufman, fire marshal, wrote a county planner.

*Durango Herald*, July 31, 2002

#### **Drought dries up honey**

At the Pikes Peak Beekeepers Association's annual meeting, none of the 60 members expected to have enough honey to sell this year, said the group president. Bees eat the honey they produce in the summer to survive the winter. Without enough flowers to provide bees with nectar and pollen, many hives are dying of starvation. Beekeepers normally sell any honey the bees don't need. Stores will sell honey made elsewhere, but honey produced by Colorado bees may be largely unavailable next year because of the drought.

*Denver Post*, July 30, 2002

#### **Automated weather data aids farmers**

A statewide network of automated weather stations is helping farmers deal with the drought and helping them plan how much water their crops need. The Colorado Agricultural Meteorological Network (COAGMET) has grown from 30 remote stations in 1990 to nearly 50 today. Each hour, the stations record temperature, humidity, solar radiation, rainfall, wind speed and measure evapotranspiration - the amount of moisture that evaporates from the air and soil. The Colorado Climate Center at Colorado State University downloads the data just after midnight each day and makes it available to farmers and researchers throughout the state. Agriculture brings in \$15 billion a year, making it Colorado's third largest industry. Accurate weather data helps farmers schedule irrigation, model crop growth and manage pests. Outbreaks of plant diseases and pests are often weather dependent, so having accurate weather information allows growers to anticipate and deal with these outbreaks. The network standardizes the collection of weather data because each station has identical equipment and collects information from the field, rather than airports and cities. Thousands of growers access COAGMET data through CSU, the U.S. Department of Agriculture, water conservancy districts and others in the private sector.

*The Fort Collins Coloradoan*, June 16, 2002

#### **Trickle-down irrigation - Drop by drop, cantaloupe grower conserves water**

Gary Shane of La Junta waters his cantaloupe crop drip-by-drip and underground, using an irrigation system that saves more than half the water he would use in a normal irrigation system by watering underground where the roots are, instead of on top. Shane said the system is expensive - \$650 to \$800 per acre to install - but worth it. Mindful that high winds can dry out fields across the valley, Shane uses a complex system of underground drip line soaker hoses set 8 inches deep that irrigate his seven fields by zones. "In the course of a 12-hour period, your whole field has been watered thoroughly," Shane said. At 8 inches deep, Shane said, the drip line is in the center of the root zones for most crops. Shane explained the cost savings by saying, "We only put exactly what the plant needs that day so the plant is never under stress." To go along with the drip line, Shane's system uses black plastic mulch coverings that keep the moisture up and the cantaloupes clean. "I think the valley would be better off if more people used this irrigation so there would be more water available for other uses," Shane said.

*The Pueblo Chieftain*, July 11, 2002

#### **Prewitt Reservoir Golden algae killed fish**

Thousands of game fish and rough fish were killed at Prewitt Reservoir between May 28 and May 30, including drum, walleye, channel catfish, wipers, river carpsuckers, common carp and large numbers of gizzard shad. Researchers' preliminary findings indicate that golden algae (*Prymnesium parvum*) were responsible. The findings have prompted wildlife managers to prohibit all boating at the reservoir and to extend bans on fishing, wading and swimming. Golden algae, named from its golden-brown pigment, aren't true algae but a motile "photoflagellate" resembling many protozoa. They are unusual in that they have traits of both protozoa and plants and are capable of photosynthesis. During bloom, golden algae secrete a potent neurotoxin that is deadly to gill-breathing species. Researchers don't know how golden algae could have spread to Colorado. However, they believe a number of vectors have the potential to transport the algae to the state, including aquariums, water inside boat bilges and outboard motor shafts, bait buckets and the plumage of waterfowl. Boat owners who have



been to Prewitt Reservoir lately are advised to empty their boats' bilge and drain the motor before visiting other water bodies, as a precaution. Golden algae, while extremely toxic to fish, have not been found to pose a health threat to humans. The bans on boating, swimming, fishing and wading at Prewitt will remain in effect until further notice. On the Net: Division of Wildlife <http://wildlife.state.co.us>

*Fort Morgan Times*, June 6, 2002

#### **Heat threatens fish population**

The trout population in the Yampa River may not survive this summer if the extreme drought conditions continue. Kevin Rogers, the Division of Wildlife's aquatic biologist for Routt, Grand and Summit counties, said that a total fish kill of trout in local streams and rivers is feasible if the area's dry and hot conditions do not change. If stream flow volumes and stream oxygen levels continue to decrease, and if water temperatures continue to increase, trout will have a hard time. Trout are sensitive to water temperature and become stressed as soon as water warms to more than 70 degrees. Warmer water can't hold as much oxygen as cold water and low levels of dissolved oxygen will stress trout. Rogers said other fish such as northern pike and suckers are better able to tolerate warmer water and conditions of low oxygen. Endangered and threatened species of fish such as the Colorado pikeminnow and razorback sucker, which are found further downstream near Craig, should also be okay. If large numbers of trout die this summer, one of the most serious effects would be a loss of some of the naturally reproducing populations of Brown and Rainbow trout in the area.

*Steamboat Pilot*, June 17, 2002

#### **Drought conditions may force bears down to forage farther**

Wildlife officials fear dry conditions could make encounters between humans and bears more frequent this season. That's on the heels of a summer when five people in the state were injured in confrontations, non-hunters killed 273 bears, and the Division of Wildlife (DOW) euthanized 17 "nuisance" bears. "We've started a bear-awareness program because of our concerns - in particular this year because of the drought and to a lesser extent the fires taking away their food sources," said DOW spokesman Todd Malmsbury. Some communities are taking steps to prevent any problems. Canadian bear expert Stephen Herrero says averting human-bear encounters simply requires some common sense. Snowmass Village issues about a dozen \$50 citations annually and has invested in expensive bear-proof community trash containers. Bear encounters have dropped to almost zero.

