



COLORADO WATER

*Newsletter of the Water Center
at Colorado State University*

FEBRUARY 2000

Drought and Flood Preparedness were the topics at a conference convened by Governor Bill Owens in December. See page 17.

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**The Upper South Platte Watershed Protection and Restoration Project
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EDITORIAL



COLORADO'S NEED FOR NEW WATER KNOWLEDGE

by Robert Ward, Director

As we begin a new year, we sense more change than normal – all the digits rolled over this time! While, in practice, only one more year has passed, this new year begs considerable reflection by our society upon the changes that have occurred, are currently taking place, and may happen in the future. Those working closely with water resources in Colorado realize that change has always been a part of water management. Perhaps the change is accelerating, but it is no stranger to most water managers.

In dealing with the changes facing Colorado water users and managers, the demand for new knowledge (via education and research) is a constant. CWRRRI has responded to over 400 requests for new knowledge during its 35 years of existence through projects it has funded. Today, faculty working on CWRRRI projects are documenting: (1) how much water is needed to maintain a healthy population of threatened species on the high plains; (2) how extensive are the soil salinity problems in the lower Arkansas Valley; (3) ways information technology can be utilized to improve management tools employed by Colorado water managers; and (4) how much information we can abstract from existing data in support of ground water quality manage-

ment in Colorado. New CWRRRI projects will examine relationships between forest and water management practices and the monitoring needs associated with source water assessments.

These funded projects, however, represent only the surface of water research needs in Colorado. During the fall, the CWRRRI Advisory Committee on Water Research Policy (ACWRP) and a 'Resource Panel' of 25 water managers and educators, organized by a Water Outreach study at CSU, identified needs for new water knowledge and education – needs, that if met, would assist Colorado water managers and users in addressing the changes taking place in Colorado water demand and use.

Below is a list of water research and education needs as articulated during the above meetings. To gain insight into the magnitude of funding needed to address these Colorado needs, I have also indicated the type, size and duration of the project I think would be necessary to obtain the desired information. Costs and project durations provided are very rough estimates.

Projects Identified by CWRRRI's Advisory Committee on Water Research Policy (October 13, 1999)

- Knowledge is needed about the distribution, habitat, and life history of each threatened native species in Colorado to insure that the species can be allowed to survive without being included on the endangered species list (Basic research - \$100,000/year for 10 years);
- Knowledge is needed regarding alternative strategies available to maintain and improve populations of threatened and endangered species (e.g., What are the key indicators of habitat health? How should indicators be measured? Against what 'criteria' should indicator measurements be judged? What options does society have to insure indicators are in appropriate ranges while maintaining Colorado's economic vitality?) (Synthesis of existing knowledge combined with identification of future research needs - \$120,000 for one year)
- How can the 303(d) listing procedures and follow up TMDL procedures be adapted to Colorado conditions while meeting EPA guidelines? (Synthesis of existing knowledge with proposed regulation strategies and identification of future research needs - \$150,000 for one year)
- Is it feasible to expect ground water recharge in deep aquifers, in the form of ground water 'banking', to be of sufficient scale to be a major source of water supply in the future? (Synthesis of existing knowledge and identification of future research needs - \$120,000 for one year)
- What are appropriate water quality standards for reuse of treated wastewater? What water quality constituents are relevant (eg *Escherichia coli*, total dissolved solids and/or odor) to determining if water is 'safe' for reuse within the urban landscape? What health risks are acceptable in order to achieve reuse of treated wastewater on an urban

landscape? (Synthesis of existing knowledge combined with identification of future research needs - \$100,000 for one year).

- The interface between irrigation and non-point source pollution needs to be better quantified. The example used to illustrate the problem was selenium concentrations in irrigation return flows. What are the quantities of selenium in irrigation return flows today and how do these levels differ from historical levels under pre-irrigation (i.e., natural) conditions? What are the biological impacts of current levels of selenium versus those historically? Are there other constituents in irrigation return flows needing attention? (Synthesis of existing knowledge and identification of future research needs - \$120,000 for one year)

Projects Identified by a Water Outreach "Resource Panel" (Oct. 21, 1999)

- Small cities and rural land owners need information on how to mitigate non-point source impacts that are being 'spotlighted' in the Total Maximum Daily Load assessments being planned by the Water Quality Control Division of the Colorado Department of Public Health and Environment (as required under the TMDL lawsuits against the U.S. EPA). (Development and distribution of TMDL compliance information - \$200,000/year)
- Cooperative Extension is viewed as the unbiased educator that should undertake creation and operation of a 'Colorado Water Leaders' course. (Development and operation of a water leaders program - \$100,000/year);
- With so many local 'watershed' groups forming in Colorado, there is a growing need to provide the citizens involved with basic information about Colorado's water management system along with the unique nature of the hydrologic cycle operating in Colorado. (Assisting with watershed education and training - 150,000/year). As waste minimization subsidies have been provided small industries and municipalities, there is also a need to provide waste minimization assistance to Colorado's farmers. As many small industries have learned, waste minimization often translates into a more profitable operation. (Development and operation of an agricultural waste minimization program - \$100,000/year).

Currently, I, along with members of CWRRI's ACWRP, are seeking funding to address these evolving information needs in water management. In addition, higher education faculty are competing for national water research funds, often using the above topics as the core of their proposals. I encourage higher education faculty, interested in developing proposals on any of the above topics, to work closely with Colorado water managers and users interested in the results. Such partnerships often strengthen the proposals while ensuring the results are relevant and readily utilized within Colorado's water management practices. If there is a desire on the part of faculty to work on one of the above topics, please contact me and I will put you in touch with the appropriate person.

I also want to encourage Colorado water managers and users to let me know of new information needs they encounter. I can't promise that we will find the funds to perform the research, but I can make the request for new knowledge known to faculty who may be able to incorporate a new information need into their future research plans.

A major function of CWRRI is to maintain an active dialogue between those needing new water knowledge and those in a position to create it. With the active support of both water managers/users and higher education faculty, CWRRI can facilitate creation of knowledge needed to move Colorado's water management system, hopefully in a smooth manner, **into the 21st** century.



WATER COURSES/CURRICULA WORKSHOP HELD AT CSU

CSU 'water' faculty held a ½-day workshop on January 6, 2000, to discuss the history of water course and curricula development at CSU, to understand the current status of water programs, and to examine future undergraduate and graduate water education needs. The workshop was part of the annual CSU Professional Development Institute and was organized by the CSU Water Center.

Prof. Robert Ward (Chemical and Bioresource Engineering) explained the CSU Water 'Minor' available to any undergraduate student at CSU who seeks a broad understanding of western water management. The minor, administered by the CSU Water Center, consists of 21 credits and covers such topics as introduction to water resources, ecology, economics, water law, watershed management, and the sociology of water resources. Detailed information



about the undergraduate minor can be found on the CSU Water Center homepage: <<http://watercenter.colostate.edu>> under 'Water Minor'.

Prof. Freeman Smith (Earth Resources) reviewed the history of the 'Water Resources Planning and Management' graduate programs offered by the Civil Engineering and Earth Resources Departments. Since 1968, 225 students have completed the Civil Engineering Water Resources Planning and Management program. Between 1974 and 1989, 50 Corps of Engineering employees completed the program now housed in Earth Resources. Since 1990, 20 students have completed the current Water Resources Planning and Management option in Earth Resources' Watershed Sciences program. The programs consist of a variety of courses in the general areas of urban, agricultural and forest-related water management, water infrastructure, systems analysis and optimization, geographic information systems, hydrology and social sciences. The main difference between the two options is the engineering focus offered by Civil Engineering versus the watershed focus offered by Earth Resources. For more information on these programs, contact the Civil Engineering and Earth Resources Department homepages: <http://www.engr.colostate.edu/depts/ce/> and <http://www.cnr.colostate.edu/ER/>.

