

Colorado Water

Newsletter of the Colorado Water Resources Research Institute

DECEMBER 1999



*Marc Reisner, keynote speaker for the 2nd Annual Student Water Symposium held Nov. 3-5 at Colorado State, presented his views on **The Age of Dams and its Legacy**. See page 16.*



Greg Walcher, Executive Director of Colorado's Department of Natural Resources, keynoted the South Platte Forum held Oct. 27-28 and described Colorado's water and wildlife issues. See page 11.

WATER ITEMS AND ISSUES . . .

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EDITORIAL**CWRRI: A MODEL PROGRAM***by Robert Ward, Director*

The Colorado Water Resources Research Institute (CWRRI) is one of 54 water institutes established under the Federal Water Resources Research Act of 1964, and authorized currently by the Water Resources Research Act of 1984, as amended. There is one institute in each state, the District of Columbia and three territories. The institutes connect the water research expertise of higher education to the information needs of water users and managers. CWRRI is also authorized by the Colorado legislature.

The Federal legislation requires the Secretary of the Interior to “conduct a careful and detailed evaluation of each institute at least once every 5 years to determine that the quality and relevance of its water resources research and its effectiveness as an institution for planning, conducting and arranging for research warrants its continued support under this section.” A four-member external panel, operating under the auspices of the U.S. Geological Survey, the agency that administers the state water resources research institute program, conducted a review of all 54 institutes during 1999. The panel’s findings were released in November.

The Colorado Water Resources Research Institute was designated one of four ‘exceptional programs’ during the 1999 review and, thus, singled out for special recognition. New Mexico, Washington, and North Carolina were also recognized.

Among the Evaluation Panel’s comments regarding CWRRI were the following:

“The Colorado Institute is not large in terms of over-all financial support. Its program is truly a model of how a smaller institute without access to discretionary or extramural funds ought to function. The Institute’s program is clearly defined and well focused on the development of synthesized information and the dissemination of that information to water users and managers throughout Colorado. The research and information development programs are tightly integrated with the information transfer program. Both programs are excellent given that the programmatic emphasis is on the synthesis and transfer of known information rather than on the generation of new knowledge per se. The Institute’s website is exemplary and allows the Institute to serve as a clearinghouse for a number of water related activities in Colorado. The Institute has done a good job of involving other institutions of higher education, including the University of Colorado and the Colorado School of Mines, in its programs and activities.”

Such comments acknowledge that CWRRI has chosen to use the majority of its very limited funding in direct support of the needs of water managers and users to interpret existing science and technology in terms of today’s water management concerns and problems. We are always searching for the funding to support generation of new knowledge in areas needed by Colorado’s water users and managers.

This type of recognition is not possible without a considerable amount of support from a large number of people and organizations. I would like to take this opportunity to acknowledge the support that CWRRI has received over the past five years and which serves as the basis for the success being recognized in the latest national review.

Water institutes are housed on a university campus (the land grant university in most cases). The reception and support offered the federally authorized institute by the university administration is critical to an active and well functioning water institute. CWRRI has enjoyed considerable support over the years from the CSU administration, particularly from Jud Harper, the Vice President for Research and Information Technology, to whom the CWRRI director reports. Jud’s support, during both the good and bad times, has permitted CWRRI to maintain a steady course, learning from its mistakes and benefiting from its successes.

Without the active support of a sizable group of faculty, located on all campuses of higher education in a state, a water institute cannot operate effectively. CWRRI is very fortunate to have such a large group of faculty that supports the mission of CWRRI, both in their discussions with water users and managers as well as with their time and effort in serving on CWRRI task forces, submitting excellent proposals, providing input for CWRRI’s newsletter, organizing CWRRI sponsored meetings,



and directing CWRI-supported students. The efforts of CWRI are magnified greatly by the energy the faculty bring to water-related teaching, research and outreach without financial support from CWRI. Students provide a considerable amount of the energy that permits CWRI to undertake new activities; they examine long-standing practices with new eyes, organize professional meetings, and critique water courses and curricula. Many of the students ultimately join the ranks of Colorado's professional water managers. CWRI, with only a half-time director and one staff person, depends heavily upon students to undertake many of its new initiatives while maintaining its routine operations.

As noted above, a water institute, organized under the Water Resources Research Act, is designed to connect its programs with water users and managers. Without active and engaged participation by many, many Colorado water managers, CWRI would not be successful. Their advice, guidance, critiques, legislative support, and financial support are critical elements of CWRI's success in carrying out its mission in an excellent manner. I particularly want to thank members of CWRI's Advisory Committee on Water Research Policy for their time and energy in ensuring CWRI's water research and information is addressing current water problems facing Colorado.

I want to also acknowledge the outstanding efforts of Shirley Miller, the long-time, and only, staff person at CWRI. Shirley keeps the books, manages the students, edits this newsletter and research reports, answers the phone, keeps the web pages up-to-date, and fills the many information requests we receive. She provides the steady support that keeps so many of the systems running in a high-quality manner.

All of us working at the interface of Colorado's higher education and water management organizations can take great pride in the recognition that our efforts have received in CWRI's being designated a 'model' program by a national review panel. Let's continue to search for ways to make CWRI, and what it represents to Colorado's water resources, even stronger and more effective.

CWRI ADVISORY COMMITTEE MEETS TO PLAN FY 2000 RESEARCH PROGRAM

The CWRI Advisory Committee on Water Research Policy met on October 13, 1999, to receive progress updates on the four FY 1999 CWRI projects and to make key decisions regarding CWRI's FY 2000 water research program. The FY 1999 CWRI research program represents the first year of a new state-based water research program (the traditional state-based program operated by CWRI was terminated in FY 1996 in favor of a regional competition that, in turn, was terminated in FY 1999). The following faculty provided updates on current CWRI projects that began on March 1, 1999.

◆ Luis Garcia – South Platte Mapping and Analysis Project (in collaboration with seven South Platte water organizations). Ending date: June 2000.

◆ Grant Cardon – Statewide Groundwater Quality Database Evaluation (in collaboration with the Water Quality Control Commission and Region VIII of the U.S. EPA). Ending date: February 2000.

◆ Tim Gates – Description and Interpretation of Salinization in the Lower Arkansas Valley (in collaboration with the Agricultural Experiment



Tim Gates discusses his research on salinization in the Arkansas Valley. The Agricultural Experiment Station is cooperating on the project.

Station, Cooperative Extension and five local, state and federal water organizations operating in the Valley). Ending date: February 2002.

◆Kurt Fausch – Distribution, Habitat, and Life History of the Brassy Minnow (in collaboration with the Colorado Division of Wildlife). Ending date: February 2002.

After the research progress update, the Advisory Committee reviewed the current status of CWRRRI's research program. Two of the current projects requested multiple year funding during the FY 1999 competition, thus these requests received attention before further action on the FY 2000 funding was undertaken. Prior to 1996, CWRRRI did not provide multi-year funding for research projects. The 1994 USGS review of CWRRRI suggested that "Larger multiple year projects in support of major State issues might be more productive." After considering the progress and the relevance of the two projects, the Advisory Committee voted to provide CWRRRI FY 2000 funding for continuation of the Arkansas Valley Salinity and Brassy Minnow projects. The funding provided these two projects consumed most of CWRRRI's FY 2000 budget.



Kurt Fausch describes the project he is conducting in collaboration with the Colorado Division of Wildlife on the Brassy Minnow

Given the limited funding remaining, the Advisory Committee chose not to issue a Call for Proposals for FY 2000. Rather, the remaining CWRRRI money is being matched 3:1 by funding from Denver Water, the Northern Colorado Water Conservancy District, and the Colorado River Water Conservation District to permit state-of-the-art reviews of two critical Colorado water issues with a goal of identifying research needs for future CWRRRI programs. The two topics are:

Water/Forest Management Interface Issues - During the FY 1999 meeting, the Advisory Committee expressed a strong desire to initiate research into the science that underpins our understanding the impacts of forest management practices on water yield and water quality. Several scientists working in the field have pointed out that there is a considerable amount of such information available, but it has not been interpreted in the context of today's water management questions. The Advisory Committee requested that a task force consisting of faculty, water managers, and forest managers be assembled to examine the state-of-the-art, identify where scientific knowledge may be lacking, and formulate a research program to address the information gaps.

Source Water Protection Information Needs Assessment – The drinking water supplies of Front Range cities are being impacted by development occurring in the mountains of Colorado. With trans-mountain diversions, storage of water in reservoirs, and distribution to multiple cities in eastern Colorado, there is concern that the science underpinning the methods to be employed to perform source water assessments, per the new Safe Drinking Water Act regulations, may not be well developed, especially in such a complicated water supply system as exists in Colorado. An assessment of the state-of-the-art in source water assessments, as applied in Colorado, will be undertaken with a goal to identify future research needs. Denver Water will be used as a case study.

The funding support provided by Colorado water management organizations for FY 2000 is permitting CWRRRI to expand its water research planning efforts to better address water issues of concern to Colorado's water users. This support is gratefully acknowledged.



FORAGE WATER USE IN COLORADO

by Dan Smith

Department of Agronomy

The overall objective of the project is to better define and clarify how water is used in irrigated forage production systems in Colorado. Specific objectives include determining 1.) the seasonal variation in consumptive water use in relation to yield for various perennial forage crops produced in eastern Colorado, 2.) the magnitude and timing of consumptive water use by forage crops in selected western slope basins, and 3.) the best climatological methods for estimating consumptive water use in mountain meadow irrigated forage production systems.

Agricultural Experiment Station Project Number 792

Importance of the Research

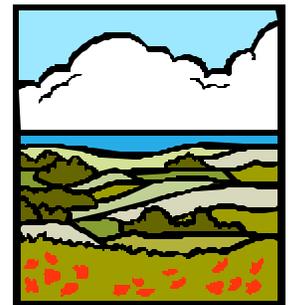
Irrigation of agricultural crops accounts for more than 80 percent of the total water diversions and approximately 94 percent of the total consumptive water use in Colorado. In 1992, forages harvested for hay were produced on approximately 36 percent of the total irrigated land, according to official state surveys. However, these surveys generally underestimate the overall importance of developed water resources in forage production because much of the acreage of irrigated pastures (acres not harvested for hay) is not recorded.

In some watersheds, such as the upper tributaries of the Colorado River basin, almost all the irrigated acreage is devoted to forage production. Despite the magnitude of water use for forage production in Colorado, little is known about the quantities consumed per unit of production, the variation in seasonal consumptive water use among different forages in different watersheds, and the variation in consumptive water use within a season for different forage crops. Information about these vari-

ables will help to define the overall efficiency of water use for forage production in Colorado.

Better understanding of the magnitude and efficiency of water use in forage production systems in Colorado is important for several reasons. First, irrigated forage production systems in the western US are frequently the target of criticism because of the significant acreages devoted to these crops, the fact that perennial forages consume higher amounts of water per acre than annual crops under similar environmental conditions, and the relatively low yield of actual food produced by these crops per unit of water consumed

Second, in eastern Colorado watersheds, the value of water is increasing because of higher demands for alternative competing uses (e. g. municipal, recreational, and environmental uses) and limited capacity for development of new water resources. As a result, water rights currently devoted to production of relatively low-value forages are increasingly susceptible to purchase and transfers. In addition, other watersheds are currently engaged in basin-wide planning efforts, which will partly involve the determination of relative efficiencies of water use by different sectors of the economy. Irrigation of forages consumes the vast majority developed water resources in several of the state's watersheds. Finally, the information on the magnitude of consumptive water use by forages in the Colorado River basin is of critical importance to state officials concerned with Colorado's entitlement under existing interstate compact agreements.





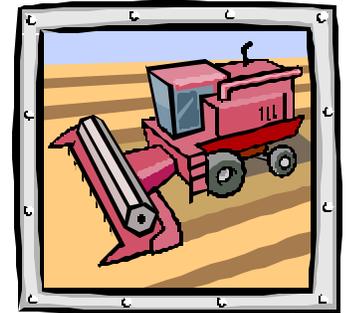
Description of Research

Research under objective 1 to determine seasonal variation in consumptive water use, yield, and water use efficiency for various forage crops is being pursued using two approaches. First, field studies are being conducted at CSU's Agricultural Research, Development, and Education Center (ARDEC) near Fort Collins. These studies include evaluations of alfalfa, smooth brome grass, meadow brome grass, and orchard grass. A second strategy, directed specifically toward alfalfa, involves obtaining yield data from other research centers (Arkansas Valley, Center, Southwestern, and Fruita), where alfalfa variety yield tests are conducted, and estimating water use from local weather station data.

The results from the field studies at ARDEC have been somewhat variable over years, but some consistent patterns have emerged. Variation in consumptive water use among the different forage species has been minimal during both the spring growth period (April to early June) and the summer (mid-June to late August). However, alfalfa generally has produced higher yields during both periods, which has resulted in higher efficiencies of consumptive water use for alfalfa as compared to the grasses. The largest difference in water use efficiency between alfalfa and grasses occurs during the summer,

when the growth of cool-season perennial grasses is limited by higher temperatures.

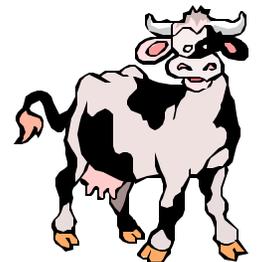
Research under objectives 2 and 3 is being pursued in the Yampa River basin and the upper Gunnison River basin. Studies in the Yampa basin have been conducted in collaboration with Water Division 6 of the Colorado Division of Water Resources, with supplemental funding provided by the Colorado Water Resources Research Institute. Initial work consisted of an analysis of irrigation water use for forage production in the basin using raw data from water diversion records compiled by Division 6. Results of this analysis have been published under the Colorado Water Resources Research Institute's "Water in the Balance" series (Smith, D.H. et al., Water in the Balance No.8, Nov. 1998).



Additional collaborative effort with Water Division 6 has been pursued to develop improved climatological methods for estimating consumptive water use by crops in high-elevation environments. Blaney-Criddle methods are used widely in the western US to compute consumptive use over relatively extended periods (15 days or more) using average daily temperature (average of minimum and maximum), a daylength function, and a so-called crop coefficient. The conventional Blaney-Criddle approach often produces significant variation between computed consumptive use values and those obtained from lysimeter measurements. These errors are known to be especially high in semi-arid, high-altitude environments. In this research, the use of alternative measures of average monthly temperature are being explored as a means of improving the accuracy of Blaney-Criddle consumptive use estimates. Low-cost temperature loggers have been installed at two established lysimeter sites within the Yampa basin so that temperature can be monitored continuously.



Studies similar to those described above for the Yampa basin were initiated in the upper Gunnison River basin in 1999. Lysimeters and temperature loggers were installed at eight sites within the basin, and consumptive use and temperature were monitored throughout the growing season. Supplemental support for these studies has been provided by the Upper Gunnison River Water Conservancy District.





'WATERFEST' TEACHES CHILDREN ABOUT WATER

by Dell Rae Moellenberg



Water is one of the world's most precious resources, so teaching

younger generations about water's value in society and the role water plays in the world is an important task. That task is the mission of the Northeast Colorado Youth Waterfest.

Waterfest is a day packed with activities designed to teach fourth, fifth and sixth grade students about water. For the past eight years, the Northeastern Colorado Ground Water Quality Committee has sponsored the event. The committee is comprised of Colorado State University Cooperative Extension Golden Plains Area; Yuma and Philips County Natural Resources and Conservation Services; Ground Water Management Districts; and the North East Colorado Health Department.

"We want to provide a fun atmosphere for kids to learn about water," said Joy Akey, Colorado State Cooperative Extension family and consumer agent, Yuma County. "The kids love the workshops and, in addition to enjoying themselves, they walk away with a great appreciation for our natural resources."