*DENVER (AP) Pueblo Chieftain*, June 24, 2002

#### **Fish salvage disappointing**

With 30 people lending a hand it was a pitiful catch at this year's Jackson Lake fish salvage. They could have pulled in a good 10,000 pounds of carp, as one Department of Wildlife official said, but other than that the crew snared only about a half dozen sports fish. Most of those were catfish and only one catfish was of any decent size. Any normal salvage year the irrigation ditch below the dam would have swarmed with thousands of game fish, but the shallow areas that rippled with fish were almost all carp, considered a trash fish by anglers. "That was the worst (rescue) I've ever seen," one official told his buddy as they were putting away equipment to call it a day. The DOW tries to rescue some reservoir fish in years that the lake falls too low and sports fish populations could possibly die out completely. Unlike Antero and Jumbo Reservoirs, which have doubled the number of fish allowed for fishermen, Jackson Lake has a history of bringing the remaining fish through low water times. While those other reservoirs have doubled the allowed catch, Jackson remains at normal regulation levels. This allows as many fish to stay in the lake and maintain stock as long as possible, Area Wildlife Manager Larry Budde said. Anglers may have 10 wipers or 10 catfish in their possession at any time or five walleyes. The wipers and walleyes must be at least 15 inches long.

*Fort Morgan Times*, July 30, 2002

#### **Water reserves may be needed to help endangered fish survive drought**

The ongoing drought is affecting endangered aquatic life such as the Colorado pikeminnow and razorback sucker, Colorado River Fishery Project leader Chuck McAda said. McAda said water reserves are in place to keep water flowing in areas with endangered species, and because the two types of fish live generally long lives, both should survive the drought without too much harm to either population. "As long as we can keep some water flowing in the rivers, we should be in good shape," he said. However, McAda advises citizens, "be concerned about water use in general. Do what you can to conserve water." "We have water right now," he said, "but if we don't have some relief in the form of rainfall, it will be worse."

*The Grand Junction Daily Sentinel*, July 11, 2002

### **WATER CONSERVATION, SUPPLY AND DEVELOPMENT**

#### **Water limits may cost Boulder \$2M this year**

After enacting outdoor water use restrictions to cut citywide consumption by 25 percent, Boulder city officials expects to see \$2 million less in water bill revenue by year's end than it had planned. Before the drought, the city projected collecting about \$17.5 million from water customers this year. Boulder has long planned a series of water, wastewater and flood control construction projects for 2003. They are estimated to cost \$30.5 million and range from repairing aging water supply pipelines and improved water treatment to a \$15 million sewage

composting facility. If the current drought extends into next year and the area's snowpack again fails to produce adequate runoff, some of those projects will be scaled back or delayed.

*Boulder Daily Camera*, June 19, 2002

#### **Lafayette secures water**

Officials of the city of Lafayette announced that they are nearing the acquisition of at least 167 acre-feet of water rights, including 50 from the city of Boulder, using some of a \$10 million city surplus. The acquisitions add up to about 6 percent more water than the city has now. The City Council also directed the city administrator to begin negotiations with the Northern Colorado Water Conservancy District, which controls much of the Western Slope water that several Denver metro area cities rely on. Facing its worst water crisis ever with snowpack that feeds Boulder Creek dwindling to its lowest levels in at least 97 years, Lafayette officials passed a water conservation act May 21 that attempts to cut peak outdoor summer water use by 75 percent — or overall water use by 35 percent — by requiring residents to limit lawn-watering to two hours per week. Lafayette landed in its predicament partly because city officials in the 1970s failed to obtain more diverse water sources than the Boulder Creek watershed, officials have said. Unlike nearby Louisville, Erie and Longmont, Lafayette also did not participate in a \$10 million pipeline project to tap Carter Lake near Loveland for a backup water supply of Western Slope water. Now, Lafayette city officials will ask voters this November for permission to join the Northern Colorado Water Conservancy District (NCWCD). City council members directed city staff to seek inclusion into NCWCD as well as the Colorado Big Thompson water project. The city would pay a \$4 million inclusion fee and about \$10 million to \$15 million over the next decade. If NCWCD board members decide to include Lafayette, the process could take more than a year. In 1996, the Lafayette City Council bought about 70 percent of Baseline Reservoir instead of buying into NCWCD. Baseline Reservoir stores 3,730 acre-feet of water.

*Boulder Daily Camera*, June 6, 2002; *Longmont Daily Times-Call*, June 13, 2002

#### **Denver Water will drain popular reservoir**

Faced with the dual concerns of drought and the Hayman fire aftermath, the Denver Water Department has pulled the plug on the 4,102-acre Antero Reservoir west of Hartsel on the south fork of the South Platte. The move to transfer water to Cheesman Reservoir above Deckers, which is rimmed by the Hayman fire burn area, will lower Elevenmile Reservoir by more than one-third and affect the volume of flow in much of the South Platte River system well into autumn. Water department officials expect the reservoir to be dry by late August. The water will be passed through Spinney Mountain and Elevenmile reservoirs downstream to Cheesman. Denver Water expects to spend about \$1 million by the end of September on Cheesman rehabilitation. Fifty-five Denver Water workers will spread grass seed and build log and straw-bale check dams around the reservoir to reduce the damage expected from flash floods, erosion and sedimentation. With flash-flooding likely in the burned area, Denver hopes to catch ash, soot, other fire debris and sediment from soil erosion in Cheesman, rather than passing it to its water-treatment facilities below. The extra water will help dilute ash flowing into the reservoir, and it will help prevent sediments from clogging the reservoir outlets, according to Denver Water. Water-department manager, Chips Barry said Antero was selected for draining to reduce evaporation losses. It is wide and shallow, and evaporation rates are high in contrast to the deeper, narrower Cheesman Reservoir where losses are significantly less. The transfer is expected to save 1,500 acre-feet. A timetable for refilling Antero is not known. Although many of the fish will leave the reservoir as the water level drops Division of Wildlife biologists will attempt to trap and relocate some large trout below the reservoir. The DOW is not likely to restock Antero until it has returned to full capacity, said Steve Puttman, senior fisheries biologist for its northeast region.