Prof. David Freeman (Sociology) described the relatively new, one-credit graduate Water Resources Seminar (GS 592) being offered each fall on the CSU campus. The theme of the seminar changes each fall and students are encouraged to attend the seminar each year they are in school. The 1997 theme introduced students to the water problems and concerns of local water managers in each of Colorado's major river basins. The 1998 theme introduced students to the state-federal conflicts regarding western water management. The just completed 1999 offering introduced students to the concept of watershed management and the areas of potential conflict with traditional water rights management in Colorado. The fall 2000 theme is currently being formulated and Prof. Freeman requested input from interested faculty, students and Colorado water managers. Students taking the seminar for credit are organized into interdisciplinary groups to develop a presentation at the end of the seminar on a specific aspect of the semester's theme.

Prof. Freeman described his development of a short course in the 1980s that taught international water managers about the social underpinning of water management organizations. The goal was to assure better integration of water

technology, particularly irrigation technology, into the local culture. Many of the concepts developed by Prof. Freeman are now being incorporated into his recently revised course, S 461 - Sociology of Water Resources. This is one of the core courses in the CSU Water Minor.

A new three-credit, freshman 'water' seminar, being developed by Prof. Dan Smith (Soil and Crop Sciences), was described. The seminar is part of a larger university effort to improve the freshman experience at CSU, with small classes, and improve basic competencies through oral presentations, writing papers, and explicit promotion of logical/critical thinking skills. Prof. Smith's students will be thinking, writing and speaking about water resources.

CSU has a history of offering numerous water-related short courses during the summer. Prof. Tom Sanders' (Civil Engineering) experience in developing, organizing and promoting water-related short courses was used to initiate discussion among faculty regarding development of new short courses addressing emerging water management concerns in Colorado and the western U.S. A list of upcoming water-related short courses can be found on the CSU Water Center homepage.

Toward the end of the workshop, faculty discussed the feasibility and need for a graduate level water 'minor' as well as the need to better inform all CSU students interested in water about the many opportunities to learn about water outside the classroom (e.g., the CSU Student Chapter of the American Water Resources Association, the Student Water Symposium, Hydrology Days, departmental water seminars, and local professional water meetings such as those presented by the Colorado Water Congress, Western State College and South Platte Forum).

The faculty concluded that while CSU is extremely rich in water-related courses and curricula, communication among the many water-oriented faculty on campus and water professionals in Colorado, as well as sharing this communication with students, is a task that requires constant attention. The workshop helped stimulate such communication on campus - one of its main goals.





**JIM LOFTIS AND JESSICA DAVIS
RECEIVE CSREES AWARD**

The Cooperative State Research, Education, and Extension Service (CSREES), under its Higher Education Programs' (HEP) Food and Agricultural Sciences National Needs Graduate Fellowships in Water Science Program, has awarded a \$207,000 grant to Jim Loftis, Chemical and Bioresources Engineering Department, CSU; and Jessica Davis, Soil and Crop Sciences Department, CSU. The award will provide fellowships to conduct research on water management issues of critical importance to agriculture in the western U.S. Critical research needs include the development of methods for assessing ambient water quality conditions, understanding the natural functioning of water bodies, determining the impacts of agriculture and other land uses on water quality, and formulating options for managing those impacts. All fellows will be required to complete an interdisciplinary core curriculum including hydrologic science, biological science, aqueous chemistry, social and institutional factors, and a special seminar in water resources. Below is the fellowship program announcement of invitation for applications.



**ANNOUNCING
PH.D. FELLOWSHIPS IN WATER SCIENCES
COLORADO STATE UNIVERSITY**

Colorado State University invites applications for three USDA National Needs Fellowships in Water Sciences to begin in summer or fall 2000. Fellows may pursue the Ph.D. in any of five academic disciplines: Bioresource and Agricultural Engineering, Civil Engineering, Earth Resources, Fishery and Wildlife Biology, and Soil and Crop Sciences. The five programs are located in three different colleges: Agriculture, Engineering, and Natural Resources. The fellowships are administered through the Water Center at Colorado State University and carry a stipend of \$22,000 per year for three years plus a travel allowance to attend two national meetings. Fellows must be U.S. citizens and must have completed an M.S. degree. Awards will be made as soon as outstanding candidates have been identified.

The Water Sciences Fellowship program at Colorado State supports research related to the increasing pressures on water quality and quantity in the rapidly developing "New West" and to conflicts between competing users of water, including agriculture, urban areas, and recreation. Dissertation research may be pursued in any of the following areas: assessing ambient water quality conditions in streams, ground-water basins, and reservoirs; understanding the natural functioning of western water bodies; determining the impacts of agriculture, increasing population, recreational pressure, and changing land use on western water quality; and formulating options for pollutant loading reduction and/or pollutant trading in order to meet TMDLs or other water quality objectives. Potential research advisers include over twenty participating faculty.

For more information and application materials see the Water Center web page at <http://watercenter.colostate.edu> or contact :

Jim Loftis, Chemical and Bioresource Engineering, (loftis@engr.colostate.edu)
Jessica Davis, Soil and Crop Sciences, (jgdavis@lamar.colostate.edu)
Deanna Durnford, Civil Engineering (durnford@engr.colostate.edu)
Brett Johnson, Fishery and Wildlife Biology (brett@cnr.colostate.edu)
John Stednick, Earth Resources (jds@cnr.colostate.edu)





REQUEST FOR PROPOSALS
FY2000 National Competitive Grants Program

The National Institutes for Water Resources (NIWR) and the U.S. Geological Survey (USGS) have issued a Request for Proposals for the FY 2000 National Competitive Grants Program (authorized under Section 104 of the Water Resources Research Act of 1984). The RFP is only available electronically, for reading and/or downloading, at <http://www.uky.edu/waterresources/pdf/RFP6.pdf>. Any investigator at an institution of higher education in the U.S. is eligible to apply for a grant through a Water Resources Research Institute established under the provisions of the Water Resources Research Act.

The FY 2000 National Competitive Grants Program, funded at a \$1,000,000 level, requires a one-to-one match with non-federal funds. University overhead is normally used as one component of the non-federal match. The proposals are due March 24, 2000, and must be submitted through the website <http://www.niwr.org>. Prospective applicants (PIs) must register at that site prior to submitting an application and may do so now. Proposals will be accepted on the Internet site beginning February 15, 2000. Following March 24, 2000, CWRI must approve the proposals for submission to the National Competitive Grants Program no later than April 3, 2000. The University of Kentucky is coordinating the proposal review and selection process.

The FY 2000 research priorities are: (1) Research to complement or extend work by the USGS related to non-point source pollution; and (2) Research to complement or extend work by the USGS related to the collection, compilation and analysis of water-use information. As you will note, collaboration with USGS is strongly encouraged by the competition. Projects can be one-to-three years in duration and request up to \$250,000 federal funds.



RESEARCH FACULTY AT UNIVERSITY OF NEBRASKA
SUPPORT STRONG WATER CENTER LEADERSHIP

The following article is abstracted from the December 1999 issue of Water Current, newsletter of the Water Center/Environmental Programs unit at the University of Nebraska.