Akey is one of several Colorado State Cooperative Extension agents who plan Waterfest. Others include Gisele Jefferson and Bonnie Sherman, also family and consumer agents in the Golden Plains Area.

life-size riverlike maze. Students walk through the maze and find hidden wildlife facts and diagrams. The Water Witch amazes them by finding underground water with a wire rod, which sends a slight change in electrical conductivity and turns the rod toward the grounds.

Among 15 exhibits is bubbleology, a favorite, which uses a little water magic to capture a student volunteer in the heart of a huge bubble. Mystery of Bad Water allows young sleuths to analyze the purity of water through a variety of experiments. An old-fashioned bucket brigade, sponsored by the Wray and Vernon Fire Departments, gives students an appreciation for modern fire-fighting equipment. A Jeopardy-style game, called What're We Eating, tests students' knowledge of the water content of food.

The Waterfest was started to help educate youth about water. In addition, children often share new information from school with their parents, said Jefferson, which helps educate the entire community about the importance of water.

"We provide a current picture of our water resources —its quality and quantity," said Jefferson. "We do this through creative, fun presentations, games, videos and workshops. Kids get the message that water is very valued in our world ... all life depends on it. They learn about water conservation and the major uses of water, such as agriculture, and how water is managed. Several workshops also address domestic use of water, showing the students how much a

normal household of four use in a year. We use that statistic to talk about conservation methods that can be applied everyday when landscaping, showering and doing laundry."

Jefferson added that students also learn about the recreational uses



of water and safety rules to follow when swimming, skiing, boating and fishing. The Division of Wildlife's 50-gallon aquarium full of fish and information about the fish hatchery in near Wray helps students understand the state's fishing industry.

"In addition to educating students about water, we also introduce them to water-related careers," added Jefferson. "Throughout the day, they are exposed to a wide variety of professions, which might inspire their future."

Sponsors also provide packets to teachers whose classes attend the field trip so the experience can be extended into the classroom. The event is supported financially by local businesses, ground water management and soil conservation districts, and grant money. Local volunteers help make the event successful.

The event draws about 650 students from 11 schools in Colorado and Nebraska.



Among some of the attractions are a



THE ROUTT BLOWDOWN: AN UPDATE

by *Bob Sturtevant*

On October 25, 1997 the Front Range of Colorado experienced an early yet powerful snowstorm. Denver was paralyzed. Thousands of travelers were stranded at Denver International Airport. All the newscasts centered on the weather and associated human dramas.

In the mountains west of the Front Range another drama was occurring that same night. One that would receive much less media coverage, but would have much more long-term impact to the state. This was the Routt Blowdown. Thirteen thousand acres of high elevation forest were flattened by winds in excess of 120 miles per hour. The affected area covered some 30 square miles and blew down trees in approximately 40 patches ranging from 50 - 4000 acres in size.



A large opening threatens adjacent stands of trees

The vast majority of the blowdown occurred in the Routt National Forest, including approximately 8,000 acres within the Zirkle wilderness area. The US Forest Service (USFS) was responsible for assessing this event and developing a plan to react to the short and long-term effects of some five million trees lying on the ground. Here are some of the concerns that were addressed:

◆ **additional windthrow:** many trees were left unstable from the wind event and a large opening threatened adjacent stands of trees. The areas within and around the blowdown were unsafe.

◆ **Infestation of spruce bark beetles:** spruce bark beetles reproduce in green, downed trees. Populations can dramatically increase in a patch of blowdown, and once they have exhausted the favorable horizontal trees, they can infest standing green trees. This

infestation will kill the host trees. Thirteen thousand acres has an astronomical potential for breeding these beetles. How far and wide they will spread is a question many foresters and entomologists are concerned about with this event.

◆ **changes in wildlife species composition and habitats:** the habitat changed from a dense, mature forest to an open stand with a heavy layer of downed trees. This must have an impact on the composition of the wildlife inhabiting the blowdown area.

◆ **wildfire:** there will be a heavy layer of dry fuels susceptible to fire for the next few years.

◆ **visual aesthetics:** although this is a natural disaster, to the human eye the area looks "destroyed." It will look different for many decades and possibly several centuries.

◆ **recreational use:** human use of the affected area will change due to the difficulty in travel, aesthetics, and hazards.

◆ **changes to water yield and quality:** fewer trees could mean more runoff. Disturbed soil from toppled trees could mean increased sediments in the water.

Three different analyses were completed with input from local and regional publics. It was acknowl-



CSFS personnel inspect downed tree

edged that much of the downed timber would not be salvaged, especially those trees within the wilderness. There were areas previously designated as suitable harvest sites that were now part of the blowdown. These, as well as other easily accessible sites, were set up for salvage cuts.

Seven salvage sales were advertised and sold during the summer of 1998. The sales ranged in size from 5 acres to 947 acres and included conventional machine harvesting, cable harvesting and helicopter logging. All seven were sold with a total acreage of 1950 acres. Three of the sales were completed this summer. The remaining four sales will be completed over the next two years.

Logging companies from as far away as Alabama are involved in the salvage effort. Some of these companies are specialized in working in blowdown timber and travel around the country following hurricanes, tornados and other wind events. Their equipment safely handles the jack-strawed trees and enables the landowner to use much of the damaged wood resource.

Not wanting to build extensive road systems to clean up the trees, one of the salvage units was offered as a helicopter logging sale. Using a Bell 212 helicopter the logging company was able to move approximately 70,000 lbs of material from the salvage site to the existing road each hour. This is an average of three logs per load and thirty loads per hour. The 70,000 lbs is enough wood to fill two log trucks.

Three areas not included in the salvage work but designated as high-value areas are Buffalo Pass, Rabbit Ears Pass and Steamboat Ski Area. Assessment of spruce bark beetle populations in the downed trees near these areas showed

elevated numbers. The expected populations of 40 insects per square foot of infested tree were at levels of 200-300 insects per square foot.



Downed tree infested with spruce bark beetle

In response to these levels of insects, the US forest Service started a program of piling and burning the infested trees near these high-value sites. Most of this is hand labor and requires a considerable amount of physical effort. In the Buffalo Pass area 250 piles have been created and will be burned this fall and winter.

Future plans in these areas include creating trap trees for the spruce bark beetles. This requires cutting a few trees to attract the insects. Since they prefer downed trees, the plan is to draw them to these cut trees and then burn them before the next generation can fly to the surrounding timber.

Of all the long term impacts of this wind event, the spruce bark beetle is the greatest concern. The U.S. Forest

Service will be completing a bark beetle analysis this winter and consider various methods of mitigating the insect's damage. Due to the size of the Routt Blowdown, options are limited, and any major eradication campaign would be extremely costly, if feasible.



Logging company equipment safely handles jack-strawed trees

The Colorado State Forest Service has been carefully following this event with the knowledge that we will

become involved once the beetles move from the federal lands onto state and private property. At this time all we can do is give our assistance to the USFS and help educate people about the spruce bark beetle's potential and the need to maintain a healthy forest.

For more information about the Routt Blowdown contact the Routt National Forest 970-870-2192 or www.fs.fed.us/mrnf.

MEETING BRIEFS


**SOUTH PLATTE FORUM:
OLD RIVER – NEW COURSE?**


From left: Gene Schleiger, Northern Colorado Water Conservancy District; Lindsay Martin, South Platte Forum Coordinator, and Rbo Henneke, Environmental Protection Agency, Region VIII, discuss forum organization.

The 1999 South Platte Forum provided attendees with an excellent overview of a number of key issues facing water and wildlife managers, as well as citizens, in the South Platte basin.

The rationale behind the Preble's Jumping Mouse listing was described along with the response of the water community in a session entitled, 'The Mouse that Roared'.

The status of the Mountain Plover and Blacktail Prairie Dog listings was reviewed along with a description of the means being used to help restore these species.

The Three States Agreement on the Platte River, designed to restore habitat in central Nebraska, was reviewed and the current actions described. It is obvious that a number of key decisions will be made within the next year regarding the future of the Agreement and its implementation.



From left: Dan Luecke, Environmental Defense Fund; Kent Holsinger, Colorado Water Conservation Board; Dayle Williamson, Director, Nebraska Natural Resources Commission; Becky Mathison, Wyoming State Engineer's Office; and Curt Brown, South Platte EIS, Moderator for panel on Three States Agreement.

Beyond the immediate need to address endangered species, the Forum had sessions on source water protection and its implications to water supply providers and the people living in the watersheds providing the water. The Confined Animal Feeding Operation (CAFO) regulations, emerging from passage of Amendment 14 in 1998, were discussed and described along with another session on broader non-point source pollution issues and solutions.

Bill Brown, a Fort Collins water attorney and the South Platte representative to the Colorado Water Conservation Board (CWCB), during the talk on October 27, reviewed a number of issues facing the CWCB including the construction fund audit and its implications to the fund's operation.

Greg Walcher, Executive Director of the Department of Natural Resources, in the October 28 luncheon talk, described a number of water and wildlife issues facing the State of Colorado. He articulated a new emphasis on recovering species via a number of action oriented programs such as stocking streams with endangered species and providing additional water via enhanced management of the forest/water interface in Colorado.



From left: Nolan Doesken, Assistant State Climatologist; unidentified Forum participant; Ron Gosnell, Area State Forester; and Kent Holsinger, Assistant Director, Colorado Water Conservation Board.

The breaks and poster sessions were buzzing with active and animated conversations about water and wildlife in the South Platte Basin. Planning for the 11th South Platte Forum will be underway soon and any suggestions for improvement in the program for 2000 are welcomed.

USCOLD OFFERING \$10,000 GRAD SCHOLARSHIP

The United States Committee on Large Dams is again offering a \$10,000 scholarship for a graduate student at a university located within the United States. All applicants must be U.S. citizens. The proposals from graduate students should contain a description of the proposed research (1 or 2 pages), the name of the faculty member who will supervise the research, a brief resume for the student, and a copy of the student's graduate transcript to date. Acceptable topics for the research are rather broad and include any topic concerned with the design, construction, analysis, safety, maintenance, or rehabilitation of dams. **DEADLINE:** December 31, 1999. Send proposal to: Dr. Charles L. Bartholomew, P.E., Professor and Chairman, Department of Civil Engineering, Widener University, One University Place, Chester, PA 19013


**THIRD ANNUAL CSU
STUDENT WATER SYMPOSIUM A SUCCESS**

The 1999 Colorado State University Student Water Symposium was held November 3-5 at the Lory Student Center on the CSU campus. The event began with a poster session held Wednesday afternoon. There were nine undergraduate and graduate participants in the session, which was evaluated by four faculty members and two students. Best undergraduate poster went to Rose Wallick, Department of Earth Resources, for her poster entitled Preliminary Paleohydrological Investigations at Kaplan-Hoover Bison Kill Site. The best graduate poster went to Koren Nydick, Natural Resource Ecology Laboratory, for her poster on Nutrient Limitation Experiments in Subalpine Lakes of the Loch Vale Watershed, Rocky Mountain National Park.

The keynote address, given by Marc Reisner, author of Cadillac Desert, was held Wednesday evening, November 3rd, at the Lory Student Center Theatre. His topic of water management in the west: "Dams and their Legacy", drew a large audience of approximately 400, including students, faculty, community members,



John Wilkins-Wells, Sociology Department (right), CSU, poses question to Marc Reisner after his keynote address



Nathan Foged (left), winner of best graduate presentation, received an award from Mike Dodd, Teledyne Water Pik

and out-of-town attendees. His focus on the history of dam building, consequences to endangered species, and his call to remove many of the dams in the west which are no longer economically beneficial challenged many of the audience members to look at water management in a new way, and drew lots of audience participation during the question period. At the reception following the keynote, many were able to talk with Mr. Reisner personally. An abridged version of Mr. Reisner's remarks can be found on page 19.

The oral presentations of water-related student research were held the following two days at the Lory Student Theatre. Presentations covered the following topics: Water Resources and Management, Groundwater and Water Quality, Aquatic Ecosystems and Remote Sensing/Modeling. The best undergraduate oral presentation went to Alejandro Flores, Department of Civil Engineering, for his topic of The Effect of Watershed Urbanization on Traditional Salmon Spawning Grounds, and the best graduate presentation went to Nathan Foged, Department of Chemical and Bioresource Engineering, for his research on Monitoring of Salinity and Waterlogging in the Arkan-

sas River Valley. An awards reception was held Friday evening. Teledyne Water Pic provided awards for the top honors.

A highlight of the Student Water Symposium was the presentation of the first annual Water Center Awards for Outstanding Interdisciplinary Activities in Water Education, Research and Outreach. Faculty recipients of the awards were Brett Johnson, Department of Fishery and Wildlife Biology; and Luis Garcia, Department of Chemical and Bioresource Engineering. These young faculty have shown considerable energy and initiative in moving outside their disciplines to conduct creative and original research and to collaborate with faculty of other CSU departments and organizations outside the university. Particularly striking in both nominations is the involvement of students in the interdisciplinary work.

GARCIA, JOHNSON RECEIVE CSU WATER CENTER AWARDS



Bob Lange, MS Graduate Student in Earth Resources, nominated Luis Garcia for the Water Center Award and presented the award during the symposium closing ceremonies.



Greg Stewart, Symposium Co-Chair, Mike Dodd, Teledyne Water Pik, Paul Haby, Symposium Co-Chair, and Lindsay Martin, Symposium Co-Chair.

Luis Garcia Department of Chemical & Bioresource Engineering

Luis Garcia coordinates the South Platte Advisory Committee, which is comprised of local and state water organizations and agencies. The group has identified critical areas of technology needed for state and regional water planning and management goals in the South Platte River Basin. By using an interdisciplinary approach with collaboration and active participation of these organizations and agencies, the project has developed key pieces of software including a Stream Depletion Factor Interface (being used by Nebraska as part of Colorado's contribution to the Three-State Agreement),

a Consumptive Use Model, and a Mapping and Analysis Program that includes data layers assembled for future use as a framework for future Decision Support Systems in the South Platte Basin.

Dr. Garcia, along with other faculty members, is also improving water quality and agricultural sustainability in the Arkansas Basin by working with local farmers to manage irrigation and drainage systems. He implements the technology developments in the classroom with practical, hands-on courses, has participated in a number of development committees for minority students, and directs the Integrated Decision Support Group which provides an excellent environment for Ph.D. and Masters candidates to work on water-related research projects and gain valuable work experience.

Brett Johnson
Department of Fishery
& Wildlife Biology

Brett Johnson has worked for the past three years on an interdisciplinary research effort at Shasta Lake in northern California, with the U.S. Geological Survey. He became interested in the project while serving as a non-departmental member of Laurel Saito's graduate committee. Dr. Johnson "...put in hundreds of hours providing guidance to Laurel in her research and contributing substantively to her project," according to John Bartholow, Ecologist with the U.S. Geological Survey. Bartholow added, "Devoted efforts like his are the best way to foster interdisciplinary collaboration in today's educational system."

Dr. Johnson's research collaboration on other projects includes Effects of Dam Operations on Reservoir Physics and Biology, Blue Mesa Reservoir, Colorado, with John Bartholow; Water Quality in Front Range Reservoirs, with Ben Alexander of the City of Fort Collins Water Treatment Facility; and Biogeochemistry and Biology of Nitrogen Deposition in Alpine Lakes, with Dr. Jill Baron of CSU's Natural Resource Ecology Laboratory.

Dr. Johnson teaches three interdisciplinary courses: Conservation Genetics, Regulated Rivers, and Experimentation in Ecology; and has guest-lectured on Aquatic Ecology and Water Quality in several courses.



Brett Johnson was presented his Water Center Award by Laurel Saito, Ph.D. student in Civil Engineering, Laurel nominated Dr. Johnson for the award.