*The Colorado Springs Gazette*, July 18, 2002; *Rocky Mountain News*, July 18, 2002

#### **Water buyers close first deal on Ft. Lyon irrigated farmland**

High Plains A&M, a Nevada based limited liability corporation, officially became owner of the first irrigated farmland under the Ft. Lyon Canal system when they closed on a farm owned by Kenneth Dodson of Las Animas. To date, High Plains has not announced plans for what it intends to do with the land and water. The corporation, organized last fall as a Nevada LLC, lists two Colorado men, former attorney Kenneth Broadhurst and Mark Campbell, and Louisiana real estate developer Hunter "Terry" White as owners. None of the men has ever expressed what they will do with the land or water, but they have purchased options on numerous farms under the Ft. Lyon system. To date, they are believed to have made offers for at least 10 farms in Bent County, as well as several in Otero and Prowers Counties. The transactions have prompted fears that the water will leave the valley and spurred creation of a multi-county organization, Arkansas Valley Water Preservation, to search for means to raise funding to buy water and land, and thus prevent any future transfers of water.

*Lamar Daily News*, June 12, 2002

#### **Western Slope to consider water-project levy**

Voters in 15 Western Slope counties will be asked in November to approve a 0.25-mill levy increase to raise money for water projects. The announcement comes less than two weeks after the death of a \$10 billion state water storage project proposal during a special session of the state Legislature. If the property tax increase is approved, homeowners would pay an additional \$2.30 for every \$100,000 of assessed valuation of their home. The tax increase would be in effect for 20 years, raising about \$2.5 million annually for the Colorado River Water Conservancy District. The district serves Moffat, Routt, Grand, Summit, Eagle, Pitkin, Rio Blanco, Garfield, Mesa, Delta, Gunnison and Ouray and portions of Saguache, Hinsdale and Montrose counties. The failed statewide bonding bill, which had passed the House by a 36-



27 vote and would have required voter approval, was voted down in the Senate Appropriations Committee on July 10. No particular water storage projects had yet been earmarked for funding by the bill, but officials have several projects in mind. District spokesman Chris Treese said funds would be used to buy federal water from Ruedi Reservoir in Pitkin County and Blue Mesa Reservoir in Gunnison County, giving the district more control of water on the Western Slope. That would ease some demands on Green Mountain and other upstream reservoirs, and downstream users would benefit from additional water supplies. Treese said officials also are considering improvements for irrigation canals, mostly in Montrose and Delta counties, to reduce sedimentation, salinity and metals pollution.

*Pueblo Chieftain*, July 22, 2002

#### WATER QUALITY

##### **Morrison advises residents to drink only bottled water**

Morrison residents were warned July 16<sup>th</sup> that although the town's water is still safe to drink, they should start using bottled water just in case. The borderline water is being caused by extremely low flow rates in Bear Creek, which supplies Morrison. Chemical contaminants aren't killed by heat, so boiling the water only concentrates the contaminants. The advisory recommends that bottled water be used for drinking, making ice and preparing food until further notice. While Morrison probably won't be the last town to see its water affected, this sort of problem would not likely affect a large city like Denver or Colorado Springs.

*Rocky Mountain News*, July 17, 2002

##### **County Commissioners, Selenium Task force wary of contamination from coal-bed methane drilling**

Hydrology reports lack data to fully assess the risk to water resources from coal-bed methane development on the south flank of Grand Mesa, the U.S. Geological Survey reported to the Delta County Commission. Gunnison Energy Corp. is seeking county approval to explore for coal-bed methane and natural gas at five sites on 90,000 acres roughly between Cedaredge and Paonia. The test wells would determine if methane or natural gas is accessible in sufficient quantities, at reasonable cost to justify production. The Colorado Oil and Gas Conservation Commission (COGCC) has already approved drilling at three of the well sites. Critics allege the exploration process will dry up springs, wells and aquifers that are vital in the sparsely populated arid high desert.

Members of the Gunnison Basin Selenium Task Force also expressed concern over a possible new source of water contamination. The Gunnison Basin Selenium Task Force was formed to bring selenium levels into compliance with requirements imposed in 1997 by the Colorado Water Quality Control Commission (CWQCC). CWQCC has established a selenium standard of 5 parts per billion for the Gunnison River Basin. Waters downstream from irrigated areas often have selenium concentrations in excess of 5 ppb. Gunnison Energy acquired mineral rights to 95,000 acres, 90 percent of which are located on public lands. Delta County Commissioner Jim Ventrello said, "They are proposing hydrofracturing, because they want to fracture all of the coal seams to capture more of the gas. Initially each well would produce 6,000 gallons of water per day, although they believe it would later drop to about 2,000 gallons." The high amount of water produced by coal-bed methane drilling can be disposed of in a number of ways, Geologist Ron Johnson of the United States Geological Survey said, including discharge to wetlands or waterways if it is clean enough, or through injection to subsurface aquifers and groundwater. Wastewater can also be stored in lined evaporation ponds. The problem of wastewater disposal is one that has caused concern for Delta County according to Ventrello, who said none of the alternatives, is ideal.

The most probable method of disposal in Delta County would be through injection, Ventrello said, and although the water would be injected below the Mancos Shale, the source of most selenium leaching, unanswered questions remain, such as triggering of small earthquakes and fracturing near existing wells allowing an opportunity for water to migrate up or down. Despite vocal opposition, the power may ultimately lie with the COGCC. Larry Kontour of the state parks department echoed Ventrello's concerns over possible damage by injection wells, and expressed anxiety over a well recently approved in the Muddy River area by Gunnison County Commissioners. Ventrello is also concerned that the COGCC could override the interests of the Delta County community, including water quality.