More than two dozen University of Nebraska researchers and state and federal agency representatives have expressed support for strong leadership from the UNL Water Center/Environmental Programs unit to help guide water-related research. These views were shared when participants gathered for a day-long water research forum on October 5, the first held in nearly 5 years. The UNL Vice Chancellor for Research stressed that an ever-increasing share of university research dollars will come through competitive grants. The nation's top 100 research universities currently receive 70 percent of their research funding from the federal government. Research teams must be formed and "horizontal collaboration" should be the rule, the Vice Chancellor said. State and federal representatives said that government and researchers must find new ways to pool resources, coordinate, and communicate to reduce duplication of effort. Participants divided into four groups to discuss the future of the UNL Water Center and presented their recommendations, which included the following:

There is a need for aggressive leadership and better coordination of research funding and programming. The Water Center director should facilitate and organize faculty and research as a system-wide center under the guidance of the UNL Vice Chancellor for Research.

The Water Center director should facilitate both long-term and immediate goals and funding of water-related research at NU. A top priority would be the allocation of funds to researchers and facilitating lateral interchange between the center and researchers.

The Water Center director should facilitate and actively pursue water research funding and provide the dissemination of information both to the public and to research faculty, staff and students.

The Water Center needs to act as a data clearinghouse for researchers – for both short and long-term research and programming.

RESEARCH

**MEASURING THE TOTAL ECONOMIC VALUE
OF RESTORING ECOSYSTEM SERVICES IN THE SOUTH PLATTE BASIN**

by

John Loomis and Paula Kent

*Department of Agricultural and Resource Economics, Colorado State University
and*

Liz Strange, Kurt Fausch, and Alan Covich

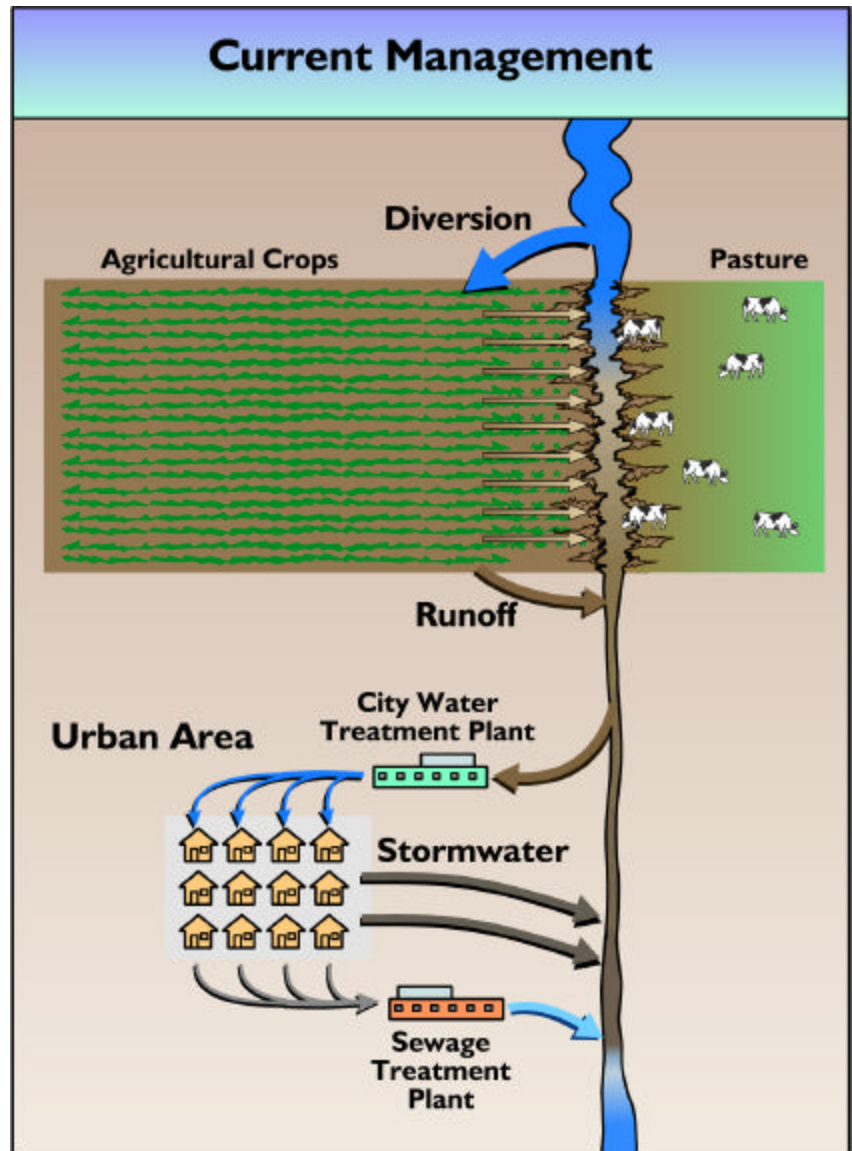
Department of Fishery and Wildlife Biology, Colorado State University

River systems can provide many services to humans, including water supply for municipal, industrial and agricultural users, fish habitat and recreation. When demands from all these uses are low, the uses can be complementary. However, in an over-appropriated river basin, the uses become competitive. Water managers and policy makers must monitor and adjust the mix of these ecosystem services as society's priorities change to insure that the highest valued mix of services is produced. Since uses like fish habitat and recreation are not priced, finding the right mix of ecosystem services presents a challenge.

Like many river basins throughout the world, the South Platte has been modified from its natural structure by diversions of water, adjacent land uses (both urban and rural), and pollution. These modifications, in some instances, have reached the point where the river's natural habitat is unable to support sustain some fish species, resulting in six native species of fishes being 'at risk.' Today the river is highly regulated with 500 diversions. Return flows from wastewater treatment plants and irrigation activities now constitute a large portion of the flow in the South Platte River during several months of the year.

There is interest by many Colorado citizens and water managers in restoring the natural functioning of the river's habitat to the point where native fishes are able to sustain their life cycle and maintain healthy populations. Thus, there is a need to incorporate the value of 'ecosystem service' (i.e., what are the benefits of maintaining a healthy ecosystem for threatened species) into the economic decisions being made by water managers along the South Platte River.