WATER SUPPLY

October water supply conditions held at an acceptable level as indicated by the SWSI values, in spite of all basins experiencing a drop in their SWSI numbers from the previous month. Most basin administrators reported dry conditions during October, with precipitation amounts well below average. The dry conditions caused more irrigation water to be applied in October than is typical. Reservoir levels are above average statewide. The surface Water Supply Index (SWSI) developed by this office and the USDA Natural Resources

Basin	11/1/99 SWSI Value	Change from the Previous Month	Change from the Previous Year
South Platte	3.5	-0.1	+0.3
Arkansas	2.1	-0.4	+0.3
Rio Grande	2.0	-0.4	+0.8
Gunnison	1.5	-0.3	+1.0
Colorado	2.6	-0.2	+0.7
Yampa/White	0.0	-1.0	-2.8
San Juan/Dolores	0.8	-2.9	+0.3

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 snowpack, reservoir storage, and precipitation for the winter period (November through April). During the winter period snowpack 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 November 1, 1999, and reflect conditions during the month of October.

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





THE AGE OF DAMS AND ITS LEGACY

by Marc Reisner

Marc Reisner certainly is best known as the author of Cadillac Desert, the American West and its Disappearing Water, which was published in 1986 and has had an enormous influence on how people have talked about and studied the West, its water, and its water problems. It certainly had a big influence on me when I was working as a public historian and later went to graduate school. This is one of the books that influenced me and turned me toward water history. Without a doubt, this is one of the best-known and widely read books on water in the West. If you have not read it, I suggest you get the book and read it. It is a hard-hitting critique of water policies and water practices in the region. I would best describe it as part history and part muckraking journalism, although Marc Reisner is not really a journalist. I have been talking to him backstage. Cadillac Desert launched Reisner into national prominence and placed him at the center of intense debate over Western water issues. Since the publication of the book, Reisner has continued to work as a consultant and advisor to various groups and organizations on conservation matters including water. He is now at work on a book about the relationship of disaster to California history. His talk tonight is titled, "The Age of Dams and its Legacy."

Mark Fiege, History Department
Colorado State University

The past hundred years have been the hydraulic century, the Age of Dams. Nearly all of the world's mentionable dams were built in the 20th century. It was the age of levies as well, the age of infinite liberty taken with planetary hydrology. There never was — and I suspect there never again will be — an era of such gargantuan and disruptive civil engineering works.

Wally Stegner, the late novelist and Western historian, opined that the Age of Dams began not with the construction but with the destruction of a dam. On May 31, 1888, a privately owned dam erected on a fork of the Canemaugh River in Pennsylvania by the Pennsylvania Canal Company, failed during a series of tremendous rainstorms. The 50,000 acre-ft. reservoir, which was the biggest in the world at the time, wiped Johnstown, Pennsylvania and 2200 people, off the face of the earth. That disaster convinced a lot of people that the private sector had no business building dams, and that new prejudice led directly to the Reclamation Act of 1902, which in its time was revolutionary legislation. It brought the Federal Government, with all of its moral authority (it still had moral authority, back then) and powers of taxation and eminent domain, into the water development business. That was a stupendous first.

But the muscle-bound agencies that would build America's largest dams — the Bureau of Reclamation, the Corps of Engineers, TVA — never really hit their stride until a stunning little cluster of historic events occurred about a

half-century later: the Great Depression, the Dust Bowl, and the election of Franklin Delano Roosevelt. In the wake of these events, harnessing rivers became the Lord's work, and as far as many people were concerned, FDR, who loved building dams, was next to God. Early in his second term, the five biggest structures on earth — Hoover Dam, Bonneville Dam, Grand Coulee, Fort Peck and Shasta Dam — were all being built at the same time, in one relatively small quadrant of one region of one big country.

The socioeconomic benefits of water development are undeniable. Even environmentalists, at least some of us, will acknowledge them. But the problems created by water development are still undervalued, and they will get worse. Here in a nutshell are some of the big ones (I am sure that many of you in environmental studies will find none of this new:

- ◆The inexorable sedimentation of reservoirs on which hundreds of millions of people have come to depend.
- ◆The ruin through salt buildup of millions of acres of once-fertile soil.
- ◆The creation of monstrous cities in stark deserts where they arguably should not exist.
- ◆Vulnerability to earthquakes, which can destroy aqueducts and cause dams to collapse. There was an earthquake in the Mojave Desert just a few weeks ago, and the first thing anybody worried about was, Did LA's Colorado River aqueduct break in half? It did not — yet.

- ◆ Stoppage of river-borne sediment and the erosion of river deltas and ocean shorelines.
- ◆ The collapse of great fisheries like the Caspian Sea sturgeon and Great Lakes lake trout.
- ◆ The deoxygenation and nutrient depletion of river reaches below reservoirs and the insidious bioaccumulation of methylated mercury.
- ◆ The displacement of millions of people from fertile river valleys.

Viewing this whole situation cosmically, one is forced to conclude that our frontier mentality just boomeranged and smacked us right in the face. We had a pretty good idea even decades ago what the environmental consequences of water development would be, but we told ourselves that there are always other rivers, other wetlands, other salmon runs — we couldn't run through this abundance. (They still say that up in Alaska.) Or, we simply decided in the end that the tradeoff was worth it. What nobody foresaw in the '40s, '50s and '60s was an imminent epochal shift in public attitudes toward nature, which gave us the ESA and other environmental laws. Now, the public demands protection or restoration of species, landscapes, and river scapes. Few people appreciate how difficult that will be without some sacrifice of water, and, most importantly, some deconstruction of the grand edifice that we have built.

Thus far, in California and up in the Northwest, we've tried to solve this dilemma mainly by sacrificing water or hydroelectricity, bypassing turbines so that the juvenile salmon don't get crunched up there, and reallocating water from agriculture back for instream flows. We have also built hatcheries, which according to many biologists is a band-aid approach that will make things worse in the end. We have installed fish ladders and fish screens, which is good, and we have even removed a few tiny dams, but reallocation of water supply remains the principal strategy. In 1992, Congress passed the Central Valley Project Improvement Act, which took ten percent of the water in that project, the biggest in the western world, going mainly to agriculture but also to Silicon Valley, and gave it back to nature. If that doesn't help meet the fish restoration goals, give water back to nature.

Viewing this whole situation cosmically, one is forced to conclude that our frontier mentality just boomeranged and smacked us right in the face. We had a pretty good idea even decades ago what the environmental consequences of water development would be, but we told ourselves that there are always other rivers, other wetlands, other salmon runs -- we couldn't run through this abundance.

Although I strongly supported the CVPIA reform legislation, I have very mixed feelings about this kind of reallocation. It is a politically risky recovery strategy that can backfire, because you are taking water from some very powerful players, like Metropolitan Water District. But mainly, reallocation hasn't done much. In California, we have seen very little recovery of any salmon species. In the Northwest, they have spent \$4 billion dollars directly or

indirectly on salmon recovery since 1980. Basically, the result has been zip. The fishery is just as bad off as it was then. Reallocation is a zero sum game, and doesn't seem to work well. We need to try something else. Several things, actually.

First, we have to expand, appreciably, the available spawning habitat for our anadromous fisheries. That can only mean that we have to modify, or dare

I say it, demolish, blow up, tear down, some dams. Not Shasta, not Grand Coolee, not Hoover (I don't even think we should take Glen Canyon down) — but especially on the salmon rivers of the Pacific Coast — some antiquated dams that offer minimal benefits, and perhaps a handful of fair-sized dams that offer serious regional benefits, and whose removal or modification will be ferociously resisted by various interest groups.

As candidates, I am thinking of the four navigation and power dams on the lower Snake River, which are huge dams, 100 feet high, a quarter-mile wide, built by the Corps of Engineers. The Corps of Engineers, however, says these dams are losing money despite the fact that they produce 1200 megawatts of electricity between them. The operation and maintenance and amortization of the cost amount to more than the value of the hydroelectricity, and that does not even count the tremendous negative impact the dams have had on the fishery. In simple economic terms, according to the Corps — which built the dams — or at least according to their consultants, it makes sense to take them down. Don't bet on it happening soon.

I am also thinking of Englebright Dam in California. I am a participant in an officially sanctioned debate over whether

we can get rid of that one. If you do, you have about 140 miles of spawning habitat on the South Fork of the Yuba River that somehow the dam builders left alone. I don't know why. They went to sleep and the South Yuba above Englebright Dam made it into the 1990s looking largely as it did 500 years ago. Nowhere in my state can you take one dam down and get that much habitat back. That is why we are seriously talking about taking down this 280 foot dam, which would be the largest dam ever removed in the history of the world, for environmental reasons alone.

I am thinking of what is tops on my list of dams that should have been removed 20 years ago, the Elwha dams up in Washington State, whose removal, according to biologists, could restore a run of 350,000 salmon and steelhead. Some of those salmon in the Elwha weighed 100 pounds. That was probably the most productive salmon river, mile-for-mile, that existed on the face of the earth. Two crummy-looking old dams now prevent the restoration of that fishery. Thirty megawatts of electricity is all they produce, but because one person, Senator Slade Gordon of Washington, likes the dams and does not believe that he and his wife brought babies into this world so that they could watch dams being demolished, those dams are still there. He won't allow it.

Then we have Savage Rapids dam on the famous Rogue River in Oregon, which the Bureau of Reclamation built and which the Bureau now wants to tear down. The local water board even voted twice to take the dam down; it's their dam now. But both times the members who voted to take it down were recalled by their constituency. There is a potent Wise Use movement in southern Oregon, and they abhor dam removal.

I am thinking of Condit dam on the White Salmon River in Washington, which actually is going to come down. Its private owner just agreed, under great pressure from the Federal Energy Regulatory Commission, to remove it.

I am thinking of a few dozen dams that ought to come down, mostly smaller dams and not-so-important dams that killed off important salmon fisheries. I think in virtually every instance you can make a case that getting rid of the dam is worth it just in economic terms — forgetting anything else. But if we are going to remove dams, we will lose some water storage. Most of these dams are not significant in that regard, but this is a growing region and we can't stop people from moving to Colorado, California, Oregon or anywhere else.

So, we need some more water storage, and I am one of the few environmentalists who will go on record saying that. We can't just say that the only "new" water that we will ever create in the West will come from reallocation, which means buying it from farmers and giving it to cities. The result of that is Thornton. Sooner or later, Thornton becomes Los Angeles. I actually am a guilty party in this, because I am in the water business myself now, brokering water deals, but I still maintain that reallocation can't be the only strategy.

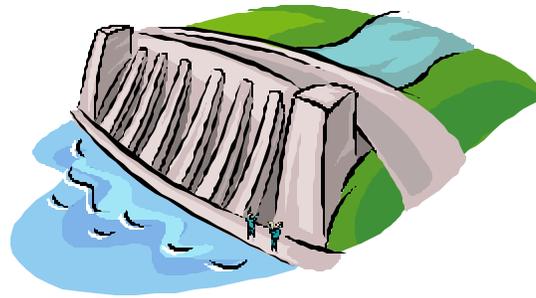
Let me discuss voluntary reallocation of water, where you have a willing buyer and a willing seller, which is still hamstrung in some states, notably my own, by heavy-

handed government restrictions regarded as fine and dandy by a lot of people who say they believe in free enterprise.

Water transfers have their obvious downside, as most everything does, but

either we believe in free markets or we don't. You can't say we will have socialist, government-managed water while we super-privatize the rest of the economy. That is hopelessly hypocritical, not to say inefficient. But water transfers — reallocation legitimized by capitalism — still aren't enough. We need new storage, which doesn't necessarily mean dams. There are plenty of opportunities to store water underground. I am sure they are here; they certainly exist in California. William Mulholland, in fact, who was the father of the Los Angeles water system, was a great proponent of underground storage. He looked down his nose at dams and reservoirs; they evaporated too much water and he hated that waste. But then he got smitten with an edifice complex and he built several dams, one of which collapsed. It killed 450 people and ruined his reputation.

I don't know what is so radical about any of these ideas. Since when, in America, is the free-market system radical? But there are many people who say you can't have a free market in water — that's too radical. There is no law that says dams have to be permanent. We can take them down if they're unsafe, so why can't we take a few taxpayer-financed dams down if they cause more environmental, social, and economic disruption than they are worth? We



can store water benignly in depleted aquifers underground; we can increase the capacity of those aquifers through conjunctive use programs where, for example, an irrigation district in northern California (or here in central-eastern Colorado) with a big water right agrees to forego some of its entitlement and sells that water downriver, pumps groundwater in its place, and then when wet weather returns stores some surplus water such as there is back into the aquifer or even recharges it actively under pressure. We still have some big surpluses when we have these huge storms in California. That can really stretch water supplies, but conjunctive use isn't happening, at least in California. We have been talking about groundwater storage for 20-odd years and have done next to nothing about it. Now private companies, including one that I am on the board of, the Vidler Water Company which owns the Vidler Tunnel up here, are trying to do what the government has not done — create new storage and/or new water through willing-seller/willing-buyer deals. But the government is in our way all the time. So are a lot of people who just don't like change.

There is only one kind of political game that is allowed right now. Its name is consensus. To get anywhere with anything these days, all God's chillun have to find consensus.

That really leads me, I guess, to the summing up of this overly long lecture. What has hamstrung efforts to inaugurate a modern water era in the West: to deconstruct instead of construct, to get beyond the zero sum reallocation game, to privatize and decentralize this most centralized and unprivatized natural resource in the country? To merge the best interests of the human and natural worlds, it's less a set of laws or rules than an idea, a concept that, in my view, has been taken almost to a ludicrous extreme. You students are too young to have been in water politics much, but some of your professors and others may have been involved in water politicking. There is only one kind of political game that is allowed right now. Its name is consensus. To get anywhere with anything these days, all God's chillun have to find consensus. It has become a mantra of the CalFed program, which is vested with billions of dollars and great responsibility for new water storage and reliability on the one hand, and environmental restoration on the other. In the Northwest, there are 900 parties seeking consensus on salmon issues from morning 'til night, and they never find it — dams that, according to polls, the majority of people want removed. The Elwha dams are a good example, or the Savage Rapids dam in Oregon. They are not being removed because some people remain opposed. Usually this is because they have some tight little local self-interest, but

many modern politicians are petrified of proceeding without 'consensus,' a buy-in from practically everyone.

In California, it has been exactly the same story with new water storage, even environmentally-benign underground water storage. I was involved with the owner of a big piece of land, the only undeveloped, privately owned piece of land in the San Joaquin Valley of that size — 13,500 acres, about the size of Manhattan Island. It was owned by a family that got so rich from other exploitative industries — logging, mining, railroads — that they never had to irrigate it. They didn't need the money, but all of the farmers

around them did, and they all were on pumps until quite recently. They literally created a "pump hole" under Madeira Ranch. They sucked the aquifer down about 150 feet. The person I partnered with was smart enough to see that this ranch, despite its very low water table (which was a great drawback from an irrigation perspective), had "added value" simply because there was a hole in the aquifer. We are not building any dams in California (there's one big new

one built by Metropolitan Water District, but that's pretty much it), and we are gaining 700,000-800,000 people a year. We need new storage. The environmental community is opposed to dams. How are we going to store water? Underground.

We thought we had a wonderful deal there, until we were clobbered by environmentalists who basically did not want any new storage. They equate it with growth. Growth is bad. Send people to Colorado — that's what they say in California. No more water development here. Take it from agriculture. Meanwhile, the local farmers, who had a bunch of reasons to oppose this project — none of which in my view was rational — were worried about us putting selenium in the aquifer, among other things. Perhaps for the first time in history, a bunch of extremely conservative local farmers and ranchers made an alliance with the likes of the Environmental Defense Fund, Natural Resources Defense Council (where I used to work and my wife still does — this was not dinner table conversation for a while), and opposed this project. They beat it back and stopped it dead because the state, which was going to develop it together with the federal government, said it couldn't do it because there was no consensus.

I have a problem with consensus, and not just that

consensus cost me potentially what could have been a lot of money. My problem with consensus is that it doesn't work, at least not in a lasting sense. That is especially true with an issue as volatile as water, and especially true in a region as Balkanized as ours. By Balkanized, I mean the way they think in Boulder compared to the way they think in Limon, for example. Buzz Thompson, a friend of mine who teaches law at Stanford, has been studying this whole consensus politics infatuation for several years, and he has come to the conclusion that consensus seeking actually wastes more time than litigation, which is what it is supposed to replace. That is partly because in a majority of cases it leads to litigation anyway. People say, "All right, I'm for it," but then when they see what they just decided they were for — when they see it in practice — they sue.