*Montrose Daily Press*, July 10, 2002; *The Daily Sentinel*, July 20, 2002

##### **Water source closed off to avoid ash**

Durango's connection to its main water source, the Florida River, had to be closed July 7<sup>th</sup> when rain runoff from burned areas threatened to wash ash into the supply line. Jack Rogers, the city's director of public works, said the pipeline was closed for about eight hours starting around midnight. Water from Lemon Reservoir flows down the Florida River for a few miles before it is picked up by the city's pipeline. Rogers said that occasional closures at the Florida River intake might continue indefinitely. Butch Knowlton, La Plata County director of emergency preparedness, said that shutting the water supply is a process that needs to be addressed. The Animas River is Durango's backup water source. Right now the city is using more water from the Animas than the Florida, Rogers said.

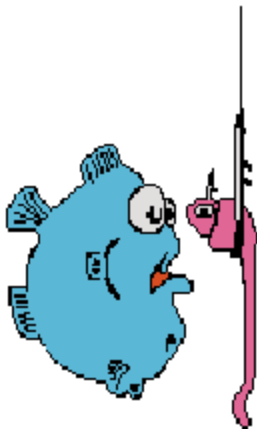
*Durango Herald*, July 9, 2002

**GS 592 WATER RESOURCES SEMINAR**  
**Tuesdays, 4:10pm, C-142 Clark Building**  
**Fall 2002 theme: Cross Currents in the Arkansas River:**  
**Changing Values, Competing Demands, and Policy Reactions**

Water users and managers in the Western United States face many new challenges, including changing societal values, increasing competition for water, and adapting institutional arrangements. We often think of these challenges in the context of such high profile situations as the Columbia River system in the Pacific Northwest or the Cal Fed efforts in the San Francisco Bay area. Similar challenges, while perhaps not as high profile nationally, are facing each of Colorado's rivers. The Arkansas River, in particular, faces considerable change – change brought on by an interstate compact lawsuit; new definitions of 'beneficial use'; pilot testing of the concept of a water 'bank'; and intrastate concerns over future of trans-mountain diversions. The Fall 2002 offering of the Water Resources Seminar (GS 592) will use the experiences of the Arkansas River to examine a number of key issues facing Colorado water managers as well as citizens. Topics to be discussed include:

- The Arkansas River 'as it was'! What changes are creating pressures on the traditional water management system?
- Redefining 'beneficial use' under the prior appropriation doctrine.
- Changes in water allocation brought on by population growth, water sales, and lawsuits.
- What will water management look like in the Arkansas Valley in 2020?

**Students interested in taking the one-credit seminar should sign up for GS 592, Water Resources Seminar, Section ID Number: 281888. Interested faculty, students and off-campus water professionals are encouraged to attend and participate.**



### **George gets authority to close waters to anglers**

The Colorado Wildlife Commission has authorized Division of Wildlife (DOW) Director Russ George to close rivers and streams to anglers where low flows and high water temperatures are endangering fish. The Commission gave George the power after discussing the impact on fish of Colorado's severe drought. Low flows and high temperatures reduce fish habitat, deplete oxygen and spur growth of parasites and fungus. High water temperatures can kill cold-water species like trout. George said he wouldn't order any closures until he gets such a recommendation from state biologists. Voluntary restrictions are in place on a 30-mile stretch of the Yampa River from the Stagecoach Dam to south of Steamboat Springs. The DOW has asked anglers not to fish there because of extremely low flows and water temperatures approaching 80 degrees. While the commission meets monthly, the DOW wants authority to close rivers without waiting for a monthly meeting. "These conditions are really pretty urgent," George said. "Biologists are monitoring these streams every day." DOW spokesman Todd Malmsbury said rivers other than the Yampa have been hurt by the drought. DOW biologists said anglers should take a thermometer with them and stop fishing if the water temperature climbs above 65 degrees. They said hooked fish should be released quickly and kept in the water while the hook is removed. People should also make sure their hands are wet when handling fish to avoid removing the mucous that protects fish from fungal infections.

*The Grand Junction Daily Sentinel, July 11, 2002*





## WATER EDUCATION



### COLORADO ALLIANCE FOR WATER EDUCATION (CAWE) FORMED

The Colorado Alliance for Water Education (CAWE) is a statewide, nonprofit, non-advocacy organization, presently in its organizational stages. CAWE's mission is:

*The development and dissemination of impartial educational programs for the people of Colorado to provide a wide range of water related information from various viewpoints with no advocacy position taken on any issues in order to foster a broader understanding of water challenges among the general population and aid in the informed and timely discussion of water issues.*

A broad-based Steering Committee has been working actively for the past two years to form a statewide water education foundation. That effort received a jump-start from the Colorado Water Conservation Board (CWCB) this year with a \$250,000 grant. CWCB will also be providing \$150,000 annually to CAWE. The CAWE Steering Committee is currently reviewing applications for the organization's first Executive Director.

In July 2002, the CAWE Steering Committee began reviewing applications for the organization's first Executive Director. The final selection of the Executive Director, to be hired by October 1, 2002, will be made by the organization's Board of Directors. The Board of Directors will be selected at the end of August, with nominations taken through August 29, 2002. The founding board members will come from the following interest areas (Total: 21 Board Members):

- Education - 3 reps (K-12, Higher Education, Adult Education)
- Finance - 2 reps (1 with fund-raising/foundation experience, the other with banking/budgeting background)
- CWCB - 2 reps (at least one of these should be a board member)
- Water - 4 reps (1 with water education background, 1 with water supply, 1 with water conservation, 1 with water law)
- Legislature - 2 reps (Chair of the Senate and House Ag Committees)
- Colorado Water Congress - 2 reps
- Agriculture - 1 rep
- Environmental - 2 reps
- Industrial - 1 rep
- Recreation - 1 rep
- Water Quality - 1 rep

Details on the board member duties are available on the CAWE website. Selection of the Board Members will occur during the Inaugural Colorado Water Education Workshop, to be held on Thursday, August 29, 2002, at the University of Southern Colorado in Pueblo. The Workshop will be held during the 2002 Colorado State Fair, also to be held in Pueblo. This workshop is intended to launch the statewide Education Alliance and explore mutually beneficial partnerships with the Alliance. The draft agenda for the Workshop is below. There will be no cost to attend the Workshop (lunch and snacks included), but registration is required. Additional information, registration forms, and Board nomination forms are provided on the web site at [www.co-water-edu.org](http://www.co-water-edu.org).