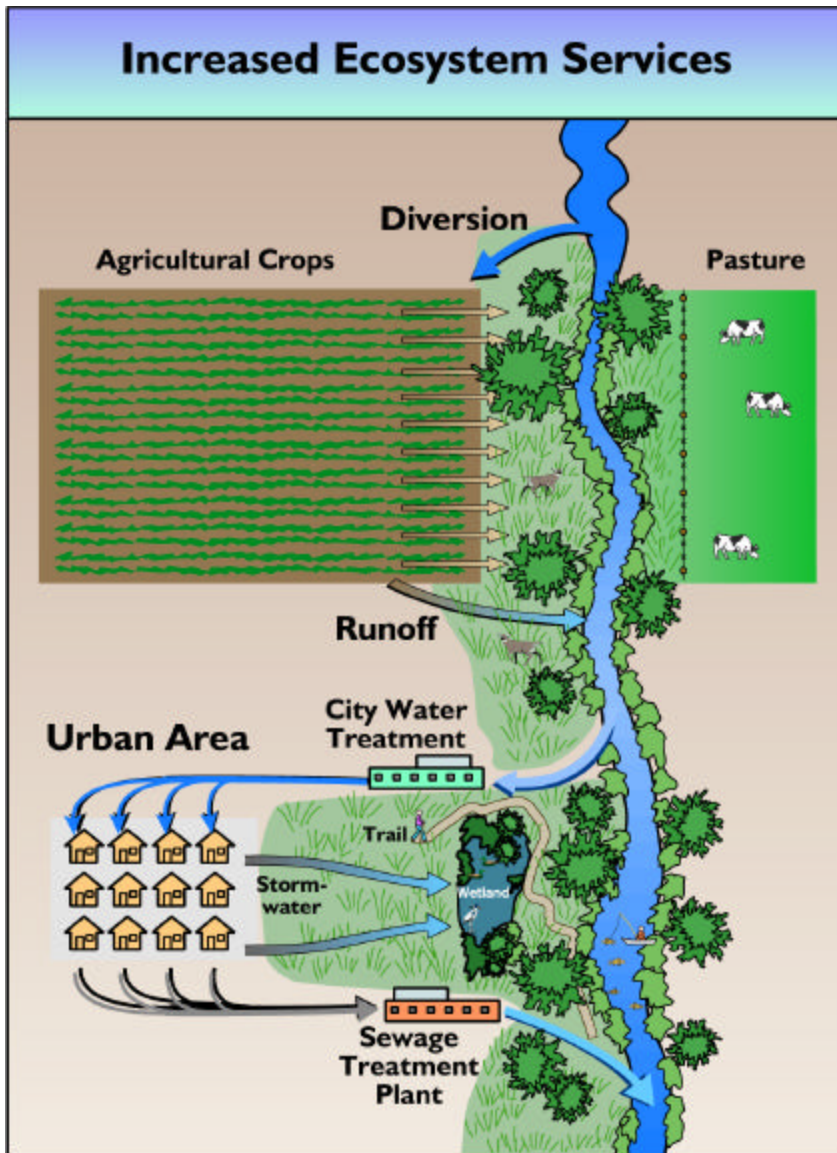
Changes that water managers may consider to improve 'ecosystem service', such as reduction of diversions and



replacement of crop and grazing areas at the river's edge with native vegetation, would result in opportunity costs for irrigators. Are the 'ecosystem services' benefits to society, in economic terms, able to offset the losses to urban and agricultural water users along the river? What would the general public be willing to pay for the increased ecosystem services?

To address this question, faculty members and graduate students from Colorado State University in the Department of Agricultural and Resource Economics and the Department of Fishery and Wildlife Biology joined forces to develop a “contingent valuation” or “willingness-to-pay” survey of residents of the South Platte River Basin. The study section of the South Platte River was selected based on an actual policy proposal by the Centennial Land Trust.

conditions with the proposed changes. The survey provides a dollar figure for how much each respondent would have to pay for the proposed changes, and how that payment would be made (e.g., through increased water bills in this survey). Each survey respondent then states whether they would or would not pay that dollar amount for the proposed changes. For this survey, the respondents were told that their payment for the increased ecosystem services, if approved, would be through an increase in their water bill.



This rural stretch of river goes from Kersey to Fort Morgan, Colorado.

In a contingent valuation survey, the current conditions are described, using words and pictures, as well as the future

Three biologists worked with two economists to define what the ecosystem services were being provided by the Platte River and how these could be conveyed in words and figures. A great deal of effort was expended to carefully define and clearly display the current and proposed levels of ecosystem services to respondents. The survey respondents were asked about all of the ecosystem services in one survey, rather than each service separately, to avoid “double counting” of the value of each service. The researchers determined that the ecosystem services that could be provided by the Platte River were:

- dilution of wastewater
- natural purification of water
- erosion control
- habitat for fish and wildlife, and
- recreation.

Once the key ecosystem services were identified, the researchers developed management actions necessary to increase the level of ecosystem services. These management actions included:

- A five mile wide conservation easement along 45 miles of the South Platte River, downstream of Greeley. This area is 300,000 acres in size.
- Restoration of native vegetation along the river in the form of buffer strips and eliminating cropland and cattle grazing in the buffer strip area. Livestock grazing would be allowed in the remainder of the conservation easement.
- Reduction of water diversions from agriculture were from their current 75% to 50% with the corresponding increase in instream flow from

17% to 42%. This would result in a gain of 145,817 acre-feet of water for instream flow, dilution and aquatic habitat.

Using the wording in the box and the illustrations in Figures 1 and 2, which show the current and proposed future conditions of the reach of the South Platte River, respondents were asked whether they would pay a specified dollar amount, through an increase in their water bill, for the increased ecosystem services. The dollar amount was randomly filled in with one of 12 possible dollar amounts (\$1,2,3,5,8,12,20,30,40,50,100).

The average willingness-to-pay to increase five ecosystem services (dilution of wastewater, natural purification of water, erosion control, habitat for fish and wildlife, and recreation) along 45 miles of the South Platte River was \$21 per month in a higher water bill. When the \$21 is generalized to households living along the river, even if the percent of non-responding households were assumed to be willing to pay nothing for these changes, the total dollar amount paid would be sufficient to cover the costs of the conservation easements on agricultural land along the river and the leasing of water for instream flow. Thus, the suggested policy to increase ecosystem services would both benefit the public (through the increased ecosystem services) and provide sufficient compensation to the farmers and ranchers for the conservation easements and water.



2000-2001 RICH HERBERT MEMORIAL SCHOLARSHIP

The Colorado Section of the American Water Resources Association (AWRA) is soliciting applications for the 2000-2001 Rich Herbert Memorial Scholarship. Students pursuing research on any aspect of water resources at any college or university in the State of Colorado are encouraged to apply. Qualified applicants must meet the following criteria: Enrollment as a student in a degree program at any accredited Colorado public or private college or university; and involvement in research or independent study pertaining to hydrology, engineering, hydrogeology, geomorphology, aquatic biology, water law, water-resources policy or planning, environmental science or other topics concerning water resources in Colorado. The application should include a resume, an abstract of current research, and a

“The purchase of water and 300,000 acres of conservation easements along 45 miles of the South Platte River from willing farmers as well as restoring these areas in natural vegetation costs a great deal of money. To fund these actions a South Platte River Restoration Fund has been proposed. All citizens along the Front Range from Denver to Fort Collins would be asked to pay an increased water bill (or rent if water is included in your rent) to:

One, purchase water from farmers to increase water for fish and wildlife from 17% shown in the top pie chart to 42% as shown on the Lower Pie Chart (point to).

Two, to manage the South Platte River as shown in the Increased Ecosystem Services (point to Figure 1) along the 45 miles of the South Platte River shown on the map (point to area). The funds collected can only be used to restore natural vegetation along 45 miles of the South Platte River and purchase water from willing farmers to increase instream flow to improve habitat for six native fish so they are not in danger of extinction.

If the majority of households vote in favor of the South Platte River Restoration Fund the 45 miles of river would look like the Figure Increased Ecosystem Services with increased water quality and fish and wildlife (point to Increased Ecosystem Service—Figure 1).

If a majority vote against, these 45 miles of the South Platte River would remain as they are today, as illustrated in Current Management (Point to Current Management—Figure 2).

If the South Platte River Restoration Fund was on the ballot in the next election and it cost your household \$___ each month in a higher water bill would you vote in favor or against?

___ I would vote Yes ___ I would vote No”

NOTE: The \$___ was filled in with one of 12 dollar amounts (\$1,2,3,5,8,12,20,30,40,50,100)

letter of reference from a faculty advisor. Since 1991, the Colorado Section of AWRA has presented awards of \$750 to \$1500 to 17 undergraduate and graduate students in water resources programs at Colorado colleges and universities. Awards are based on the technical merit of the research and the academic background of the applicant. Deadline: June 1, 2000. Send completed applications to: Dave Mueller, U.S. Geological Survey, P.O. Box 25046, MS 415, Lakewood, CO 80225-0046.