The other more serious problem I have with the politics of consensus is that we abdicate an ability to make anything happen whenever an outspoken minority doesn't want it. In Margaret Thatcher's apt phrase, and I'm not exactly a fan of hers, consensus is "the negation of leadership." It substitutes minority tyranny for majority will.

Would a colonial America so obsessed with finding consensus ever have fought the Revolutionary War? Some of those colonial governors were Anglophiles or monarchists who thought independence and democracy were rotten ideas. What sort of consensus prevailed at the constitutional convention? Intractable disagreement was the order of the day. Alexander Hamilton called Thomas Jefferson a "...contemptible hypocrite whose politics were tinctured with fanaticism." Jefferson called the venerated John Marshall, the first Chief Justice, "...a man of lax, lounging manners." Marshall in turn pronounced Jefferson "totally unfit for the chief magistracy of a nation." Hamilton was killed in a duel by Aaron Burr simply because he disagreed so profoundly on what the shape of the constitution should be. But we got a constitution out of it, because the majority finally prevailed.

QUESTION AND ANSWER SESSION

Q: We here in Colorado...have a conjunctive use project that is in the planning stages in South Park, southwest of Denver about 85 miles. The Town of Aurora has proposed it, and they are really presenting the project as environmentally benign, ignoring the growth of Aurora. They present it as Aurora taking excess water, storing it underground in wet years, and using it in dry years. If it were a situation where I knew the water tables had been depleted by 150 or 200 feet, and we were taking space that we had created, I might be able to support the conjunctive use project. But I wonder how you feel about the situation here. This particular

More to the point — and to sum this all up — how was it that we built so many dams? How was it that we decimated our salmon runs and dried up our waterfowl habitat? Was there consensus? There was not. There was, until about the 50s, but by the '60s, when some of the most objectionable projects were yet to be built — including every one of those Snake River dams — there was powerful opposition from sport fishermen, hunters, commercial fishermen, conservationists, Indians, ordinary citizens — even from conservatives who felt the government had no business being in the dam-building business in the first place. But we built them anyway. We invoked Teddy Roosevelt's gospel: the greatest good for the greatest number. If you got in the way, we moved you. Ask the Indian tribes whose reservations, promised to them forever, got flooded by the Missouri River reservoirs.

Within reason — and that is an important caveat because the opposite of minority tyranny is mob rule — within reason, the greatest good for the greatest number is the gospel we need to re-invoke today. Sure, it won't mean what it did 50 years ago because our values and needs have profoundly changed. Most of us don't want to lose our wild salmon. We want to restore them. Most of us want to restore some of our wetlands. Most of us don't want a totally regulated Colorado River any more than our forebears wanted a totally unregulated one. We may even want to stop New Orleans and southern Louisiana, the greatest coastal wetland still on the continent, from disappearing into the Gulf of Mexico.

In the end, we need leadership. Leadership willing to take this country where it wants to go, not where entrenched power, money, and habit insist it stay. Serious leadership, more than anything, is, in my view, what is missing in America today.

mountain valley has a lot of both state and globally rare wetland ecosystems that are found certainly nowhere else in Colorado, and possibly nowhere else in North America...this is the Upper South Platte. I wonder how you would qualify your support of conjunctive use in this case?

A: I am not saying that conjunctive use doesn't have a downside. In this particular instance, it may have a greater downside. The problem with Colorado is you are really up against the limit. You use practically every drop of water that you are entitled to use here. What little surplus water

still manages to escape downriver somewhere does some environmental good. Your runoff that you are entitled to use, I believe, is about 7.7 million acre-feet per year. Ours in California is 70 million. We have about five or six times as many people. Basically, Colorado is second to California in every category except water. California has ten times as much water as Colorado.

In my state, conjunctive use can be done with minimal impact. It varies on a case-by-case basis, but I guess the point I am trying to make here is that I don't see how you can stop people from moving where they want to go in a democratic society. There is no city, to my knowledge, that has successfully kept people out by saying, "All right, we don't have any more water," because the city next door or a suburb next door said, "We want you. Come here." So, you have the same kind of growth, just spottier growth. It's like trying to squeeze air in a balloon. It goes somewhere.

I think building dams is the most damaging way of providing a new water supply. Even off-stream reservoirs have their impacts. There is a limit to the amount of water that you can take from agriculture without having a serious impact on agricultural communities and prime farmland. It is a real pickle. And I think it is at the edge here on the East Slope as much as anywhere in the West. You have some wonderful agriculture. You don't want to see it crawling with homes. On the other hand, Aurora, if it can't do conjunctive use, will probably try to resuscitate the Two Forks Dam. That city is determined to grow, and I don't know how you stop it. When you look at the alternatives in California, which I know something about, conjunctive use looks benign compared to the other options. Of course, desalinated saltwater is probably the most benign environmental option, but it is wildly out of reach economically, and some people even say it is environmentally troublesome. Believe it or not, Metropolitan Water District was talking about scaling up a small-scale demonstration plant that they have going now, and the EPA said they had to get a permit to dump the salt. Metropolitan said, "You mean we need a permit to dump salt in the ocean?," and the EPA said, "Yes, that's right." So, there are impacts, depending on one's point of view.

I think science, and especially engineering, has a great role in solving this dilemma. For example, fish ladders have advanced tremendously. That is a combination of biology and engineering. Biologists can come up with the idea for a fish ladder but they can't build it. Engineers were building awful fish ladders until they got some input from biologists.

Q: What role do you think the scientific community can play?

A: I think a lot. I gave a similar speech last night in Salt Lake, and I was asked the same question. I don't have blind faith in science. I think fusion energy is ten years away and always will be ten years away. That's what they were thinking when they built all these reservoirs – that someday we would have energy so cheap from fusion that we could pump all the silt out. It wouldn't cost a thing, and we could build ski mountains with it or something like that.

But Now, in California and also in Idaho, we are probably at the cusp – we have state-of-the-art fish ladder construction. A little dam on Butte Creek, which is a tributary of the Sacramento, got a fish ladder installed just about four years ago. Twenty years ago at that dam they counted 15 returning spawners above it. Fifteen fish had managed to get beyond that dam through the old fish ladders. Two years ago, 20 years later, 20,000 fish came up. That is partly because we had lots of runoff, lots of rain, and that helped. Also, we took a couple of downriver dams down. But the new fish ladder is unbelievably better at passing fish. Somebody saw six salmon jumping in the air at the same time, when you would have waited two months 20 years ago to see that many salmon getting above that dam. Now somebody needs to figure out how to get fish around a 200-300 foot dam, because the highest fish ladders that still manage to pass fish anywhere in this country are on those Snake River dams I mentioned, and they don't pass an appreciable portion. A lot of the fish just don't make it.

Part of the problem is cost. That is one example, and there are plenty of others. If some plant breeder could figure out how to breed a new type of alfalfa that uses 75 percent of the water that current alfalfa breeds use, in California alone that would be a savings of one million acre-feet of water which you could give back to nature, because alfalfa is the biggest water user in the state. The five biggest water users are alfalfa, pasture, irrigated rice, cotton, and metropolitan Los Angeles, in that order. Alfalfa is a crop that has its value, obviously a good rotation crop, but it is fed to cows.

Metabolically speaking, it is a tremendously inefficient user of water. That is why one pound of steak takes 6,000-8,000 pounds of water.

Q: I suspect that tomorrow morning when we read about your speech it might say Marc Reisner says to remove all dams. I am sure that is not what you are saying.

A: No. I emphatically am not saying that.

Q: Would you to comment on your perception of how the media has treated the kinds of issues that you addressed this evening?

A: The media, I think, don't have much patience for stories that have to do with something that won't happen for a couple or three years – global warming puts the media to sleep, and of course, the biggest story in the country that is not being reported on at all outside of Louisiana is the disappearance of southern Louisiana. It is an amazing story, and most people don't know anything about it.

I think the media — and I am including myself — are inclined to the dramatic, if not the melodramatic, so when a dam comes down on the Kennebec River in Maine, which happened last summer, we learned that the dam came down but we don't exactly learn why. We don't learn that the dam was built almost 200 years ago and blocked one of the great Eastern Atlantic salmon fisheries. It is just that a dam came down and there was a big political fight about it. The media is not doing a very good job of reporting, and especially in the complex interaction between civilization and nature. In California, we used to have thousands of salmon boats fishing, and now we have hundreds. In three or four years we may have none. If we have one more species join the ESA list, the Pacific Coast Federation of Commercial Fishermen, which I represent as a consultant now and then, believes they are out of business. What that means to coastal communities all the way up to Oregon and even to Canada is terrible. The logging industry is gone; the tanning industry is gone; all that is left is tourism and fishing.

The press has been very one-sided when it comes to this issue. They look at a poor farmer and feel sorry for him because everyone wants his water. We have a very, very sentimental — and I think justifiably so — attitude in this country toward farmers. But we forget about all the impacts — and the media is largely responsible for our failure — we forget about the cumulative impacts on people of 100+ years of dam construction, especially upon the Indians. Dam construction was a terrible calamity for most Indian tribes in the West, especially those depending on salmon fishing, but

also the inland tribes on the Missouri River, for example. They had their entire reservations drowned out. That is the media's biggest failing, I think — no hindsight and no foresight.

Q: Could you elaborate more on the reallocation issue? I almost see a dichotomy, in that you advocate a capitalistic approach, but when it comes to reallocation you said that's not really the answer.

A: You will find that I am inconsistent and ambivalent on every one of these issues. That is because I am truly torn. I believe in free markets up to a point. I am a gray-area kind of guy. I can't see anything in black and white. We should be raising the price of irrigation water that taxpayers subsidize. It is crazy to be giving Idaho potato growers water for \$1 per acre-foot. That is insane, but we still do it. Of course, we — being the government — have only so much ability to raise water prices, because only 25 percent of the water supplied in the western states is supplied by the federal government, but that is a very important 25 percent.

In California, we did raise prices dramatically under the Central Valley Project Improvement Act, because that CVP project was never going to be repaid in a thousand years at the rate that the revenues were coming in. They were buying water for \$3 an acre-foot. Now, they pay \$40, and the farmers said they couldn't possibly survive on \$40 water. We'll go broke. Well, what did they do? They got rid of a lot of cotton, about 200,000 acres of it, and they substituted high-value crops — walnuts, peaches, cherries. I personally believe that farmers, having done that, should be rewarded. They moved away from these water-consuming, relatively low-value crops, and planted what you should be growing in a semi-desert region with a limited water supply — crops that offer the greatest productivity per unit of water consumed.

Also, it is helpful if they are labor-intensive, as orchards are. You can efficiently irrigate orchards with drip irrigation. You can't really do that with cotton. So, now let's reward these guys by giving them a more reliable water supply during drought. I have advocated, along with the American Farmland Trust, that in the periphery of an urban area, where farmland could get gobbled up in the next 20 years or so, that if farmers owning that land are willing to sign an easement saying they will not allow a developer to put houses on that prime farmland for 40 years, we should give them cheaper water as a reward. Or give them a more reliable water supply in droughts as a reward. We have a bunch of dilemmas here: population growth, environmental restoration, farmland protection, and we are trying to solve them all at

once. There is no perfect solution. I think that market-based water is a path we ought to be going down, and you have gone further down that path here in Colorado than anybody else. But, as I said earlier, the result is Thornton, or for that matter, Aurora.

Q: *You summed up your speech by saying someone has to take the power to put the removal of dams at ...*

A: A dictator – yes.

Q: *It seems ironic that the media doesn't have the hindsight and it would seem that politics is the same. Looking to how you have power, where do we get that kind of power?*

A: NRDC does a lot of good work, but they are not really involved in dam removal efforts. The way this happens is you need somebody with vision. . Now, a lot of his vision in retrospect looks flawed, perhaps. He wanted to be a conservationist, but he really was the biggest civil engineer-type we have ever had in the White House. It was under him and Harry Truman that a great many of these dams were built, but he had vision. And that vision was taming the desert; settling people during the depression; defusing these explosive cities, where 30-40 percent of the work force was unemployed. Sending people out west. Putting them on irrigation farms. That is what we did back then. Now, we need somebody with Roosevelt's vision, determination, and cunning and willingness to play power politics to get any of this restoration agenda advanced very far. I have a great respect and admiration for Bruce Babbitt, and he has that vision. He has been talking about removing dams ever since he was appointed Interior Secretary, but Bruce has one flaw, in my view. He believes too much in consensus. He is always talking about consensus, and you will not get people who have homes around a reservoir to agree that that reservoir ought to be drained and the dam demolished. Believe me, you won't. I can show you instance after instance in California where 100 people, a houseboat community up on Englebright Lake, 190 houseboats, have basically stopped the efforts to remove a few marginal dams. I'll bet if you took an opinion poll and people understood the situation, you would find probably 70 or 80 percent that say, "Get rid of that dam." Especially in southern California, because if you don't, we will have more ESA listings, which means less water that we can bring down here. Babbitt and the head of the CalFed Program, Lester Snow, said "...we can't do that. It's a deal breaker. Not everybody buys into it." We didn't used to think that way. We moved people out the way; we had political leaders who had not just vision but a certain ruthlessness, if you want to

A sage once said that water flows uphill toward power and money. Water will flow uphill toward power and money.

call it that, a determination to see something through. We do the best we can for those parties who are going to be affected, but right now this is important, and you can't make the proverbial omelet without breaking eggs. Nobody thinks that way anymore.

Q: *The Bureau of Reclamation changed its mission to being more environmental. Now that you are in water development, do you see a role for the Bureau?*

A: The Bureau has certainly seen its star fade. I think their mindset has changed.

The Corps of Engineers has changed. The question is, "Do they become a maintenance agency where they basically take care of these dams and meter out water and that's it, or do we give them a role in this restoration agenda. My experience in California with the Bureau has been that despite a really good regional director, Roger Patterson, the rank and file just think their mission is building dams – water development. I don't know whether or not you can change the essential nature of an agency that has spent 85 or 90 years building dams and suddenly doesn't know what else to do, and is told they ought to be doing something else and even told what it is. I think a lot of people in that agency are just biding time waiting for retirement, afraid to ruffle anybody's feathers or raise anybody's hackles. I don't know what the answer is. I don't think the Bureau of Reclamation will be abolished, but I am not sure they are the agency that ought to be tackling some of these tremendously difficult restoration agendas. I'm not sure what agency should be. We have the Departments of Fish and Game in every state; we have the U.S. Fish and Wildlife Service, the Environmental Protection Agency, but these are issues that take a tremendous amount of social sensitivity. You are affecting a lot of people who are now in a privileged position of having a reliable water supply, which you are going to make less reliable, or cheap water, which you are going to make more expensive, or flood control from a dam that you now are going to take down. I don't know whether a lot of people in government have great political skill, without meaning to be offensive to anybody in government who I know is out here in the audience.

Q: *Could you share anything you have come across lately of a predictive or prognosticative picture of what water usage is going to be over the next 20 or 30 years.?*

A: A sage once said that water flows uphill toward power and money. Water will flow uphill toward power and money.