*For details about the Colorado Water Education Workshop,  
see "Meetings" on page 34.*

VISIT THE COLORADO ALLIANCE FOR WATER EDUCATION WEB SITE AT:  
[WWW.CO-WATER-EDU.ORG](http://WWW.CO-WATER-EDU.ORG)

**MEETINGS**

**COLORADO ALLIANCE FOR WATER EDUCATION  
An Introduction and Invitation to Participate in the Inaugural  
Colorado Water Education Workshop  
University of Southern Colorado, Pueblo, Colorado  
August 29, 2002**



- 10:00 **Welcome** by Tom Cech, Central Colorado Water Conservancy District
- 10:15 **Who's on First?** A panel discussion on current educational efforts by various interest groups and how a state-wide foundation would expand/integrate those efforts, moderated by Dan McAuliffe, CWCB
- Panel:**
  - Grassroots: Chris Rowe, Colorado Watershed Network
  - Agriculture: Betty Blinde, Colorado Foundation for Agriculture
  - Environmental: David Nickum, Colorado Trout Unlimited
  - Recreation: Headwaters Institute
  - Classroom: Don Hollums, Colorado Department of Education
- 12:00 **LUNCH Keynote Address:**
  - Rita Schmidt Sudman, The Water Education Foundation
- 1:15 – Colorado Alliance for Water Education Roundtable Discussion, moderated by Chris Treese, Colo. River Water Conservation District

- 2:30-2:45 Break
- 2:45 Interest Group Caucuses  
(Select CAWE board nominees)
- 3:00 CAWE Board Nominations
- 3:15 Wrap-Up: Moving forward together:  
Senator Lewis Entz (Invited)
- 4:00 Adjourn

- Panel:**
- Tom Cech, Central Colorado Water Conservancy District
  - Sara Duncan, Denver Water
  - Brian Werner, Northern Colorado Water Conservancy District
  - Don Hollums, Colorado Dept. Of Education
  - Rita Crumpton, Ute Water Conservancy District

Cost to attend: **FREE.**  
Registration required.  
Registration forms on web:  
[\*\*www.co-water-edu.org\*\*](http://www.co-water-edu.org)

**WELLS – ARE THEY A DEPENDABLE WATER SUPPLY? Forthcoming Educational Programs**

The Colorado Water Well Contractors Association (CWWCA) and the Colorado Division of Water Resources are sponsoring daylong educational programs for Durango on November 12 and Alamosa on November 13, 2002. The emphasis will be on small capacity wells serving domestic or household purposes. The meetings will provide a forum for well drillers, pump installers, engineers, geologists, realtors, planners, sanitarians, attorneys and Division of Water Resources staff to discuss updated information on obtaining well permits, constructing wells in compliance with current rules and satisfying local county rules on the use of wells and septic systems. Speakers will describe where and how to obtain well permits and data for existing wells. The limits on water usage to comply with permit and statutory conditions will be reviewed. Emphasis will be placed on proper well construction and well testing to develop a dependable supply. Local counties permit the septic systems and that may impact where wells can be drilled. Testing of wells for water quality will be discussed.

The meeting will be informal. Questions from the attendees will be encouraged. The meeting will present an opportunity to make valuable future contacts. A brochure containing program details and registration instructions will be available in the near future, as final arrangements are completed. Attendance will be limited to 150 pre-registrants. The meetings will qualify for continuing education credits for realtors, appraisers, plant operators and lawyers. Mark your calendars now!

For further information contact CWWCA at 8674 West Warren Drive, Lakewood, CO, 80227, phone 303-986-5035, fax 303-986-8375, e-mail [office@cwvca.org](mailto:office@cwvca.org).



## COLORADO WATER CONGRESS FALL WORKSHOP SCHEDULE

The Colorado Water Congress prepares a series of six to ten workshops each fall for the purpose of increasing and updating water knowledge both for the actively involved water community and general public knowledge. These workshops are all held in the Colorado Water Congress Conference Room, 1580 Logan Street, Suite 400, Denver, Colorado. A 2002 Water Law Seminar will be held on September 9-10, 2002, and our fall workshops will be announced as they are scheduled.

**2002 Water Law Seminar** will be held on September 9-10, 2002,  
in the Colorado Water Congress Conference Room, 1580 Logan Street, Suite 400, Denver, Colorado

The 2003 45th Annual Convention will be January 23-24, 2003 in Northglenn, CO  
The 2003 Summer Convention will be August 21-22, 2003 in Steamboat Springs, CO  
The 2004 46th Annual Convention will be January 29-30, 2004 in Northglenn, CO

CONTACT: Dick MacRavey, Executive Director, at Phone 303/837-0812, FAX 303/837-1607, E-mail [macravey@cowatercongress.org](mailto:macravey@cowatercongress.org). Web site: [www.cowatercongress.org](http://www.cowatercongress.org)



## THIRD ANNUAL COLORADO WATERSHED ASSEMBLY CONFERENCE

**September 12-13, 2002**  
**Beaver Run Resort in Breckenridge, Colorado**

*State of Colorado's Watersheds Report Coming in September*

The Colorado Watershed Assembly (CWA) will unveil the first "State of Colorado's Watersheds Report" at its annual conference in Breckenridge on September 12 and 13. The conference is being conducted in conjunction with the 10th National Nonpoint Source Monitoring Workshop, which takes place September 8-12.