CROP, SOIL, AND IRRIGATION RESEARCH

by

Abdel Berrada

Southwestern Colorado Research Center

Colorado AES Project 615

The overall objectives of this project are to:

- ◆ *Develop higher yielding, drought tolerant, and pest resistant crops adapted to production in the semi-arid southwest.*
- ◆ *Generate and test crop management systems to optimize sustained economic yield, minimize environmental degradation, and maximize soil moisture storage on non-irrigated cropland in southwestern Colorado.*
- ◆ *Study irrigation systems that improve water use efficiency, minimize environmental deterioration, and optimize crop production.*

exceeded the allocated 6 out of 10 years in the Full Service Area (FSA). The anticipated system capacity of 20.5 inches per acre was based on a water delivery efficiency of 87% and an 'ideal' crop rotation of 55% alfalfa, 20% small grains, 15% dry bean, 3% pasture, and 7% corn. While water delivery efficiency has been exceeded, the acreage in alfalfa has been much higher than anticipated (84% in 1998), which may explain in part the high water usage during dry years. Poor management (learning curve) may also be to blame. In 1996, which was a particularly dry year, the average water use in FSA was 26.3 inches/irrigated acre, with a range of 11.8 to a staggering 46.6 inches/acre. Total water used by FSA farmers in 1996 represented 96% of a total allocation of 55,200 AF, although only 24,182 acres (out of 28,000 allocated acres) were irrigated. As more acres become irrigated, less water will be available to FSA farmers to use above their allotment of 20.5 in/ac (22.5" with current delivery efficiency of 95 percent).

The focus of this article will be on irrigation water management in southwestern Colorado. Irrigated acreage in the Dolores River Basin includes approximately 33,300 acres served by Montezuma Valley Irrigation Company and 35,500 of allocated acres in the Dolores Project Area. Irrigation is important to agricultural production in southwestern Colorado due to the low and erratic precipitation. Water quality generally is excellent, but efforts are underway to reduce leaching of salts from the Mancos shale formation that underlies most of Montezuma valley. The cost-share program of the McElmo Salinity Unit has allowed many farmers in the lower valley to convert from surface to sprinkler irrigation, thus greatly reducing seepage losses and the amount of salt that could end up in the Colorado River.

The conversion of dryland farms to irrigation in the Dolores Project water used per irrigated acre area is fairly recent (1987-present). The amount of water used per irrigated acre



Figure 1. Siderolls are commonly used to irrigate field crops in southwestern Colorado.



A questionnaire was sent to 178 farmers, of which 95 were farm operators, in the fall of 1996 to assess irrigation management in FSA. Forty-two completed questionnaires were returned. The majority (88 percent)

of the respondents used siderolls to irrigate their land (Fig. 1), while 44 percent used siderolls and/or center pivots. Forty-two per cent of the respondents reported using 6 gpm or smaller nozzles on some of their systems, while 22 percent reported using 9 gpm or larger nozzles. The smaller nozzles approximate the Dolores Project pumping capacity (5.8 gpm during peak usage), while larger nozzles may result in deep percolation or runoff if not carefully monitored. Sixty-two percent of the respondents reported irrigation water runoff from their fields, while 36 percent reported no runoff. Fifty-two per cent of the respondents based their decision on when to irrigate by checking soil moisture with a shovel or soil probe. However, 45 percent reported that they continuously moved their siderolls regardless of soil moisture content and/or crop water use. Most of the respondents expressed the need for timely information on crop water use and irrigation scheduling.

As a follow up to the survey, a total of 20 irrigated fields in FSA were monitored for one to three years (1997-1999) to gain a better understanding of the issues identified by the survey. Watermark sensors were used to monitor soil moisture on a weekly basis. Etagage atmometers were installed at five locations to measure alfalfa reference ET. Pertinent information on each field such as soil type, current and previous management history, and irrigation system design was gathered. Several infiltration and catch-can tests were performed to assess soil water infiltration rates and irrigation uniformity. Soil water balances were computed on a regular basis and the information was shared with the cooperators. Several cooperators used the information to adjust their irrigation

scheduling to meet crop water needs.

A good correlation was found between Etagage readings and modified Penman ET calculated from climatic data at Yellow Jacket. The information gained from this study was discussed at:

- ◆ Three field days at Yellow Jacket and Pleasant View (Aug. '97, June '98, Aug. '99)
- ◆ The Irrigation Management Workshop on March 18, 1998 in Cortez
- ◆ The Four States Agricultural Exposition on March 12, 1999 in Cortez
- ◆ The Soil, Water, and Groundwater Management Workshop at the Ute Mountain Ute Tribe Farm and Ranch Enterprise on March 18, 1999
- ◆ The American Society of Agronomy Meetings on November 1, 1999 in Salt Lake City, UT

As a result of this study, a research project will be initiated in the spring of 2000 to address irrigation water management of alfalfa. The Bureau of Reclamation funds the project. Alfalfa has been the most profitable crop in FSA and has other benefits as well, such as reduced soil erosion, improved soil quality, and minimal chemical input. Market and economic considerations will continue to have



Figure 2. Monitoring of soil moisture in an alfalfa field with Watermark sensors.



a major impact on alfalfa acreage in the foreseeable future. Studies are needed to determine the effects of limited water supplies on alfalfa hay production and quality in FSA, and to develop best management strategies to address water shortages.

Earlier studies at the southwestern Colorado Research Center revealed the need to develop crop coefficients that more closely reflect the climatic conditions in southwestern Colorado than those used in existing irrigation scheduling programs. It is important that local environment be considered in any adaptation or transfer of water management programs.

Acknowledgments: The research and demonstration programs at the Southwestern Colorado Research Center have been supported by a number of local and regional entities, particularly the Dolores Water Conservancy District, the Southwestern Water Conservation District, and the Bureau of Reclamation.



WATER SUPPLY

This month's SWSI values, which indicate very low water supply conditions, are a result of low snowpack at the end of December. Well below normal snowpack existed across the state during the month, with an end of December statewide average of 45 percent of normal. The Rio Grande, Gunnison, and San Juan/Dolores basins had both the lowest SWSI values and the lowest snowpacks. Much of the winter snowpack accumulation season is still ahead. Stream flows are still holding at acceptable levels. Reservoir storage is average to above average in most of the reservoirs across the state. The surface Water Supply Index (SWSI) developed by

this office and the USDA Natural Resources Conservation Service is used as an indicator of mountain based water supply conditions in the major river basins of the state. It is based on 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 January 1, 2000, and reflect conditions during the month of December.

Basin	1/1/00 SWSI Value	Change from the Previous Month	Change from the Previous Year
South Platte	0.9	+0.1	-0.1
Arkansas	-2.8	-0.1	-1.7
Rio Grande	-3.7	0.0	-5.2
Gunnison	-3.3	+0.4	-2.4
Colorado	-2.1	+1.0	-1.5
Yampa/White	-2.5	+1.0	_0.9
San Juan/Dolores	-3.3	0.0	-2.4

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





THE UPPER SOUTH PLATTE WATERSHED PROTECTION AND RESTORATION PROJECT

by David L. Hessel

The Upper South Platte Watershed is a critical watershed in Colorado, as nearly 75 percent of the water for the City of Denver and surrounding communities comes from or through this drainage. The Colorado Unified Watershed Assessment, as called for in the Federal Clean Water Action Plan, identified it as a Category 1 watershed in need of restoration (Fig. 1).