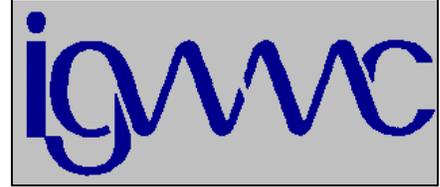


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CSM Water News

International Ground-Water Modeling Center
Colorado School of Mines
Golden, Colorado, 80401-1887, USA
Telephone: (303) 273-3103
Fax: (303) 384-2037
Email: igwmc@mines.edu
URL: <http://www.mines.edu/igwmc/>



International Ground-Water Modeling Center 1999-2000 Short Course Schedule

Hydrus-1D and -2D Software for Variably Saturated Flow and Transport	DEC 17-18	\$ 995	\$1095 after 12/1
Less than Obvious : Statistical Methods for Data below Detection Limits	MAR 16-17	\$ 650	\$750 after 3/7
Calibration and Uncertainty of Ground-Water Models	May 22 -25	\$1195	\$1395 after 5/15
Polishing Your Groundwater Modeling Skills	JUN 6-9	\$1345	\$1545 after 6/4
Applied Environmental Statistics	JUN 19-23	\$1295	\$1495 after 6/4

**FOR INFORMATION CALL (303) 273-3103
FOR REGISTRATION CALL (303) 273-3321
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CSU Water News

CSU FACULTY MEMBER AUTHOR OF NEW WATER HISTORY PUBLICATION

Irrigated Eden: The Making of an Agricultural Landscape in the American West by Mark Fiege, History Department, Colorado State University

Irrigation came to the arid West in a wave of optimism about the power of water to make the desert bloom. Mark Fiege's fascinating and innovative study of irrigation in southern Idaho's Snake River valley describes a complex interplay of human and natural systems. Using vast quantities of labor, irrigators built dams, excavated canals, laid out farms, and brought millions of acres into cultivation. But at each step nature rebounded and compromised their intended agricultural order. The result was a new and richly textured landscape made of layer upon layer of technology and intractable natural forces – one that engineers and farmers did not control with the precision they had anticipated.

Weyerhaeuser Environmental Books, 352 pp., 25 illus., notes, bibliography; Cloth, ISBN 0-295-97757-4, \$35.00. Available from local bookstores or contact University of Washington Press at Phone 1-800-441-4115, FAX 1-800-669-7993.

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Institute

CU Water News

UNC Water News

The Natural Resources Law Center at the University of Colorado, Boulder, will hold its next annual conference on June 7-9, 2000 on water and growth in the west.

For further information, call 303/492-1286

Or

Check the website at

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

EDUCATORS AND OTHER WATER USERS!!

Two graduate evening courses on WATER are offered by the Earth Science Department this spring, specifically to attract working professionals such as K-12 teachers:

WATER MANAGEMENT AND POLICY—ESCI 575-012 (3 SEM. HRS.) UNC course number #2644

This course is an Earth Systems Education course designed to attract teachers interested in using water as a theme in their curriculum. Upper level undergraduates (60 or more semester hours) from a variety of majors and graduate students from many departments are also invited to take this course.

-Instructor: Tom Cech, Masters in Community Planning, Executive Director of the Central Colorado Water Conservancy District, will teach the course, weaving the science and social engineering of western water policy into course work and research projects. Tom started the Greeley Water Festival and has been a leader in regional water systematics. He is in the process of writing a textbook which could be used in this course, eventually! For further information contact Tom at the Central Colorado Water Conservancy District (330-4540) or Bill Hoyt, Chair of Earth Sciences (351-2487) whhoyt@unco.edu. For information on UNC course registration, call (970)351-2521 or sign on to the UNC web address: www.unco.edu

-Meets Wednesday evenings 6-9pm, in Ross Hall of Science Rm. 3580 (on the top floor). Starts January 12 and ends May 3, 2000 (with spring break off during the week of March 13-17).

GROUND WATER GEOLOGY—GEOL 510-011 (2 SEM. HRS.) UNC COURSE NUMBER #1142

This course is technically based in ground water flow dynamics and explores properties of water as they apply to underground processes. The course is designed primarily for upper level undergraduates (60 or more semester hours), graduate students, and teachers who wish to bring real-world examples of physical processes into the secondary classroom.

-Instructor: Dr. Jared Morrow, Professor of Geology at the University of Northern Colorado. Contact Dr. Morrow at (970)351-2483 jrmorro@unco.edu or Bill Hoyt, Chair of Earth Sciences (351-2487) whhoyt@unco.edu. For information on UNC course registration, call (970)351-2521 or sign on to the UNC web page address: www.unco.edu.

-Meets Monday evenings 7-9 pm in Ross Hall of Science Rm. 0280 (in the basement). Course starts January 24 and ends on May 1, 2000 (with spring break March 13-17, 2000). Best Wishes!

RESEARCH AWARDS AT COLORADO UNIVERSITIES

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, CO 80523

TITLE	PI	DEPT.	SPONSOR
Quantifying Space-Time Variability in Agricultural Landscapes	Salas,Jose D	Civil Engr.	USDA-ARS
Partnership for Geography/Earth Science	Laituri,Melinda J	Earth Res.	Poudre Dist. R-1
Nitrogen Sources in Surface Waters in the Glacier Lakes Experimental Ecosystem	Stednick,John D	Earth Res.	USDA-USFS-RMRS
Nonpoint Source Information Education Coordination	Gray,Mary Mcphail	Cooperative Ext.	CDPHE
Rangeland Classification on a Short Grass Ecosystem	Child,Dennis R	RES	USDA-USFS-RMRS
Integrated Research on Hazardous Waste Chemical Mixtures	Duteau,Nancy M	Microbiology	HHS-PHS-Superfund
Leaf Litter Breakdown in Tropical Streams	Covich,Alan P	FWB	USDA-USFS
Population & Environment in the U.S. Great Plains	Parton,William J	NREL	Univ. Texas at Austin
Evaluation of the Potential of GPS for Measurement	Elder,Kevin J	Earth Resources	Booth Creek Ski Holdings
Towards a Multisensor Approach to Improve on	Stephens,Graeme L	Atmos. Science	NASA
Climate Analysis & Extended Range Seasonal Prediction	Gray,William M	Atmos. Science	NSF
An Experiment to Determine if Living Brown are Capable of Expelling Viable Myxobolus cerebralis Trout	Bergersen,Eric P	CFWLR	Montana State Univ.
Retrieval of Properties of High Clouds from LITE data	Stephens,Graeme L	Atmos. Science	NASA
Assess Ecological, Hydrological, & Geochemical Effects of the Dome Fire on the Capulin Watershed...	Clements,William H	FWB	DOI-NPS
GOCO Eagle County Biological Assessment	Wunder,Michael B	FWB	DOI-BLM
Theories & Methods for Measuring Environmental Values & Modeling Consumer & Policy Decision Processes	Loomis,John B	DARE	USDA-USFS-RMRS
Diversifying Cropping Systems to Enhance Rural Development	Johnson,Duane L	SCS	Univ. of Missouri
The Ecology of Fishes in McKittrick Creek, Guadalupe Mountains National Park, Texas	Bergersen,Eric P	CFWLR	DOI-USGS
Altered Channel Morphology as a Result of Increased Urbanization & Other Land Use Changes in Watersheds	Watson,Chester C	Civil Engr.	DOD-ARMY-COE

FEDERAL SPONSORS: BLM-Bureau of Land Management, COE-Corps of Engineers, DOA-Department of the Army, DOE-Department of Energy, DON-Department of the Navy, DOT-Department 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, USBR-US Bureau of Reclamation, USDA/ARS-Department of Agriculture, Agricultural Research Service, USDA/NRS-Department 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 Department of Natural Resources, CDPHE-Colorado Department 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., CIRA-Cooperative Inst. for Research in the Atmosphere, DARE-Dept. of Agric. & Resource Economics, FWB-Fishery & Wildlife Biology, HLA-Horticulture & Landscape Architecture, NERL-Natural Resource Ecology Lab, NRRT-Nat. Resources Recreation & Tourism, RES-Rangeland Ecosystem Science. University of Colorado: 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, 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.

TITLE	PI	DEPT.	SPONSOR
Uses of Climate Forecast Information in the Livestock Sector of the Arid Regions of South Africa	Galvin,Kathleen	NREL	DOC-NOAA
Pueblo Chemical Depot Permanent Vegetation Monitoring	Rondeau,Renee	FWB	DOI-USFWS
Recreation Needs Assessment: Green River Wyoming	Aukerman,Robert	NRRT	DOI-USBR
State Technical Assistance to Wetlands Program	Culver,Denise R	FWB	CDWL
GIS & Database Product Delivery to End Users Utilizing the Internet	Kelly,Eugene F	SCS	USDA-ARS
International Perspectives on Recreational Carrying Capacity	Haas,Glenn E	NRRT	USDA-USFS-RMRS
Analysis & Modeling of the Transport of Lightning-generated NOx & Other Chemical...	Rutledge,Steven A	Cira	DOC-NOAA
Effects of Heavy Metals in Sediments	Clements,William H	FWB	School of Mines
Nebraska National Forest Cultural Resource Database	Todd,Lawrence C	Anthropology	USDA-USFS
Nitrogen Sources in Surface Waters in the Glacier Lakes Experimental Ecosystem	Stednick,John D	Earth Resources	USDA-USFS-RMRS
Wildlife & Wildlife Viewing Along the Yampa River	Knight,Richard L	FWB	CDWL
Establishment of Baseline Water Quality Conditions in the National Park Service	Hannah,Judith L	Earth Resources	DOI-NPS
Flaming Gorge Studies: Technical Integration & Synthesis	Bestgen,Kevin R	FWB	DOI-USBR
Watershed Restoration in Degraded Pinyon-Juniper Woodlands	Redente,Edward F	RES	DOI-NPS
Development of Theory & Application of the Trapping Web for Estimating Density of Biological Populations	Anderson,David R	CFWLR	DOI-USGS
Studies of Flash Floods and Sediment Transport in the Southwest	Adams,Christopher R	Cira	DOI-USGS
Conference Support: World Conference of Landscape Ecology held at Snowmass Village, Colorado	Wiens,John A	Biology	NSF
Canal Seepage Reduction Demonstration	Valliant,James C	Coop. Ext.	DOI-USBR
Ecosystem & Habitat Management on Fort McCoy, Wisconsin	Shaw,Robert B	Forest Sciences	USDA-USFS-RMRS
Land Surface Climate Analysis	Ojima,Dennis	NREL	DOI-USGS
Integration of Geological and Ecological Indicators for Assessment of Impacts on Stream and Riparian...	Clements,William H	FWB	DOI-USGS
Water Usage of Cottonwoods	Jacobi,William R	BSPM	Denver Water
Study of Boater Recreation at Lake Sonoma, Sonoma County, CA	Haas,Glenn E	NRRT	DOD-ARMY-COE
Air-Sea Interaction Remote Sensing Processes	Vonderhaar,Thomas	Cira	DOC-NOAA
Impact of Enhanced Cloud Condensation Nucleus Concentrations on Microphysics & Dynamics of Marine	Feingold,Graham	Cira	DOC-NOAA
A Volunteer Rain & Hail Monitoring System for Agricultural Applications	Pielke,Roger A	Atmos. Science	USDA-CSRS
The Effects of Remotely-Sensed Data on Modeled Land Surface Atmosphere Interactions; Consequences . . .	Denning,A Scott	Atmos. Science	NASA-Goddard
Management Practice Study II - County Land Use Impacts on Irrigation Districts	Wilkins-Wells,John R	Sociology	DOI-USBR
Greater Outdoors Colorado 2000 Aquatic Geographic Information Systems Manager	Baker,Barry B	FWB	CDWL
International Satellite Cloud Climatology Project Sector Processing Center for GOES-9...	Vonderhaar,Thomas H	Cira	DOC-NOAA
Planning for the Development of a Distributed, Internet Database System for Biodiversity Data Sets...	Baker,Barry B	FWB	NSF
Identifying Ecosystem Controls on Biodiversity: a US & UK Project (Collaborative Research): REU	Wall,Diana H	NREL	NSF
Biogeochemistry of Fire in Boreal Ecosystems	Parton,William J	NREL	DOI-USGS
Bureau of Land Management Riparian Classification	Culver,Denise R	FWB	DOI-BLM
Recreation Instream Flow & Reservoir Assessment-Truckee River (California/Nevada)	Aukerman,Robert	NRRT	DOI-USBR
The CSU-CHILL Radar Facility	Rutledge,Steven A	Atmos. Science	NSF

TITLE	PI	DEPT.	SPONSOR
Funds for Satellite Data Reception	Vonderhaar, Thomas	Cira	DOC-NOAA
Characterization of Soil & Vegetation with Use of Biosolids	Trlica, Milton J. Jr	RES	CDPHE
Temperature, Precipitation & Wind Continuity with Automated Surface Observing System-ASOS	Mckee, Thomas B	Cira	DOC-NOAA
Hydrologic Forecasting System Evaluation & Development Support	Johnson, Lynn	Cira	DOC-NOAA
Very High Resolution Gridded Meteorological Forecast Development	Vonderhaar, Thomas	Cira	DOC-NOAA
Development of Environmental Contaminant Encyclopedia	Hannah, Judith L	Earth Resources	DOI-NPS
Research & Education Activities to Enhance Water Management & Conservation in Southwest Colorado	Berrada, Abdelfettah	SCS	DOI-USBR
Cooperative Agreement for Technical Assistance in Water Resource Investigations	Julien, Pierre Y	Civil Engr.	DOI-USBR
VEMAP Phase II (Vegetation/Ecosystem Modeling & Analysis)	Ojima, Dennis	NREL	NASA
Snow Distribution & Runoff Forecasting, Kings River Basin, CA	Elder, Kevin J	Earth Resources	DOD-ARMY-COE
Characterization & Improvement of Earth Observing Systems Land Products...	Hanan, Niall P	NREL	Univ. of Nebraska
Toxicity Assessment of Stream & Sediments in the Angus Creek Watershed	Castle, Carla J	FWB	DOI-USGS
Assessing Values at Risk in the United States from Wildland Fires	Rideout, Douglas B	Forest Sciences	DOI-NPS
Quantification of Federal Reserved Water Rights for National Park Purposes	Sanders, Thomas G	Civil Engr.	DOI-NPS
Riparian Vegetation Studies on the Green & Yampa Rivers	Cooper, David J	Earth Resources	DOI-USBR
Water Management Education Program for Navajo Nation Water Users	Podmore, Terence H	CBE	DOI-USBR
Dam Foundation Erosion Study	Ruff, James F	Civil Engr.	DOI-USBR
Inventorying & Monitoring Natural Resources Status & Trends in the National Park System	Loftis, Jim C	CBE	DOI-NPS
The Application of Laser Turbidimetry for Water	Carlson, Kenneth H	Civil Engr.	Montana State Univ.