The new State of Colorado's Watersheds Report will include information from many of Colorado's watershed groups, as well as information about the new Colorado Watershed Protection Fund Grant Program, Senate Bill 156, the Colorado Water Trust, the Water Education Foundation, Fire restoration efforts and much more.

For more information about the conference call Marc Alston at (303) 312-6356 or visit [www.coloradowater.org](http://www.coloradowater.org).



## GROUND-WATER DEPLETION AND OVEREXPLOITATION: A GLOBAL PROBLEM

**The Geological Society of America 2002 Annual Meeting**  
**October 27-30, 2002 -- Colorado Convention Center, Denver, Colorado**

The volume of fresh ground water in storage has decreased significantly during the past century, but the magnitude and global impacts are uncertain. The U.S. National Chapter of the **International Association of Hydrogeologists (IAH)** will sponsor a special session to focus on the magnitude and effects of ground-water mining, methods to quantify depletion, U.S. and international case studies, status and future trends, global impacts, and management solutions. This special session will be held during the **2002 Annual Meeting of the Geological Society of America in Denver, Colorado, October 27-30**. The purpose of this session is to document methods and examples that would help define the magnitude of the problem, at both local and global scales, and explore local and regional management approaches to mitigate the problem or assure sustainable development. For information about the GSA Meeting, go to their web site at: [www.geosociety.org](http://www.geosociety.org). For information about IAH, go to their web site at: [www.iah.org](http://www.iah.org).

**John McCray** and **Tom Boving** of the Department of Geology and Geological Engineering at CSM are organizing a topical session on subsurface transport and remediation for this year's meeting. The session is titled, "Subsurface Characterization, Remediation and Natural Attenuation of Organic Contaminants in Heterogeneous Physical or Chemical Settings.

**Who's Running This Ecosystem?**

**SOUTH PLATTE FORUM**

The 13th Annual South Platte Forum

Oct. 23-24, 2002  
Raintree Plaza  
Longmont, Colo.

**REGISTER TODAY!!**

*Who's Running This Ecosystem?*  
**13TH ANNUAL SOUTH PLATTE FORUM**  
 Oct. 23-24, 2002, Raintree Plaza, Longmont, Colorado

**Wednesday, October 23**

- 8:00-8:30 Registration and Continental Breakfast
- 8:30-8:45 **ROBERT WARD, DIRECTOR, COLORADO WATER RESOURCES RESEARCH INSTITUTE**
- 8:45-9:15 **DAN LUECKE, FORMER DIRECTOR, ENVIRONMENTAL DEFENSE, KEYNOTE PRESENTATION**
- 9:15-10:30 **INTEGRATING HABITAT PROTECTION WITH AGRICULTURAL PRODUCTION**  
 Moderator: TBA  
 Allen Green, Natural Resource Conservation Service — *NRCS Water Conservation & Habitat Protection Programs*  
 Tim Davis, Colorado Division of Wildlife — *Conservation Reserve Enhancement Programs*  
 Greg Kernohan, Ducks Unlimited — *Lower So. Platte Habitat Development*
- 11:00-12:15 **UNDERSTANDING COLORADO CLIMATE CHANGES**  
 Moderator - Marc Waage, *Denver Water*  
 Nolan Doesken, Colorado State University — *South Platte Basin Climate Overview*  
 Roger Pielke, Colorado State University — *Colorado Climate Changes*  
 Kevin Trenberth, NCAR — *Colorado Climate Changes*
- 12:15-1:30 **ROBERT E. ROBERTS, REGIONAL ADMINISTRATOR, U.S. EPA REGION 8, KEYNOTE LUNCHEON**
- 1:30 – 1:45 **Special Award Presentation, Chuck GrandPre, South Platte Forum “Founder”**
- 2:00-4:00 **FOULING YOUR NEST**  
 Moderator: Robert Ward, Colorado Water Resources Research Institute  
 Cynthia Peterson, Colorado Water Protection Program — *Nonpoint Source Education Campaign*  
 Cathy Tate, US Geological Survey — *NAWQA Long-Term Trends and Results*  
 Troy Bauder, CSU Extension — *Agricultural Groundwater Vulnerability Study*  
 Bob Siegrist, Colorado School of Mines — *Septic System Water Pollution Issues*
- 4:00-6:00 **POSTER SESSION AND NETWORKING HOUR**

**Thursday, October 24**

- 8:00-8:30 Registration and Continental Breakfast
- 8:30-9:00 **STEVE SIMMS, STATE ATTORNEY GENERAL'S OFFICE**

9:00-10:05 **REDEFINING BENEFICIAL USE IN THE SOUTH PLATTE BASIN**  
 Moderator: Jan Schenk, *Former Mayor, Golden*  
 Glen Porzak, Attorney -- *Golden Recreational In-Channel Diversions*  
 Senator Ken Gordon, Colorado State Legislature -- *Recreational In-Channel Diversions - Beneficial Use Legislation*

10:35-11:50 **PROTECTING OUR FUTURE**  
 Moderator - Bill Jerke, Weld County Commissioner  
 Robert Sakata, Chair, Water Quality Control Commission -- *Water Use Classification*  
 Eric Wilkinson, General Mgr., No. Colo. Water Conservancy Dist. -- *So. Platte Decision Support System, Senate Bill 216 & RICD Process*  
 Brad Lundahl, Colorado Water Conservation Board -- *Drought Planning for the Future*

12:00-1:00 **KEYNOTE LUNCHEON - HONORABLE JONATHAN HAYS, DISTRICT JUDGE, WATER DIVISION 1**



**2002 SOUTH PLATTE FORUM REGISTRATION**

The forum will be held at the Raintree Plaza Conference Center in Longmont, Colo. For directions please visit their website at [www.raintreeplaza.com](http://www.raintreeplaza.com) or call 303-776-2000.