The South Platte River is a major attraction for recreation with its close proximity to Denver and its "Blue Ribbon" trout fishery. Nearly all of the watershed is located within the Pike and San

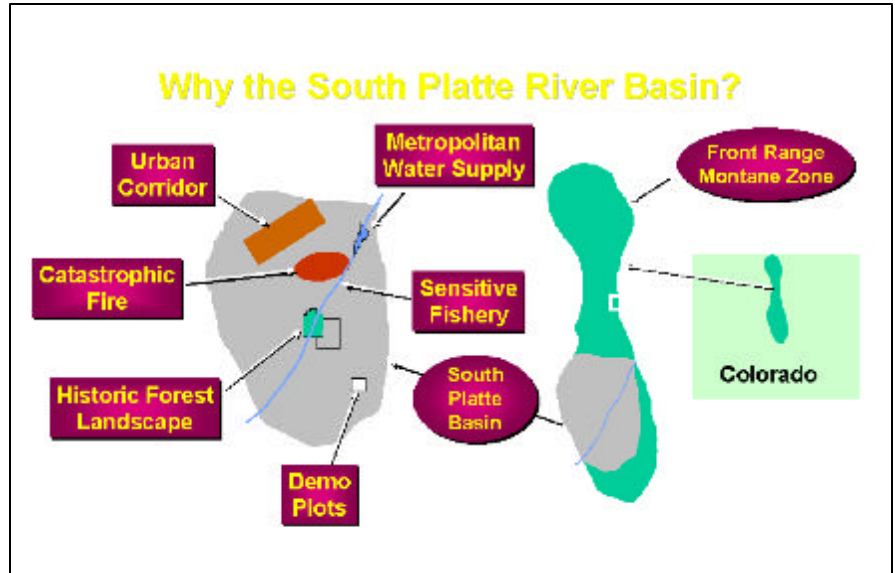


Fig. 1. Why the Upper South Platte Watershed?



Fig. 2. Forest Conditions in Ponderosa Pine /Douglas Fir in the Project Area

Isabel National Forest just southwest of the City of Denver. The watershed generally is characterized by dense, young homogenous ponderosa pine and Douglas fir forests (Fig. 2). These forest conditions and wild land interface set the stage for future disastrous disturbances, primarily from wildfire and insect outbreaks. The conditions not only pose a threat to the health of the watershed but also to public safety.

In 1996, the Buffalo Creek Fire burned nearly 12,000 acres in the watershed, resulting in loss of homes and essential forest cover on highly erosive soils formed from decomposed granite. The fire was followed by several intense rain events resulting in



flooding and major impacts to Denver's water supply system. Large amounts of sediment and fire debris were transported downstream to a reservoir that is an important water storage facility for the Denver metropolitan area (Figs. 3, 4 and 5).

Millions of dollars have been spent by Denver Water to clean debris from the reservoir, with more to be spent in dredging operations to remove sediment. In addition, the small community of Buffalo Creek lost several homes and its water system. Many roads in the area were heavily damaged. The Buffalo Creek Fire and the following rain events have provided a highly visible focus for the Upper South Platte Watershed Protection and Restoration Project.

The watershed restoration project was proposed in the fall of 1998 by a partnership that included Denver Water, the Rocky Mountain Region of the U.S. Forest Service, the Colorado State Forest Service, the Rocky Mountain Research Station and Colorado State University. The goal was to develop a strategy to restore and protect the Upper South Platte Watershed. In February 1999, the project received support and funding at the national level from the U.S. Forest Service in addition to the funding of the other partners. A landscape assessment was



Fig. 3. Buffalo Creek Fire of 1996



Fig. 4. After Effects of the 1996 Buffalo Creek Fire After Intense Rain Event

contracted and completed in just three months on 645,000 acres to study ecological processes, to prioritize the six-level watersheds (smaller watersheds within the Upper South Platte River drainage), to restoration opportunities and to make recommendations for prescribed treatments to manage and restore watershed function.

A planning and implementation team is in place to oversee the project. The project's initial phase is planned for five years, with estimates to treat about 6000-8000 acres using such treatments as creating openings in the dense forest canopy, thinning in between openings, and the use of prescribed fire. All small stream courses within the selected sixth-level watershed will be assessed for



restoration opportunities. A steering committee of the partners and other interested state and federal agencies has been established to provide project guidance and oversight.

Recently, the project was selected by the Chief of the U.S. Forest Service as one of twelve projects involving national forest lands to receive special funding to demonstrate the benefits of large-scale watershed restoration and collaborative management

The Colorado State Forest Service (CSFS) is a partner with other agencies in this project and is involved in a number of ways. First, a cooperative agreement was signed this past year between the Denver Water Board and CSFS. The CSFS now has responsibility for forest management on Denver Water Board lands. Denver Water is the largest non-federal landowner in the Upper South Platte project area. Second, CSFS's mission is to achieve stewardship of Colorado's environment through forestry outreach and service, including forest protection and management.

Front Range forests are in an ecologically sensitive condition, and in some areas are highly susceptible to large wildfires and insect and disease outbreaks. The problems in the Upper South Platte drainage are complicated by residential home development involving multi-jurisdiction responsibilities. The Upper South Platte Protection and Restoration Project can be a catalyst for other collaborative efforts that will restore forest health and watershed conditions while protecting the lives of firefighters and the public.



Fig. 5. After Effects of Debris Going into Strontia Springs Reservoir, Which Included Over 13 Years of Annual Sediment into the Reservoir After One Rain Event



Fig. 6. Development Within the Forests Along Colorado's Front Range

In the next issue of Colorado Water, the findings of the landscape assessment will be discussed, along with the current status of project planning including public involvement and NEPA. For more information contact either Fred Patton, Pike National Forest, Phone 303/275-5639, email fpattton/r2psicc@fs.fed.us; or Dave Hessel, Colorado State Forest Service, Phone 970/491-7546; or for the assessment and more, see the Web site at <http://www.colostate.edu/Depts/CSFS/>.

MEETING BRIEFS



GOVERNOR'S CONFERENCE ON FLOOD AND DROUGHT PREPAREDNESS

Summary, Conclusions, and Recommendations

Flood and Drought Preparedness were the topics at a conference convened by Colorado Governor Bill Owens December 2-3, 1999 at the Adam's Mark Hotel in Denver, Colorado. The conference was cosponsored by the Colorado Department of Natural Resources, the Colorado Department of Agriculture, and the Colorado Department of Local Affairs. Conference attendees included representatives from federal, state and local agencies and organizations; business representatives; and individuals from across the state.

looked at impacts of floods and droughts in Colorado from an economic perspective. Luncheon keynote speaker Hank Brown, former U.S. Senator and President of the University of Northern Colorado, described flood and drought challenges and Colorado's water future.

In the afternoon, three concurrent Track Sessions were conducted — Track 1: Flood Issues, moderated by Larry Lang, Floodplain Management Section Chief, Colorado Water Conservation Board; Track 2: Drought Issues, moderated by William P. Stanton, Conservation Planning Section Chief, Colorado Water Conservation Board, and Track 3: Mitigation Issues, moderated by Marilyn S. Gally, State Hazard Mitigation Officer, Office of Emergency Management.

The second day of the conference began with a breakfast panel discussion on National Perspectives on Flood and Drought Mitigation, hosted by Representative Brad Young. The panel was comprised of representatives from the Federal Emergency Management Agency, the U.S. Army Corps of Engineers, the U.S. Bureau of Reclamation, and the National Drought Policy Commission. This was followed by presentations from representatives of the City of Grand Forks, North Dakota; the City of Tulsa, Oklahoma; and the State of Texas. They provided case

studies and presented mitigation options and issues that had been faced in those areas. Representative Gary Walker from the Texas House of Representatives provided an overview of the Texas Drought Response Legislation.