**UNIVERSITY OF COLORADO
BOULDER, COLORADO 80309**

Reservoir Stratigraphy and its Controls on Reservoir Architecture and Performance...	Pulham, Andres	Geological Sciences	Oil Companies
Hydrology, Hydrochemical Modeling and Remote Sensing of Seasonally Snow Covered Areas	Williams, Mark	IAAR	Univ. of Cal. Santa Barbara
Development of an Integrated System for Analysis of Aerosol Composition and Chemistry	Toohey, Darin	PAOS	NSF
In Situ Measurements of C10, BRO, CFC-11, Particles and Ozone...	Toohey, Darin	PAOS	NSF
Late Quaternary Variations in Sediment Provenance and Ice Sheet Dynamics...Greenland Ice Sheets	Farmer, G. Lang	CIRES	NSF
Investment of Photochemical Transformations Within Snow and Their Effects on Snow and Atmospheric Composition	Steffen, Konraad	CIRES	NSF
Stochastic Variability of Seasonal Freeze-Thaw at Local, Regional and Hemispheric Scales...	Zhang, Tingjun	CIRES	NSF
Application of LES to Understanding and Parameterizing the Arctic Cloudy Boundary Layer	Curry, Judith	Aero. Engr.	NASA
Snow and Ice Distributed Active Archive Center	Barry, Roger	CIRES	NASA
Information Management of Hydrologic and Reservoir Data for Support of the Lower Colorado River Operations and Planning	Zagona, Edith	CADSWES	USBR
Reactivity of Primary Soil Minerals and Secondary Precipitates Beneath Leaking Hanford Waste Tanks	Nagy, Kathryn	Geol. Sciences	DOE
Tide Gauge Estimates of Sea Level Rise: Effects of Undersampling of the Ocean	Wahr, John	CIRES	NOAA

TITLE	PI	DEPT.	SPONSOR
An Exploratory Assessment of the Potential for Improved Water Management by Climate Information in Three Western States	Howe, Charles	IBS	NOAA
Trophic Interactions of Infested Ponderosa Pine Communities	Linhart, Yan	EPOB	USFS
Disturbance Interactions and Catastrophic Blowdown in a Rocky Mountain Subalpine Forest Landscape	Veblen, Thomas	Geography	U. of Wyo.
Carbon Balance in Global Arid and Semiarid Lands	Wessman, Carol	CIRES	CSU
Littoral Sediment Transport Using Satellite Visible-Infrared Imaging Radiometry	Syvitski, James	IAAR	Raytheon
Watershed Characterization for Purposes of Alpine Basin Sensitivity Analysis: San Miguel	Williams, Mark	IAAR	San Miguel Co.
Analysis of Airborne Data for Validation of CLOUDSAT Ice Cloud Measurements	Evans, Franklin K.	PAOS	Jet Prop. Lab.
Regional Atmosphere/Forest Exchange and Concentrations of Carbon Dioxide	Bakwin, Peter	CIRES	Indiana Univ.
Lake Bosumtwi, Ghana: High-Resolution Paleoclimatology and Seismic Reflection Site Survey	Overpeck, Jonathan	IAAR	NSF
Water, Poverty and Sustainable Livelihoods in Colorado	Wescoat, James	IBS	NSF
Stable Nocturnal Boundary Layer: Observations and Interpretation of Mesoscale Instability Processes...	Balsley, Ben	CIRES	NSF
Inuit Knowledge of Climate Change in the Eastern Canadian Arctic	Barry, Roger	CIRES	NSF
Hydro-Climatology of the Major Eurasian Arctic Drainages	Serreze, Mark	CIRES	NSF
Cirrus Cloud Retrieval Analysis in Support of FIRSC Submillimeter-Wave Spectrometer	Evans, Franklin K.	PAOS	NASA
Comparison of 3-Dimensional General Circulation Model Simulations of the Desert Aerosol Life Cycle with Satellite Observations	Toon, Owen B.	LASP	NASA
In Situ Measurements of Carbon Dioxide in the Upper Troposphere and Lower Stratosphere	Avallone, Linnea	LASP	NASA
Spatial Variability of Cloud Characteristics and Surface Radiation Fluxes for SHEBA/FIRE III	Curry, Judith	PAOS	NASA
Spatial and Temporal Response to Anthropogenic Nitrogen Deposition in a Heterogeneous Rocky Mountain Watershed	Wessman, Carol	CIRES	NASA
Landscape Dynamics in the Arid Southwest: Interactions of Ecosystem Pattern and Process Through Time and Space	Wessman, Carol	CIRES	NASA
Land Use Impacts on Subtropical Biogeochemical Cycles: An Integrated Field-Process Modeling-Remote Sensing Approach	Asner, Gregory	Geological Sciences	NASA
Atmospheric Circulation and Regional Sea Ice Sensitivity in the Arctic	Lynch, Amanda	Aero. Engr.	NASA
Validation Studies and Sensitivity Analysis for Retrievals of Snow Albedo and Snow-Covered Area from EOS AM-1	Nolin, Anne	CIRES	NASA
Passive Microwave Snow Cover Algorithm Intercomparison and Validations	Armstrong, Richard	CIRES	NASA
Atmospheric Lifetimes of Peroxy Nitrates	Ravishankara, A.R.	CIRES	NASA
Laboratory Studies of Cirrus Cloud Formation	Tolbert, Margaret	CIRES	NASA
Ultraviolet Radiation Data Analysis and Communication for the NPS's Primenet Program	Weatherhead, E.C.	CIRES	NPS
Variability in the Composition and Amount of DOC in Surface Waters of Rocky Mountain, Glacier, Olympic, and Sequoia National Parks	Brooks, Paul	IAAR	NPS
Review Treaties with American Indian Tribes and Federal Legislation Affecting Management of Lands and Resources	Wilkinson, Charles	Law	NPS
Stochastic Forcing of Low-Frequency Variability in the Tropical Pacific	Moore, Andrew	CIRES	NASA
Integrating GIS and Environmental Modeling Workshop	Parks, Bradley	CIRES	DOA
Applied Geophysical Study of the Reservoir Structure Beneath the COSO Geothermal Field	Jones, Craig	Geol. Sciences	DON



WATER NEWS DIGEST



DAM SAFETY

Solution sought for Horsetooth Dam seepage

Bureau of Reclamation and Northern Colorado Water Conservancy District officials have been studying Horsetooth Dam and its limestone foundation since 1997, when seepage levels at the reservoir's northernmost dam began to increase. A reading taken in 1997 indicated that about 1,200 gallons of water per minute were seeping from beneath the dam. Measurements were taken about a half-mile downstream from the dam and included precipitation that accumulated from area runoff. Subsequent readings taken below the dam's west abutment registered 101.4 gallons per minute. That increased to 289 gallons per minute in 1998 and to 384 gallons per minute in June. Earlier this year, USBR officials said possible solutions included grouting the limestone foundation beneath the dam by drilling holes and pumping cement over the bedrock. Another possibility was to install a plastic liner over the lakebed beneath the dam. Both options, however, are no longer being considered. What is being looked at is creating a cement cutoff wall from the crest of the dam down through the limestone foundation. A decision on what to do, if anything, will be made early next year, a USBR official said.

Fort Collins Coloradoan 11/8/99



ENDANGERED SPECIES/RECREATION

Brown trout's major food source at risk

Brown trout are avoiding the part of the Arkansas River where tailings from a Superfund site are draining into the water, Colorado State University researchers say. In a 10-year study, CSU scientists also found that the trout's major food source — insects with a tolerance for heavy metals from former mining sites — are at risk. The tolerance makes mayflies, caddisflies and stoneflies more sensitive to ultraviolet light, says William Clements, associate professor of Fishery and Wildlife at CSU. The insects could be at greater risk in the future because the National Academy of Sciences has predicted a 10 percent to 20 percent increase in ultraviolet radiation over the next 20 years, Clements says.

Associated Press, Fort Collins Coloradoan 9/30/99

Study finds trout thriving

A weeklong analysis of the Animas River showed the trout were thriving, but that some native fish were conspicuously missing. Steve Whiteman, a biologist who participated in the monitoring, said the study was consistent in that all the fish were found in their appropriate habitat, with more stocked trout upstream and native suckers downstream. What was unusual was that large numbers of adult flannelmouth and bluehead suckers were found, but not the 1- to 10-inch juveniles. Whiteman said the trick now is to determine if the small fish are being raised somewhere else, such as the San Juan River, and then swimming up the Animas, or whether an environmental effect has wiped out the young fish. The monitoring was part of a two-year study between the Southern Ute Indian Tribe and the Bureau of Reclamation to conduct a fishery study on the Animas and La Plata rivers. In six days of surveying, scientists collected only two roundtail chubs, Whiteman said. The two roundtail chubs were found about two miles upstream from Cedar Hill in a section of the river that had never been sampled before, said Kirk Lashmett, a fish and wildlife biologist with the USBR. Lashmett said more roundtail chubs might be living in that area. Flannelmouth suckers and bluehead suckers typically live 20-25 years, so the ages of the fish caught and released over the week provides a crucial clue, Whiteman said. Gathering this information now is critical, because the roundtail chub is already considered endangered in New Mexico and is classified as a special concern on the reservation and in Colorado. The chub is also a candidate to receive federal protection under the Endangered Species Act. Neither the suckers nor the chubs were eligible for the federal protection given to threatened species, but that they are thought to be declining in numbers. The flannelmouth sucker is also a candidate for listing as an endangered species.

Durango Herald 10/7/99

Colorado DOW conducts annual stocking program

The fall spawning run of kokanee salmon above Vallecito Reservoir is under way. Until the middle of November, DOW employees will reap the benefits of the tiny fry they sowed in Vallecito Creek three to four years ago. After the fry are released, they drift down the creek into Vallecito Reservoir. They spend 90 percent of their life in the reservoir, eating zooplankton and reaching 12 inches to 13 inches in length. Then they return to the stream where they were stocked to spawn and die. The eggs are fertilized on the spot and then raised at the DOW's hatchery in Durango. The fish are fairly resistant to whirling disease. The hatchery has just received a clean bill of health. By stocking the fish at a predetermined point the DOW is able to intercept the fish later, strip the eggs and sperm and

perpetuate the program. The DOW has been stocking the sockeyes since 1968, averaging 1,000,000 eggs collected each year. The fry also are stocked in the Dolores River, where they drift down into the McPhee Reservoir and mature. There are four such stocking operations in the state, with the largest one in the Roaring Judy Fish Hatchery near Gunnison. According to Mike Japhet, DOW fisheries biologist, Colorado is one of the leading suppliers of kokanee, transplanting the native Pacific Northwest fish to Vallecito, McPhee, Blue Mesa and Grandview reservoirs as well as a number of other reservoirs in the West. The surplus is traded to other states in an open-ended gentlemen's agreement, with eggs going to New Mexico and California in exchange for other fish species. Most other states don't have a spawning population of their own. Despite the DOW's success, there have been declining runs at Vallecito that worry Japhet. In 1998 only 100,000 eggs were collected, down 90 percent from the 30-year average. Japhet said the little fish may have simply been flushed through the various dams, or fry from Vallecito may have washed down the Pine Rive to Navajo Dam, giving that reservoir a windfall of the salmon. It may be a result of the unusually heavy rains this spring and summer. The rains were so heavy that the trap DOW uses, about 1/4 mile above the reservoir, was washed away.

Durango Herald 10/18/99

Input sought on proposed fish ladder

Federal officials are accepting input on a proposal to build an endangered fish ladder at an irrigation diversion dam on the Colorado River in De Beque Canyon. A fish ladder would allow endangered fish to be sorted and move upstream while still providing for water diversion. Construction of the Grand Valley Project Diversion Dam ladder is part of the Upper Colorado River Endangered Fish Recovery Program. The U.S. Bureau of Reclamation wants to restore at least 50 miles of endangered fish habitat by adding three fish ladders in the Grand Valley. Federal officials are trying to expand habitat for the Colorado pikeminnow and razorback sucker, and have already built one such ladder at a diversion dam down river from Palisade. Federal officials are still negotiating on either removing the Price-Stubbs Diversion Dam or building a fish ladder upstream from Palisade. The Grand Valley Project Diversion Dam upstream from the confluence of Plateau Creek diverts water for both the Grand Valley Water Users Association and the Orchard Mesa Irrigation District. The dam provides irrigation water to more than 35,000 acres of land in the Grand Valley and serves four irrigation districts. The ladder would consist of a 200- to 250-foot-long concrete channel, 6-foot wide and 8- to 10-foot deep. Baffles would divide the channel into a series of small pools. The USBR plans to issue a draft environmental assessment in February, 2000.

Grand Junction Daily Sentinel 11/1/99

USBR plan to modify release rates receives support

With a few caveats, the U.S. Bureau of Reclamation's plan to make flows from Navajo Dam mimic natural patterns received mostly support from those who attended a public meeting on the proposal November 4 in Durango. Following a seven-year study initiated when biologists found evidence of reproduction by endangered fish species below the dam, the bureau introduced two alternatives to the current release rates, which range between 500 and 5,000 cubic feet per second. The first option, the bureau's proposed action, would drop the minimum release to 250 cfs, leaving 5,000 cfs as the cap on water flows. The second option would increase the maximum release to 6,000 cfs. The second alternative, said Ken Beck, a bureau economist, would take a bit more figuring. "Right now, we don't even have the capability to release 6,000 from the facility," Beck said. He said that the alternative would allow for more water development, including the Animas-La Plata Project south of Durango, in the San Juan Basin – one of the two goals of the project, known as the San Juan Recovery Implementation Program (San Juan RIP). The other goal – to recover populations of Colorado squawfish and razorback sucker in the San Juan – received the most attention at Thursday's meeting. Steve Harris, a water engineer representing the Southwestern Water Conservation District, said that the bureau's plan too narrowly defines the needs of the San Juan Basin and that natural flow patterns only answer part of the question of how to restore the endangered fish. Instead, Harris suggested an adaptive management plan that would allow for changing the flow recommendations if new research calls for such a change. The bureau will issue a draft environmental impact statement in fall 2000.

Durango Herald 11/5/99

◆◆ LITIGATION

Colorado-Kansas damages phase begins

With the damages phase in the Colorado-Kansas lawsuit beginning, at issue are millions of dollars Kansas alleges it is entitled to because Colorado took too much water from the Arkansas River, violating the 1949 water compact between the two states. Kansas claims \$78 million in damages, while Colorado contends that Kansas has missed the mark by \$70 million. Attorneys will spend the next three months trying to determine how much Colorado owes Kansas. Attorney General Ken Salazar presented opening remarks November 8 to special master Arthur Littleworth, a fact-finder appointed by the U.S. Supreme Court, in a Pasadena, California courtroom.

Denver Post Southern Colorado Bureau 11/9/99

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PEOPLE

Clinton will nominate Sisneros to chair Arkansas River Compact Commission

President Clinton has announced his intention to nominate Pueblo County Treasurer Aurelio Sisneros to succeed Larry Trujillo as chairman of the Arkansas River Compact Commission. The commission administers the Arkansas River Compact between Colorado and Kansas. Each state has three commissioners, and the president appoints the chairman. Sisneros will continue as Pueblo County treasurer in addition to his new, unpaid role chairing river compact meetings and signing the commission's official documents. He said he understands river issues from his background as a farmer and rancher with experience in irrigation, soil conservation, rangeland, and pasture management.

Pueblo Chieftain Denver Bureau 11/11/99

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WATER CONSERVATION

Rangers oust canyon tamarisk — project may be moved upstream

Fresh from an apparent victory over the tamarisk in Glenwood Canyon, the Forest Service is hoping to oust the invasive plant further up the Colorado River with the help of another federal agency. Concerned about the tamarisk's spread into the canyon, the White River National Forest's Eagle Ranger District this summer undertook an effort to eradicate it with the help of an herbicide. Tamarisk absorbs massive amounts of water along a river that is heavily relied on as a water source by cities and agricultural interests in arid downstream regions. It also harbors mosquitoes and other insects, makes riverbanks inaccessible to recreationalists, and concentrates river water salts, as reflected by its other name, salt cedar. Tamarisk is especially prevalent from Rifle downstream, but an eradication program in heavily infested areas would be costly and leave virtually no vegetation along riverbanks. The BLM would have to conduct an environmental assessment, just as the Forest Service did, before such work could go forward. Herbicides may offer some hope of succeeding where previous attempts at tamarisk eradication have failed. Back in the 1970s and early '80s, tamarisk eradication programs in Arizona and Nevada proved ineffective. The plant reportedly is very resistant to drowning, burning or being dried out. Technically, however, Glenwood Canyon offers less-than-ideal conditions for tamarisk growth, being shady and with rocky banks. Tamarisks prefer open, sunny, mud-bottom banks. Still, the plant was starting to expand its reach within the canyon. The Forest Service plan created some fears about the herbicide getting into the river, "but we used so little that I think that we dispelled some of the concerns," a USFS scientist said.

The Glenwood Post 10/5/99

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WATER QUALITY

Agreement provides South Adams County with safe drinking water

Funded by the federal government, a \$40 million arrangement will deliver reliable drinking water to Adams County, help restore wildlife habitat on the former Rocky Mountain Arsenal, and conserve Denver's water supply. Under the agreement, implemented in October, the federal government surrendered claims on water in the Highline Canal, which is managed by the Denver Water Board. In place of the canal water, the arsenal will use recycled, non-drinkable water from Denver to enhance wildlife habitat at the refuge. That means Denver no longer must pump so much water into the canal. Denver, in turn, agreed to permanently provide 4,000 acre-feet of water annually to the South Adams County Water and Sanitation District, including building some small water storage projects on the South Platte River over the next five years. Meanwhile, Denver will temporarily lease about 2,000 acre-feet of water to South Adams County. Underground contamination from the arsenal, officially declared a Superfund site, had reached drinking water wells in some Adams Communities, forcing the Colorado Health Department to provide bottled water for residents.