**Registration Fees:**

Early Registration - must be in by Oct. 1 \$85  
 Registration after Oct. 1 \$100  
 Additional invoicing fee if necessary \$20  
*Registration fees include proceedings, meals, refreshments and the networking hour.*

**Overnight Accommodations**

Raintree Plaza	303-776-2000	\$109
Courtyard by Marriott	303-682-1166	\$93

*Govt. rates will be honored at both locations.  
 Reservations must be made by Oct. 1.*

Please check here if you plan to attend the poster session and networking hour from 4:30-6:00 p.m., Oct. 23. The cost is included in your registration fees.

\_\_\_\_\_  
 Name Organization

\_\_\_\_\_  
 Address City, State, Zip

\_\_\_\_\_  
 Phone: Fax E-mail Address

Vegetarian Meal Preferred (check here)

\_\_\_\_\_  
 Amount Enclosed

To register, detach form and send with a check or money order to: South Platte Forum, c/o No. Colo. Water Conservancy Dist., PO Box 679, Loveland, CO 80539.

*Sponsored by:*  
 Colo. Division of Wildlife, Colo. State Univ. Coop. Extension, Colo. Water Resources Research Institute, Denver Water,  
 No. Colo. Water Conservancy District, US Bureau of Reclamation, US Environmental Protection Agency,  
 US Fish and Wildlife Service, US Geological Survey



## CALLS FOR PAPERS

### CALL FOR PAPERS Joint UCOWR/ASCE-EWRI/NIWR Conference WATER SECURITY IN THE 21<sup>ST</sup> CENTURY July 30-August 1 2003 — Washington, D.C.

Water security — adequate quantity and acceptable quality of water at the times and places it is needed — will be one of the major issues facing our nation and the world in the 21<sup>st</sup> Century. There is a need for new and innovative strategies to cope with water demand, water quality management, and emerging problems. As discussed in the 2001 report of the National Research Council, “*Envisioning the Agenda...*”. These strategies include establishing research priorities, educating future water scientists, and developing and implementing innovative water policy and management programs.

The goal of this conference is to bring together academia, federal and state agency experts, and other professionals to discuss the status of water resources research, education, infrastructure, management and policy, introduce innovative case studies, and propose new approaches that can be incorporated into research and education programs and formulated into new legislation and policy. The conference will consist of plenary sessions, concurrent sessions, and workshops.

**Plenary Sessions** — Proposals are solicited for organizing plenary sessions on topics relevant to the theme of the conference. Proposals should include the session topic and potential speakers.

Concurrent Sessions — Abstracts are solicited on the following:

Emerging issues related to water security  
Infrastructure rehabilitation strategies  
Innovative water resources research and curriculum development

Sustainable development of water resources  
Research applications to water policy and management

**Workshops** -- In depth presentations of 2-3 hours duration on issues relevant to the theme of conference.

Abstracts (300-500 words) that detail the objective of the paper (or workshop) and provide a discussion of approaches, results, and potential impacts on water research, education, policy and management should be submitted by December 15, 2002 to:

Margaret Skerly  
Universities Council on Water Resources  
4543 Faner Hall, Southern Illinois University, Carbondale, IL 62901-4526  
E-mail: [mskerly@siu.edu](mailto:mskerly@siu.edu)

Successful authors will receive acceptance notice and guidelines for the conference proceedings by January 15, 2003. The deadline for a full paper to be included in the conference proceedings is April 30, 2003.



### 6TH NATIONAL MITIGATION BANKING CONFERENCE

Panelists and speakers are sought for the 6th National Mitigation Banking Conference next April 23-25 in San Diego, with the California venue offering conference participants first-hand experience with conservation banking to protect endangered species and other natural resources in addition to mitigation banking for wetlands. The conference will concentrate on a dual theme: Practice and Policy. Sessions will range from a primer for newcomers to banking to panels on emerging markets, technical banking issues, techniques used in banking, and the newest information on legislation and current events in the industry. Presentations and ideas for sessions are welcomed from experienced mitigation and conservation bankers, regulators, engineers, bank users, consultants, bonding firms, venture capitalists, nonprofits who maintain banks and public interest groups. Abstracts of no more than 300 words should be tailored to one of the suggested topics listed on [www.mitigationbankingconference.com](http://www.mitigationbankingconference.com) (also available by calling 800/726-4853) and submitted to [cbahler@erols.com](mailto:cbahler@erols.com) or faxed to 703/548-6299 by **September 4, 2002**.

*JT&A Inc. in cooperation with Terrene Institute*

**RESTORING IMPAIRED WATERS -- TOOLS FOR TOMORROW**  
**Colorado Nonpoint Source Forum**  
**October 29-30, 2002 -- Colorado Springs, Colorado**

You are invited to submit a one-page abstract to Jennifer Brown (information below) by Sept. 1, 2002. Selected posters will be displayed throughout the conference.

**Keynote Perspectives**

Justice Gregory Hobbs, Jr.,  
 Colorado State Supreme Court  
 Jim Valliant,  
 Retired Extension Specialist  
 Tom Pointon,  
 Arkansas Valley Producer

**Forum Sessions**

Agriculture, Silviculture, Urban, Construction, and Mining Tools  
 Tools Available to Restore Impaired Waters  
 Communicating with Your Public  
 Successful Watershed Strategies  
 The Sediment Dilemma -- Is it Just Muddy Water?  
 Grant Proposals That Get Noticed

Jennifer Brown  
 513 N. Harding Ave.  
 Johnstown, CO 80534  
 970/213-1618  
 conferenceplanner@msn.com

*Sponsored by the Colorado Nonpoint Source Council, the Colorado Department  
 of Public Health and Environment, and the Colorado Watershed Assembly.*