Working luncheons on the second day of the conference provided attendees with an opportunity to express their own ideas on how to improve Colorado's preparation for and response to floods and droughts. Participants divided into six interest groups: Environmental, Business, Water Management, Agricultural, County, and Municipal. The groups were asked to discuss the following questions from their own interest group perspectives:



Tom McKee and Nolan Doesken listen to questions from the press.

The conference began with a welcome by Governor Owens and Greg Walcher, Executive Director, Colorado Department of Natural Resources. Governor Owens and Director Walcher set the stage with a discussion of the impacts of some recent floods and droughts in the state, including the damage caused by the Spring 1999 floods in the Arkansas Valley. The session was then addressed by two speakers who presented the State of Colorado's current level of vulnerability to floods and droughts. Tom McKee, former Colorado Climatologist and member of the Atmospheric Science faculty at Colorado State University, provided a scientific perspective of Colorado's vulnerability to flood and drought disasters. Nancy McCallin, Director of the Governor's Office of State Planning and Budgeting, then

- Define strategies for the Governor's Action Agenda for Reducing Colorado's Vulnerability to Floods and Droughts, including consideration of infrastructure, administrative, statutory, and funding issues.
- Define the Roles and Responsibilities of Federal Agencies, State Government, Local Governments, Businesses and Individuals in the reduction of Colorado's flood and drought vulnerability.

In each group, there was a facilitator for the discussion as well as an assistant facilitator who took notes. The conference attendees reassembled and the facilitator for each group presented a summary and recommendations from their discussions. Presented below are edited recommendations given to the conference by the facilitator for each group.

Environmental Interests

First and foremost, the complexity of the issues surrounding strategies for drought and flood preparedness preclude any simplistic, band-aid solutions, and we came up with none in that category.

The first recommendation was to get the word out to the general public. There are a great many people in Colorado now that don't know what it is like to live in a semi-arid state, and don't believe there is any difference in lifestyle based on what they might have enjoyed in New York or the Midwest. We need to educate the public about what it is like to deal with drought and flood here in the arid west and to consider water demand management in all of the solutions that are being offered.

We need to consider non-structural alternatives as a starting point.

In order to do one and two above, the state's role should be to facilitate watershed planning in a way that is consistent with both educating the public and considering non-structural as well as structural alternatives.

The state needs to be in a position to provide resources

for funding collaborative management solutions and to be a repository of factual information, so that we make decisions in the planning process based on the reality of the environment that we are dealing with, not just preconceptions of the problem.

Strategies should be implemented at the local level — with local planning and state support for funding a database and coordination. Everybody needs to be at the table, and that includes our federal neighbors — the federal government needs to be part of the solution and part of discussing what, as a good neighbor, we are doing.

To integrate uses within a watershed requires collaborative participation if we are going to take the next steps down the road.

Our recommendation is that we move forward to do watershed planning, incorporating what we already know. The state role needs to be primarily one of supporting and funding this coordinated effort, providing the database on which to go forward, and facilitating a collaborative-management approach. This needs to be a bottom-up as opposed to a top-down approach."

Business Interests

Overall, there is a general concern that we need more high-mountain water storage, based on the fact that there is no real cushion for a drought situation. The generation of electricity relies upon water. If we run out of water, we run out of electricity, which potentially will impact businesses throughout the state depending upon the severity of the drought.

The permitting process was discussed as being somewhat cumbersome and time-consuming, and there is a desire to see it streamlined. There is support for state oversight to help projects move along. When there are checks and reporting requirements it keeps the process moving, which results in better efficiencies for development and production in business.

Also, encourage state agencies to present proposed statutory changes to the business community and to work together to find solutions that work for all interests. Develop public-private partnerships. For example, one situation that was discussed was gravel extraction facilities. Once the minerals are extracted, this leaves a big hole in the ground. There is an opportunity for local government to work with that business in developing a recreational area. Possibly dollars could come from the state, whether from GOCO or another source. This would be considered a real win-win situation for business, the local community, and the state overall.



Make sure that the state knows what mechanisms need to be in place to have access to federal dollars, particularly in the event of an emergency.

Participants would like to see a state plan, and feel it is incumbent upon the state to set an example for local governments because of the diversity of geography and climate variability throughout Colorado. Local govern-

ments need to step up to the plate and educate their own communities about the likelihood of drought or flood situations based upon their geography.

The business community would like to work at developing partnerships with the governments to look at internal company efficiencies and educating consumers about water issues.

Water Interests

Anytime you get the water community or interests together, they certainly come forth and live up to the quote by Mark Twain, "Whiskey is for drinking and water is for fighting over."

The need for a state commission or blue-ribbon body to examine floods, drought and water-related issues with a "big-picture approach" was discussed. This would include members of the Executive Branch, the General Assembly, and the public.

Another area, the most difficult area of all, is funding. We are certainly aware in this state of the problems that we have with funding and the requirements that have been imposed by the Tabor Amendment.

We should pursue federal funding more aggressively, and lift, if possible, the Tabor limits regarding water projects or water-related needs. We should look more

seriously at the GOCO funds, particularly from the standpoint of recreation, because water is a big aspect of recreation.

There is a need for state incentives for local drought and flood planning – risk-based assessments, etc.

Finally, there is one area that we all talk about – the need in terms of education. Many new people have come into the state from areas with different environments entirely than, say, the 14.7 inches of rainfall that you have in the Denver area or the 6.9 inches that you have in the San Luis Valley. Consequently, acquainting those new citizens of the state with a better understanding of the kinds of issues that we have related to water, whether sometimes too much, or not enough, is an enormous job.

There is also need in the research area.

Agricultural Interests

The group felt education was very important, especially getting the private sector more involved in understanding what is going on with both floods and drought throughout Colorado.

Participants would like to see a review, at the least a review, of all regulations at the local, state and federal levels. For example, some felt that there are too many regulations in some places and not enough in others. Local floodplains, for example – why aren't local governments doing more to prevent development in designated floodplains? There could also be some review of federal laws that deal with the environmental side.

There was agreement that we need to keep the current water structure that we have, meaning the water rights system that has developed over the past 100 years so senior water rights are protected. With that in mind,

the group was very excited about the plan that Representative Gary Walker from Texas brought up regarding the Texas Water Plan. There seemed to be consensus that Colorado should at least look at some level of statewide planning where local groups pull together. Does it have to be on a basin-by-basin structure? Not necessarily. There was some support for perhaps not just doing it by the basin but by the geographic area of interest. That is why the group thought it was important to get all the interest groups involved, whether agriculture, environment, business, local, municipalities – get everyone involved at the local level so they can review what is going on with flood and drought in their particular areas.

There is a big need for data collection, which Colorado is beginning to be more aggressive in, but group members felt we need more data as well.

Yes, there was consensus for more storage in Colorado, both structural and non-structural, not only for flood prevention and flood control, but also to meet the state's water needs into the next Century with our growing population. Water conservation of course came up, and everyone agreed that we probably need more water conservation, but at the same time conservation, in and of itself, will not help us meet our water needs in the future.

County Interests

With infrastructure, planning is probably one of the most important things we need to do, with a broad enough look so as not to affect any of the downstream people.

With stream bank erosion and sedimentation caused by flooding, we need to get hold of this prior to. We need to look at it from the viewpoints of all the agencies and come together in coordination to get the infrastructure completed. We should look at the Corps of Engineers' work. We would like to see them help with the studies (in some cases many studies already have been completed), get their okay, and then do the work at the state and local level.