Denver Post 10/6/99

San Luis Valley water users seek plan to repair environmental damage on Rio Grande

The San Luis Valley Water Conservancy District's Rio Grande Headwaters Restoration Project has received a \$200,000 grant from the Colorado Water Conservation Board (CWCB) to craft a master plan for the river. Some of the grant will be used to begin clearing debris from under bridges and railroad trestles that could create dams during the high runoff season. Last summer, debris and bank erosion forced water managers to send 30 percent more water down the river than was necessary to meet Rio Grande Compact obligations in New Mexico and Texas. Some irrigation in the valley was curtailed despite record flows on the Rio Grande. Brian Hyde, an engineer with the CWCB, offered a plan that he recently drafted for the Roaring Fork and Frying Pan Rivers as a model for the Rio Grande, saying situations are similar. "You have to look at the entire watershed and the channel's instability," said Hyde. He also suggested that Rio Grande and Alamosa County commissioners enact "setback" regulations to keep future houses away from the river to allow over bank floodplains and high-flow areas.

Associated Press, Fort Collins Coloradoan 10/30/99



COE to help pay for Snake River cleanup effort

The Corps of Engineers (COE) is considering which sites across the West fit into the inaugural Restoration of Abandoned Mine Sites program, with up to \$100,000 available immediately for an initial plan. The ad-hoc Snake River Watershed Task Force has been struggling with a way to clean up the metals-contaminated Snake River, which provides water for ski-area snowmaking, wildlife habitat and Dillon Reservoir. The task force initially focused on the Pennsylvania Mine, but a survey led by the Forest Service has found that several mines in the area generate toxic metals — the Pennsylvania Mine, the Shoebasin Mine and Cinnamon Gulch — and as many as 35 draining mines are of concern, while another 40 dry mines contribute to water pollution through snow and rain runoff. The COE's new program will help pay for grassroots cleanup efforts such as those of the Snake River Watershed Task Force.

Denver Post Mountain Bureau 10/16/99

BLM gives American Soda approval to mine

The Bureau of Land Management has given American Soda a green light to mine nahcolite in the Piceance Basin. Anyone disagreeing with the decision could file an appeal until Nov. 26 with the BLM office in Meeker. American Soda needs only two permits before it can proceed — an underground injection permit from the Environmental Protection Agency and a special use permit from Rio Blanco County for the pipeline. The BLM decision leaves the door open for increased testing when necessary, based on monitoring results from various test wells in the area. American Soda's plans include injecting high-pressure, high-temperature water into deep wells in the Piceance Basin. The brine would then be pulled from the wells and partially processed at a new Rio Blanco County plant. It would then be transported via an insulated pipe to Parachute, processed into soda ash and baking soda and shipped to world markets. Some closely watching the project feared American Soda's underground wells might fail, sending low-quality water into pristine groundwater aquifers.

Grand Junction Daily Sentinel 11/3/99

EPA fines Amoco for spills

The Environmental Protection Agency is seeking a \$65,000 penalty from BP Amoco for nearly 100,000 gallons of contaminated water the company spilled during extraction of coal-bed methane over a four-year period on Southern Ute Indian land. The EPA says that at least 17 spills totaling 97,146 gallons of "production water" occurred between 1994 and 1998 at Amoco's Durango Operations Center, which comprises numerous sites. Production water is brought to the surface during the extraction of coal-bed methane from an aquifer about 2,000 feet underground. The water is then diverted into a separate pipeline system and transported to injection wells, which redeposit the water 8,000 feet deep. The spilled water contained benzene, toluene, ethyl benzene and high levels of chloride, according to the complaint, and wound up in Phillips Canyon drainage, Rock Creek, the Pine River, Dry Creek and Salt Creek. "It's a concern because of the connected waterways such as wetlands, Florida River and the Pine River," said Jody Ostendorf, a public affairs specialist for EPA's Region 8, which covers Montana, Utah, Wyoming, Colorado and North and South Dakota. Phillips Canyon drains into the Florida River. Dry Creek and Rock Creek empty into the Pine. Amoco's public affairs director said the oil company self-reported all spills to the National Response Center — which was confirmed — and that most of the violations involved breaks in pipelines that transported the produced water, or from mechanical failures.

Durango Herald 10/16/99

Students check health of Rio Grande's water

More than 2,000 students from Colorado to Mexico took the pulse of the Rio Grande on November 3. The tests, part of the Project del Rio, will provide a snapshot of Rio Grande water quality at 65 testing sites along a 1,900-mile stretch of the river, from the mountains of Colorado to the Gulf of Mexico. Over the program's 10 years, students have found high levels of nitrates that helped water officials discover a leaky well head and even sewage from a recreational vehicle that was dumped into the river. The students can detect traces left by cities that treat sewage and put it back into the river as well as agricultural runoff that can include fecal coliform bacteria and chemicals from fertilizers and pesticides. The data from the project are provided to the U.S. Environmental Protection Agency and a similar agency in Mexico, the Comision Nacional de Limites y Agua.

Colorado Springs Gazette and Associated Press 11/4/99

DOW may cut off funding for River Watch, hands-on science program

Citing a shortage of money, the Colorado Division of Wildlife may cut off funding for the 10-year-old River Watch program at the end of this year. The statewide initiative encompasses some 33,000 students in 400 schools, including Basalt, Roaring Fork and Glenwood Springs high schools. Its participants monitor river and stream quality, gathering and analyzing water and soil samples. The information is passed on to the DOW, which, in turn, provides testing materials, training and information about proper data gathering procedures to the classes. An annual budget of \$250,000 for River Watch, administered by DOW, has typically come from the Wallop Breaux

Funds; a federal tax placed on fishing and other water recreation activities. The DOW is looking at slashing \$40 million from its \$72 million budget over the next four years because it hasn't raised game license fees in eight years. That's due to the Taxpayers Bill of Rights (TABOR), which limits state revenue to the rate of inflation and population growth. Educators vow they will continue the program in some capacity, perhaps subsidizing it by conducting their own fundraising efforts.

The Glenwood Post 10/699

High selenium levels threaten valley farming

After a century of farming in the Uncompahgre Valley, made possible by an intricate irrigation system, a seemingly far-fetched scenario to control selenium levels in the Uncompahgre River could eliminate farming from the valley in the next century. Marc Catlin is worried that if local citizens don't come up with a solution to the leaching of selenium from the Mancos shale beds (a rock layer beneath the adobes) into the Uncompahgre River, the U.S. Environmental Protection Agency will come up with its own solution, the worst of which could be de-watering the east side of the valley. Catlin is a member of the Gunnison River Basin Selenium Task Force, a group representing private, local, state, federal, environmental and farming interests and charged with reducing selenium levels in the valley's irrigation system while maintaining the lifestyle and economic viability of the lower Gunnison River Basin. The Uncompahgre River now has selenium levels of between 17 and 21 parts per billion (ppb), putting the river on the government's 303D list, which targets impaired waters in the United States. The state water quality division also is examining nitrate and fecal coliform levels in the Uncompahgre River, which spills into the Colorado. To protect aquatic life, the state water quality division, under mandates from the EPA, has established the selenium ceiling at five ppb for the Uncompahgre River, which is considered to be out of compliance from the Ute Indian Museum south of Montrose to Delta. Also out of compliance are Leroux Creek above Hotchkiss and Sweitzer Lake. Greg Parsons, manager of the watershed section of the Colorado Water Quality Control Division, said, "We've told the EPA that we would like until 2002 to come up with the TMDL (total maximum daily load) of selenium in the targeted areas. We're still not sure what it would take to achieve the 5 ppb standard. The wild card is endangered species." In the past two weeks, Catlin has presented the story of selenium five times to various boards and government groups in Montrose. Colorado State University Extension Agent Wayne Cooley has made similar presentations in the Olathe area.

Montrose Daily Press 11/16/99

Castle Rock to watch radium levels in water

Additional tests last month for radioactivity in Castle Rock water showed that the town needs to keep a close watch on radium levels, public works officials said. Drinking water meets all state standards, but at least one plant and two wells will have to be monitored, they said. Because the town blends water from a host of wells with a variety of radium levels at treatment plants, officials said the water that leaves distribution plants for homes and businesses meets and often surpasses state and federal standards. Blending water with different levels of radium is OK'd by the state, said Will Koger, town utilities engineer. Low levels of radium are common across the Front Range, said Mark Gonzalez, an assistant professor at the University of Denver's Department of Geography and Environmental Science. The measurements are an approximation of the risk involved, Gonzalez said, because no one really knows what the health risks are. Radium decays into polonium, which decays into lead that can cause cancer, said nuclear expert John Nevshemal. The town tested six of 30 wells and all three treatment plants. Although water leaving all treatment plants meets standards, two wells and one plant require closer monitoring. Radium in finished water from the Founders water treatment plant is close to the maximum level. Although the water meets standards, the state requires more monitoring in this case. In the other two treatment plants serving Castle Rock, Meadows and Miller, radium levels were far below the maximum contaminant level, the public works report says. Two wells exceeded the maximum radium contaminant level. Raw water from a Plum Creek well had excessive radium. The well feeds into the Miller treatment plant and is diluted to acceptable levels once it leaves the plant. Excessive radium levels also were found in raw water from a Meadows well, which blends with less radioactive water at the Meadows treatment plant before it reaches the public. Two nuclear experts advised the town of a radium treatment method and well-construction methods that would minimize radioactivity in town water. The public works department already knew of the well construction method and asked the experts to come back with cost projections for a potential treatment method. In the past, the town tested for alpha emitters, an indication of radium. Because of varying results, the town now will test for radionuclides, a more accurate indicator of radium levels, Koger said.

Douglas County News Press 11/17/99



WATER SUPPLY/DEVELOPMENT

Denver Water's water plans for future outlined for legislators

At an October 12 legislative session, "Chips" Barry, Denver Water Manager, told legislators that the defeat of Two Forks in 1989 left the



Denver Water Board about 100,000 acre-feet short in coping with its future needs. Through replacement, recycling and some expansion, the board expects to be able to handle whatever problems arise from development, Barry told an interim committee exploring growth and development. "There are three ways to get the 100,000 acre-feet now," Barry said. About 20,000 acre-feet could come from conservation. "You can recycle or re-use water for nonpotable purposes, and get about 15,000 acre-feet... and you can find new supplies of water to make up the rest, and the board decided to do all three," Barry said.

Associated Press, Fort Collins Coloradoan 10/13/99

Artesian water becomes hot commodity

The Trinidad State Junior College fish farm is one of several San Luis Valley facilities that use hot artesian water, and aquaculture instructor Ted Smith thinks many area farmers and ranchers could also tap into this valuable resource. The fish farm, the James G. Kerr Educational Center, is located near the town of Hooper, a few miles south of the Valley View Hot Springs at Villa Grove and the Mineral Hot Springs Spa. Several other private fish farms are nearby. The fish farm's hot artesian well is 2,500 feet deep and bursts to the surface with a pressure of 850 to 1,000 gallons per minute at a year-round temperature of 97 degrees. After the water is circulated through the facility's six small ponds and 13-acre reservoir, it is pumped through a center-pivot sprinkler to irrigate a nearby 160-acre barley field. "I've been trying to tell valley farmers that they could expand their operations by growing fish on the side and recycling the water for their crops at the same time," says Smith.

Denver Post 11/8/99

Animas-La Plata analysis criticized

The U.S. Bureau of Reclamation's environmental analysis does not adequately define future uses of Animas-La Plata Project water by Colorado Ute Indian tribes, critics say. The bureau is also failing to seriously examine alternatives to building a dam and reservoir in Ridges Basin, two miles south of Durango, as a means of satisfying Indian water rights, Taxpayers for the Animas River said. "Non-binding use scenarios" proposed by the Ute tribes for their share of the project's water include resorts, planned communities, coal and gas power plants and tribal golf courses. "These are imaginary future uses for water, not a described purpose and need," said Jerry Swingle, Taxpayers for Animas River spokesman. The water-rights attorney for the Southern Utes, Scott McElroy, said the goal is to satisfy the tribes' need for future water, and there's no way to know how that will occur. McElroy said that even if specific water uses were known, detailing them isn't required under the National Environmental Policy Act because the Department of Interior has the final say on the tribes' future water projects. USBR is evaluating all possible scenarios, said Pat Schumacher, USBR manager for Durango. Sage Douglas Remington, director of the Southern Ute Grassroots Organization, said tribal members opposed to the water diversion project have developed an environmentally friendly alternative. The proposal would grant the tribes money to buy land and water rights. But Remington said the administration should not compare the tribal alternative to Interior Secretary Bruce Babbitt's proposed Animas-LaPlata Ultra-Lite, which is 1/3 the size of the original and would supply water only for municipal and industrial uses. "We had envisioned the water being used by the tribes to irrigate farmland," Remington said. "In the analysis conducted by the administration, they are converting all that agricultural water to municipal and industrial water, and that has far different impacts from what we proposed. We feel the analysis is deliberately weighted to make our alternative look as bad as possible." Swingle said this approach would not stand muster in the state water court, which must approve the change from using the project's water from agriculture use to municipal and industrial. A draft of the Animas-LaPlata environmental study by the USBR will be available to the public in January.

Durango Herald Wire and Staff Reports 10/2/99

Water-sale dilemma pondered in La Junta

How does rural Colorado stop water sales without trampling the property rights of the people who own the water? Nobody really knew at a meeting hosted by Don Ament, Colorado's commissioner of agriculture. The meeting is the last of several since Aurora announced plans to buy the rest of the Rocky Ford Ditch this fall. The sale will dry up about 3,000 acres of irrigated cropland, reducing its taxable value 98 percent and spawning fear that the loss of crop income could ripple throughout the community economy. The sale could also hurt water quality in the lower Arkansas Valley, where it's already pretty bad. Many fear that the 5,000 acre-feet to be taken from the river by Aurora each year (high up the valley where the water is purer) will leave more salt and minerals for farmers and drinkers here. When the Fort Lyon Canal was the subject of a purchase bid in 1991, community members met a number of times and even convinced the Colorado Water Conservation Board to study the canal and ideas that would preclude sales. Many agreed that farming water wouldn't be for sale if farmers were making any money at farming. Ament offered the services of his department and perhaps even some money from the Colorado Water Conservation Board to study possible solutions.

The Pueblo Chieftain 11/19/99



Future of La Plata River water discussed

Having given up hope of receiving any irrigation water from the long-delayed Animas-La Plata Project, western La Plata County water users are working on their own plan for meeting water needs there. At a meeting on November 18 about 25 residents gathered to give comment on what that plan – being developed by Wright Water Engineers – should include. Prevalent among the suggestions was the construction of several small dams along the La Plata River – a move that would both store water for when farmers really need it, and provide adequate flows to New Mexico as required by the La Plata Compact. The plan would also fill domestic water needs for western La Plata County residents – many of whom haul water to their homes.

Durango Herald 11/19/99

MISCELLANEOUS**North Delta mulls sewer district**

Delta City Council has authorized its Mayor to sign a \$300,000 grant petition to the Department of Health. The funds would be used to construct the North Delta Sewer Project. The Delta City Manager said the total project would cost \$4.2 million, but a timeline for construction or completion has not been set. Delta applied for a grant from the Rural Development Council in September, and in December another application will be sent to the Department of Local Affairs. City officials are awaiting an answer from the Rural Development Council, which will help determine the amount requested in future grants. Residents in the area the new sewer system will serve use septic tanks now. While the grant process has been initiated, residential participation in the system will also contribute to the project's funding.