## CALENDAR



Aug. 22-23	COLORADO WATER CONGRESS SUMMER CONVENTION, Vail, CO. Contact: Dick MacRavey at Phone 303/837-0812, FAX 303/837-1607, E-mail macravey@cowatercongress.org, or see web site <a href="http://www.cowatercongress.org">http://www.cowatercongress.org</a>
Aug. 27-29	WESTERN STATES WATER CONSERVATION ROUNDTABLE, Boise, ID. Sponsored by the "Bridging-the-Headgate" partnership. For information contact Allen Powers, USBR, Phone 208/334/1455 or Sue Lowry, Western States Water Council, Phone 307/777-5927.
Aug. 29	COLORADO ALLIANCE FOR WATER EDUCATION, Pueblo, CO. For information and registration form, see the website <a href="http://www.co-water-edu.org">www.co-water-edu.org</a> . Registration is free.
Sept. 8-11	DAM SAFETY 02, Tampa, FL. See the web site at <a href="http://www.damsafety.org">http://www.damsafety.org</a> or call 859/257-5140.
Sept. 8-12	10TH NATIONAL NONPOINT SOURCE MONITORING WORKSHOP, Monitoring and Modeling from the Peaks to the Prairies, Breckenridge, CO. For details check the web site at <a href="http://www.ctic.purdue.edu/NPSWorkshop.html">http://www.ctic.purdue.edu/NPSWorkshop.html</a> or contact Tammy Taylor at taylor@ctic.purdue.edu, Phone 765/494-9555 or FAX 765/494-5969.
Sept. 9-10	2002 WATER LAW SEMINAR, Denver, CO. Contact: Dick MacRavey at Phone 303/837-0812, FAX 303/837-1607, E-mail macravey@cowatercongress.org, or see web site <a href="http://www.cowatercongress.org">http://www.cowatercongress.org</a> .
Sept. 12-13	3RD ANNUAL COLORADO WATERSHED ASSEMBLY CONFERENCE, Breckenridge, CO. See website <a href="http://www.coloradowater.org">http://www.coloradowater.org</a> or call 303/312-6356 or 719/837-2737.
Sept. 12-13	WESTERN WATER LAW: WATER SHORTAGE, SUPPLY AND QUALITY IN THE ARID WEST, Denver, CO. Register online at <a href="http://www.cle.com">http://www.cle.com</a> or call (800)873-7130.
Sept. 22-25	2002 GWPC ANNUAL FORUM, San Francisco, CA. Contact the Ground Water Protection Council, 13208 N. MacArthur Blvd., Oklahoma City, OK, 73142, Phone 405/516-4972 - Fax 405/516-4973. Forum information is available at the web site <a href="http://www.gwpc.org">http://www.gwpc.org</a> .

Sept. 27	COLORADO'S FUTURE: HOW CAN WE MEET THE NEEDS OF A CHANGING STATE? University of Colorado at the Colorado Springs campus. Contact: Prof. Daphne Greenwood at E-mail <a href="mailto:dgreenwo@uccs.edu">dgreenwo@uccs.edu</a> or call 719/262-4031.
Sept. 27-29	COLORADO MITIGATION AND WILDFIRE CONFERENCE, Longmont, CO. For conference information and registration forms, see the Website at <a href="http://www.WildfireColorado.org">www.WildfireColorado.org</a> , or call 303/271-8217.
Oct. 16-17	2002 GWPC Produced Water Conference, Making Water Produced During Oil and Gas Operations a Managed Resource for Beneficial Uses, Colorado Springs, CO. For information see the Website <a href="http://www.gwpc.org">www.gwpc.org</a> .
Oct. 23-24	WHO'S RUNNING THIS ECOSYSTEM? 13TH ANNUAL SOUTH PLATTE FORUM, Longmont, CO. Contact: Jennifer Brown, South Platte Forum, 513 N. Harding Ave., Johnstown, CO 80534, Phone 970/213-1618, E-mail <a href="mailto:conferenceplanner@msn.com">conferenceplanner@msn.com</a> .
Oct. 23-26	USCID WATER MANAGEMENT CONFERENCE, Helping Irrigated Agriculture Adjust to TMDLs, Sacramento, CA. Contact: Larry Stephens at Phone 303/628-5430, FAX 303/628-5431, E-mail <a href="mailto:stephens@uscid.org">stephens@uscid.org</a> . Internet: <a href="http://www.uscid.org/~uscid">http://www.uscid.org/~uscid</a> .
Oct. 27-30	THE GEOLOGICAL SOCIETY OF AMERICA 2002 ANNUAL MEETING, Colorado Convention Center, Denver, CO. For details see the website at <a href="http://www.geosociety.org/meetings/2002/">http://www.geosociety.org/meetings/2002/</a> .
Oct. 29-30	COLORADO NONPOINT SOURCE FORUM, RESTORING IMPAIRED WATERS: TOOLS FOR TOMORROW, Colorado Springs, CO. For information contact Jennifer Brown at 970/213-1618 or email <a href="mailto:conferenceplanner@msn.com">conferenceplanner@msn.com</a> .
Oct. 29- Nov. 2	NORTH AMERICAN LAKE MANAGEMENT SOCIETY 22ND INTERNATIONAL SYMPOSIUM, Anchorage, AK. Registration information and forms only available on the Web at <a href="http://www.nalms.org">www.nalms.org</a> .
Nov. 3-7	AWRA 2002 ANNUAL CONFERENCE, Philadelphia, PA. Registration information available at the AWRA web site at <a href="http://www.awra.org">http://www.awra.org</a> .
Nov. 11-12	NASULGC 2002, 115TH ANNUAL MEETING, Chicago, IL. Call the Nat'l. Assn. Of State Universities and Land Grant Colleges at 202/478-6050, FAX 202/478-6046, or see the web site at <a href="http://www.nasulgc.org">http://www.nasulgc.org</a> .
Nov. 18-20	GROUNDWATER: THE FORGOTTEN ELEMENT OF WATERSHED PROTECTION, Eugene, OR. Contact: Cindy Kreifels at the Groundwater Fdn. at 1/800-858-4844, 402/434-2740 (Lincoln) or E-mail <a href="mailto:cindy@groundwater.org">cindy@groundwater.org</a> .