Montrose Daily Press 10/7/99

DOW gives up efforts for land swap

The Colorado Division of Wildlife recently announced its intention to "cease efforts" on a land and water rights exchange with the city of Salida. The DOW is working directly with Kaess Contracting on renewal and modification of its mining permit. (The DOW feared Kaess' continued mining would jeopardize its nearby million-dollar water collection facilities.) Because the land offered by the DOW was more valuable than the land offered by the city, the DOW wanted to secure city project water to help augment the evaporative loss from the Mount Shavano Fish Hatchery ponds. The city offered several water options; however, the DOW determined they would not meet its needs.

Salida Mountain Mail 10/6/99

Spring Valley sanitation site application okayed

The Spring Valley Sanitation District took another step toward expansion on November 1 when the Garfield County Commission unanimously approved the district's site application. The application proposes broadening the district's services from 52,000 gallons a day to 500,000 gallons a day. Sanitation district officials still await approval of the application from the Colorado Department of Health. The application proposes broadening the district's services from 52,000 gallons a day to 500,000 gallons a day. Commissioners in April authorized the Spring Valley Sanitation District's service area expansion in April, increasing its operations from 1,787 acres to 12,507 acres to serve 5,500 residents between Glenwood Springs and Carbondale.

The Glenwood Post 11/2/99

Voters allow water district to de-Bruce

Voters have allowed the Upper Yampa Water Conservancy District to de-Bruce from Taxpayer Bill of Rights by passing Referendum 4A. The measure passed with 68 percent of the vote. The law, known as TABOR, can force district to refund any revenues that exceeds the amount that was collected the year before. The district receives revenue from grants, property tax and from water and power sales. TABOR forced the district to turn down revenues at the end of the year that would otherwise go into water projects. Since the referendum passed, the water district will start on water projects in Routt County. "We have several projects that we'll be able to start on," said John Fetcher secretary manager for the water district. "These are the kind of projects that are truly good, environmentally, for the community." Those projects will replace earth dikes built by ranchers with permanent structures, drop-boards that dam and release water when it is needed.

Steamboat Pilot 11/3/99



CALLS FOR PAPERS

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20th Annual American Geophysical Union HYDROLOGY DAYS

April 3-6, 2000

Lory Student Center, Colorado State University

Fort Collins, Colorado USA

Sponsored by: Hydrological Section of the American Geophysical Union

Overview: Hydrology Days was founded by Professor Hubert Morel-Seytoux in 1981 and has been held on the campus of Colorado State University each year since. The purpose of Hydrology Days is to provide a forum for scientists, professionals and students involved in hydrology and hydrology-related fields to get acquainted and to share ideas, problems, analyses and solutions. Students present papers in a friendly, and yet, professional, atmosphere and have the opportunity to meet leading hydrologists and hydrology-related professionals and make presentations in oral or poster form. Papers are welcome on all topics in hydrology.

The four-day program will include contributed papers (mostly); invited papers (a few); student papers (1 and ½ days); and a poster session. Oral presentations will be scheduled for 30 minutes, including discussion. Standard audio-visual equipment (overhead, slide projector and computer projection equipment) will be provided. A written paper is not mandatory for participation in the program.

Student Awards: Awards and prizes will be given for the best student papers as oral and poster presentations in the following categories: Ph.D. Oral Presentation, M.S. Oral Presentation, Ph.D. Poster Presentation, and M.S. Poster Presentation:

Abstract Submittal: Send three hard copies (original plus two copies) of abstract(s) on a single page without a specific format, but font 12 minimum: title, author name, affiliation, full mailing address, telephone, fax, e-mail, and indication of student status (M.S., Ph.D.), if applicable. Include a cover letter indicating presentation preference or oral or poster. Indicate your special audio-visual needs. Early submission is recommended. If time is close to deadline, send first ahead a single copy by fax or e-mail and then send the three hard copies by regular mail. Abstracts are due by January 21, 2000 to: Professor Jorge A. Ramirez, Civil Engineering Department, Colorado State University, Fort Collins, Colorado, 80523. Telephone: ? Fax: (970) 491-7727 E-mail: ramirez@engr.colostate.edu

Paper Submittal: Deadline to submit a final written paper, if desired, for inclusion in the Proceedings is February 18, 2000. Guidelines will be provided on request (contact Prof. Ramirez as early as possible). Proceedings will be available at the conference. For abstract, program information, and registration forms, contact Prof. Ramirez at the above address. You may view the preliminary and final program and registration information on the Hydrology Days home page (<http://HydrologyDays.colostate.edu>).

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**Integrated Watershed Approaches: TMDLs or Tylenol PM –
Which is the more bitter pill to swallow?
American Water Resources Association, Colorado Section
Annual Symposium, March 17, 2000
Golden, Colorado**

You are invited to make a presentation regarding one of the suggested topics below or a related topic. Submit a 1-page abstract for a presentation of approximately 15 minutes, followed by brief periods for questions. An afternoon wrap-up panel discussion led by key local and visiting watershed dignitaries is planned. Send abstract and registration to: American Water Resources Association, Colorado Section, P.O. Box 9881, Denver, CO 80209-0881. For additional information contact Tim Steele, AWRA CO Section President at Phone 303/674-0266 (TDS Consulting Inc., e-mail TDSConsult@aol.com) or at Phone 303/444-7270 (Exponent Inc., e-mail tsteel@exponent.com).
DEADLINE: January 31, 2000.

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**Symposium on Spatial Methods for Solution of Environmental and Hydrologic Problems:
Science, Policy, and Standardization – Implications for Environmental Decisions
Reno, Nevada -- January 25-26, 2001**

This symposium will provide a forum for the presentation of recent applications of spatial methods for solving environmental and hydrologic problems at the regional and local level. Invited and offered papers will be presented as oral presentations, as computer demonstrations, or in poster sessions. For forms and more information contact Dr. A. Ivan Johnson, 7474 Upham Court, Arvada, CO 80003-2758, Phone 303/425-5610, FAX 303/425-5655.

◆ ◆
Water in the New Millennium: the Possible, the Probable, and the Preferable
2000 RMSAWWA/RMWEA Joint Annual Conference
Vail, Colorado – September 10-13, 2000

The Rocky Mountain Section of the American Water Works Association and the Water Environment Association have issued a Call for Presentations to promote the science and understanding of water and wastewater management in Colorado, New Mexico, and Wyoming. Submission forms for Water Topics may be requested via e-mail from Greg Trainor, Utility Manager, City of Grand Junction at greg@ci.grandjct.co.us or download from RMSAWWA's website at <http://www.rmsawwa.org>. Submission forms for Wastewater Topics may be requested via e-mail from Catherine Crabb at catch@ci.grandjct.co.us or downloaded from the same website above. DEADLINE: April 1, 2000.

MEETINGS

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Upper Missouri Water Users Association and
Four States Irrigation Council
Joint Water Conference
University Park Holiday Inn, Fort Collins, Colorado — January 12-14, 2000

The theme for this year's meeting is Seven States: Flowing Into the 21st Century. The meeting begins on Wednesday afternoon with a state-by-state perspective on water issues into the new millennium. Water users, farmers, ditch company officials, utility members, and commercial representatives from throughout a seven-state region — North and South Dakota, Montana, Wyoming, Colorado, Nebraska, and Kansas — will attend. With changes continuing to occur at the Bureau of Reclamation and Water-related legislation moving to the forefront, Eluid Martinez, USBR Commissioner, will discuss the USBR's Strategic Plan. For further information contact Brian Werner or Candee Werth at 970/667-2437.

◆ ◆
American Water Resources Association
Annual Summer Specialty Conference
International Conference on Riparian Ecology and Management In Multi-Lane Use Watersheds
Portland, Oregon — August 27-31, 2000

Monday through Wednesday will feature plenary speakers, oral and poster presentations, and discussion sessions. Poster sessions will be a key portion of the conference and will have featured times for review and discussion.

For further information contact Mike Kowalski, AWRA Director of Operations, Phone 540/687-8390, FAX 540/687-8395, E-mail mike@awra.org, or visit the AWRA home page at <http://www.awra.org>.

◆ ◆
Ogallala Aquifer Symposium
Ogallala Aquifer Beyond 2000
Northeastern Junior College, Sterling, Colorado — February 18, 2000

This symposium will enlighten you about the "big picture" of the Ogallala Aquifer and bring you up to date with the current water use and management practices, as well as give you food for thought on the issues at hand concerning the future and protection of this most valuable resource.

Why do we Need Water Policy?
Why do we Need to Manage Our Water?
What is the Future of Our Water?
What Can We Learn From Our Neighbors?

For more information contact: Mahdi Al-Kaisi at 970/345-0508; Gisele Jefferson at 970/345-2287; or Bonnie Sherman at 970/854-3616.



**COLORADO WATER CONGRESS 42ND ANNUAL CONVENTION
HOLIDAY INN – NORTHGLENN – January 27-28, 2000
Tentative Program**

Wednesday, January 26

- 8:00 a.m. Colorado Water Conservation Board Meeting
7:00 p.m. CWC Board of Directors' Meeting

**Thursday, January 27, 2000
Theme: A New Millennium of Miracles or ???**

- 7:30 a.m. Registration Opens
8:00 a.m. Colorado Water Conservation Board Meeting
8:30 a.m. Four Concurrent Workshops -- (1) Leadership in the 21st Century, by Carl Neu, nationally recognized trainer, (2) Engineering & Management Developments, (3) Protecting Your Water Rights: On Guard, and (4) Roundtable for Ditch Companies.
10:15 a.m. Five Concurrent Workshops -- (1) Engineering & Management Developments, (2) Endangered Species Issues, (3) Roundtable on Water Education, (4) Water Conservation/Conservancy District Issues, and (5) Mars & Venus in the Meeting Room.
12:15 p.m. GENERAL SESSION LUNCHEON -- Governor Bill Owens will deliver the luncheon address.
2:15 p.m. GENERAL SESSION I -- Keynote speaker Attorney General Ken Salazar has been invited to deliver the keynote address.
2:45 p.m. General Session Speakers will be: (1) "Perspectives on Water Education in the 21st Century" -- Rita Schmidt Sudman, Executive Director, California Water Education Foundation; (2) "Perspectives on Direct Democracy in the 21st Century" -- Dr. Dan Smith, Author of "Tax Crusaders and the Politics of Direct Democracy," and (3) Perspective on Water Law in the 21st Century" -- Don Glaser, Executive Director from 1996 to 1998 of the Western Water Policy Review Advisory Commission.
4:00 p.m. Five Concurrent Workshops -- (1) Engineering & Management Developments, (2) Colorado Water Conservation Board Issues (3) Ground Water Issues, (4) Water Quality & Drinking Water Issues; and (5) The Ditch Bill Issues: An Update.
6:00 p.m. RECEPTION

Friday, January 28, 2000

- 7:00 a.m. LEGISLATIVE BREAKFAST -- Speakers will be Sen. David Wattenberg, Sen. Gigi Dennis, Se. Terry Phillips, Rep. Brad Young, Rep. Diane Hoppe, Rep. Carl Miller, and Rep. Matt Smith.
8:30 a.m. GENERAL SESSION II -- A Panel on "Colorado Development and Growth Issues" -- Keynoter will be Senator Bryan Sullivant, who Chaired the Legislative 1999 Interim Committee on Development and Growth.
10:45 a.m. GENERAL SESSION III -- A Panel on "Cooperation, Cooperation, Cooperation -- Will It Work? Does It Work?" Representatives from major East, West entities will participate in the panel.
12:15 p.m. THE WAYNE N. ASPINALL LEADERSHIP LUNCHEON -- A member of the Colorado Congressional Delegation has been invited to deliver the Aspinall luncheon address. The 20th Annual "Wayne N. Aspinall Water Leader of the Year" award will be presented at this luncheon.
1:45 p.m. CWC Annual Business Meeting
2:00 p.m. CWC Board of Directors' Meeting

For information and registration forms see the Colorado Water Congress web page at <http://www.cowatercongress.org> or contact Colorado Water Congress, 1390 Logan St., Suite 312, Denver, CO 80201, FAX 303/837-1607, E-mail macravey@cowatercongress.org.

CALENDAR



Jan. 12-14	UPPER MISSOURI WATER USERS ASSOCIATION AND 4-STATES IRRIGATION COUNCIL JOINT CONFERENCE, Fort Collins, CO. Contact: Brian Werner or Candee Werth at 970/667-2437.
Jan. 26-27	WATER RIGHTS AND ALLOCATION In the West and on the Lower Colorado River, Las Vegas, NV. Contact: Univ. of Nevada at Las Vegas, Division of Continuing Education, Phone 702/895-3394, FAX 702/895-4195.
Jan. 27-28	COLORADO WATER CONGRESS 42ND ANNUAL CONVENTION, Northglenn, CO. See the Colorado Water Congress web page at http://www.cowatercongress.org , FAX 303/837-1607, or E-mail macravey@cowatercongress.org .
Jan. 27-28	UV2000 (Ultraviolet disinfection): A TECHNICAL SYMPOSIUM, Costa Mesa, CA. Contact: National Water Research Institute, Phone 714/378-3278, FAX 714/378-3375.
Feb. 6-7	ADDRESSING WATER CONSERVATION ISSUES THROUGH EFFECTIVE PARTNERSHIPS, AWWA Water Conservation Workshop, Salt Lake City, UT. See AWWA webpage at http://www.awwa.org .
Feb. 10	2000 COLORADO AGRICULTURAL OUTLOOK FORUM, Denver, CO. Contact: David Carlson, CO Dept. of Agriculture, Phone 303/239-4112, FAX 3093/239-4125.
Apr. 30-May 4	WATER RESOURCES IN EXTREME ENVIRONMENTS, Anchorage, Alaska. See AWWA webpage at http://www.awwa.org .
June 21-24	WATERSHED MANAGEMENT 2000 CONFERENCE, Science and Engineering Technology for the New Millenium, Fort Collins, CO. Contact Marshall Flug at Phone 970/226-9391, FAX 970/226-9230, e-mail marshall_flug@usgs.gov , ASCE website: http://www.asce.org .
July 10-14	USCOLD 20TH ANNUAL MEETING AND LECTURE, DAM O&M ISSUES - THE CHALLENGE OF THE 21ST CENTURY, Seattle, WA. Contact: Larry Stephens, Phone 303/628-5430, FAX 303/628-5431, e-mail stephens@uscold.org , webpage http://www.uscold.org/~uscold .
Aug. 24-25	COLORADO WATER CONGRESS SUMMER CONVENTION, Vail, CO. See the Colorado Water Congress web page at http://www.cowatercongress.org , FAX 303/837-1607, or E-mail macravey@cowatercongress.org .
Aug. 27-31	INTERNATIONAL CONFERENCE ON RIPARIAN ECOLOGY AND MANAGEMENT IN MULTI-LAND USE WATERSHEDS, Portland, OR. See AWRA webpage at http://www.awra.org/meetings/Portland/Portland.html .
Sept. 10-13	WATER IN THE NEW MILLENIUM: THE POSSIBLE, THE PROBABLE, AND THE PREFERABLE, Vail, CO. See the RMSAWWA's website at http://www.rmsawwa.org or E-mail Catherine Crabb at catch@ci.grandjct.co.us .
Jan. 25-26 2001	COLORADO WATER CONTRESS 43RD ANNUAL CONVENTION, Northglenn, CO. See the Colorado Water Congress web page at http://www.cowatercongress.org , FAX 303/837-1607, or E-mail macravey@cowatercongress.org .

AWRA Colorado Section luncheons again will be held at Denver Water, normally beginning with lunch at 11:45 followed by presentation. Cost is \$10 at the door.

Jan. 25	Radioactive Isotopes in Water Resources	Julie Suecker
Feb. 22	Endangered Species Issues	Deb Freeman
25-Apr	Denver-Thornton Case: Water Quality Issues	TBD
May	Student Scholarship Presentations	

Colorado Water
Resources Research Institute
Colorado State University
Fort Collins, CO 80523

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