We need more cooperation between agencies. The inter-agency mitigation team of the Water Conservation Board is a great start. They need to bring others in.

We also need to look at what we can do locally to help the state get funds increased and help educate our legislators as to the devastation that comes with floods. Funding at the local level is very important, because the rural areas need help from either the state or the federal government. We need to help the state and the feds get more money and that should be a cooperative effort.

We need good river measurement systems. We have some out there, but the problem is, once the water leaves the bank of that particular waterway those measurement systems do not work anymore. You can't get the data that you need.

Municipal Interests

The discussion opened with the comment that at the Statehouse water isn't a top issue, and it hasn't been from a funding standpoint. Funding is a key issue.

Discussion centered on the floods that had occurred in the lower Arkansas this year on Fountain Creek and in the areas of Colorado Springs and Pueblo, and also issues related to small communities such as Firestone. One of issue that came up is that communities have different standards for flood protection. The number one thing that we would like

Better land use planning would be helpful. Also, look at energy needs and how they affect water supplies and timing.

Finally, we need more profitability in agriculture. That is how you keep farmers farming, and ranchers ranching. What a novel idea!

We need to approach Congress again to increase appropriations for FEMA. It was suggested that it do some awards and media exposure education (there education comes up again). At the state level, we need funding and technical expertise. Expertise is vital to many of the smaller rural areas and even to some of our cities.

We need to work with local governments in funding and go to the General Assembly to get things done. There again, we need the cooperation of the local governments to help the state and our legislators.

The private sector is a very important untapped resource. Through private business and industry in many areas, even rural areas, you can get a lot of volunteers to help.

The individual needs to take more personal responsibility if they chose to live in that floodplain. They know about the chances of getting flooded, so they have to take some responsibility for that. We need their help and we need their understanding.

Water board members should take information and fact sheets to their constituents and stimulate discussion and action. It comes down to everybody working together to educate people as to what is going on and what can happen. Education is it.

to see on the Governor's agenda is the encouragement of basinwide planning to facilitate intergovernmental cooperation. There are instances where there may be 20 to 30 different individual small governments that have influence over flood control and standards of development in communities. The Urban Drainage and Flood Control District here in the Metro area would be a good model from planning through funding, implementation, and then ultimately management.



In the planning area, we need more climatic data, more monitoring for both real-time and long-term data, and more education.

As for funding, there is a need for more GIS projects and some mechanism to acquire low-interest loans for acquisition of properties. As you heard from representatives from Grand Forks and Tulsa, quite a few homes had to be acquired there.

Hal Simpson, State Engineer, sent the message that funding for gages and real-time data acquisition is important, and again for acquiring general information. Another issue is that the Corps of Engineers does not seem to think it has the authority or even the priority for issues related to streambed degradation, streambank erosion, or sediment deposition. The message came loud and clear that we need to ask our U.S. representatives to put pressure on the Corps to make this a larger issue. It certainly was in the flooding of the Arkansas Basin.

Also from the funding standpoint, it was pointed out that the Colorado Water Conservation Board only has five people there that deal statewide with issues related to flood. Some additional FTEs there would be of benefit.

In the area of drought, four words – Conservation as a value. We had Liz Gardener of Denver Water in our group, and there was a strong feeling throughout that it has been a

long time since we have had experience in drought-related issues. However, people need to keep that on their radar screens – wise use of water is extremely important. We are not seeing any long-term climatic changes from what Tom McKee (former State Climatologist) says, and we have had a very wet period here for the last 18 to 20 years. We need to keep reminding people of that, because we have a whole generation of people who have grown up not having really experienced drought.

Education was deemed extremely important. There was some feeling that there should be some revitalization of the Office of Water Conservation within the Water Conservation Board to get education out at the state level and also implemented at the local level.

Another issue that came up was water storage — the typical concept of high-altitude water storage, and perhaps more encouragement of development of local storage that could be worked in with flood control and perhaps through retention ponds. Also, the idea of aquifer recharge was brought up, and the conjunctive-use concept of taking in water during the wetter periods and/or perhaps acquiring it on an interruptible basis from farmers and recharging some of the aquifers that are being overdrafted.

Our discussion concluded with this recommendation – we need to have a balance between conservation and storage.”

*A History of Drought in Colorado:
Lessons Learned and What Lies Ahead*

The Colorado Water Resources Research Institute (CWRRI) has recently published Report No. 9 in its Water in the Balance series. This timely report is entitled “A History of Drought in Colorado: Lessons Learned and What Lies Ahead,” authored by Former State Climatologist Tom McKee, Assistant State Climatologist Nolan Doesken and John Kleist of the Colorado Climate Center (CCC), and Cat Shrier from CWRRI. This report provides a summary of a study completed by the Colorado Climate Center on the Historical Dry and Wet Periods in Colorado from 1890 to 1999. The report provides results of the analysis of the time and space patterns of Colorado’s droughts, and also addresses several frequently asked questions such as how dry can it get? Does a dry winter foretell a dry summer? And are there drought cycles? In addition to a summary of the technical report, this publication provides extensive background information on drought and drought management in general, and on water supply, water use, and drought response in Colorado. Written in clear, simple language with extensive maps and illustrations, this report is an essential introduction to drought for anyone in Colorado’s water community. The report is available on our web site at <http://cwrri.colostate.edu>. To receive hard copies at no charge, contact CWRRI at e-mail cwrri@colostate.edu, Phone 970/491-6308 or FAX (970) 491-2293.


**FOUR STATES IRRIGATION COUNCIL PRESENTS ITS
1999 COLORADO HEADGATE AWARD TO JOHN WILKINS-WELLS**

The Four States Irrigation Council held its annual meeting at the Fort Collins University Park Holiday Inn January 12-14, 2000. Established in 1952, the Four States Irrigation Council serves as a forum for irrigators in Colorado, Wyoming, Kansas, and Nebraska to exchange ideas and information about irrigation practices.

During the meeting's banquet, Prof. John Wilkins-Wells received the 1999 Colorado Headgate Award. This award is presented to a person who has been active and supportive of irrigation and water resource management in Colorado. John was recognized for his work with agricultural water supply organizations over the past four years. John is currently principal investigator for a Bureau of Reclamation-sponsored study of five western states' irrigation districts and mutual irrigation companies.

John's research has examined the social and economic vitality of irrigation organizations and explored ways to make the organizations more viable. In the course of his research, John has visited many irrigation water organizations across the western U.S.; has attended numerous irrigation organization workshops (many of which he organized); worked hard to understand the nature of today's irrigation organizations; and has produced new insight into the structure, operations and development of irrigation districts.

In presenting the award, Marc Catlin, Assistant Manager of the Uncompahgre Valley Water Users Association (and vice president of the 4 States Council) noted John's tireless efforts to understand the details of irrigation districts. John's constant questions and many visits ensure that his research is based on a thorough understanding of the situation facing today's irrigation organizations. These efforts are greatly appreciated by members of the Four States Irrigation Council, who look forward to applying the results of John's research to help improve the structure and operations of tomorrow's irrigation organizations.

John is an Assistant Professor of Sociology at Colorado State University. He has been with the university since 1986. A Colorado resident since 1970, John has BA and MA degrees from the University of Colorado in Cultural Anthropology and a PhD in Sociology from Colorado State University.

The Four States Irrigation Council's 2000 meeting was a joint meeting with the Upper Missouri Water Association. Sessions addressed topics such as, 'Visions for the Next Decade', 'Small Critters – Big Problems', and 'Bureau of Reclamation Issues into the 21st Century.' Joe Hall, former Deputy Commissioner of the Bureau of Reclamation, presented the luncheon address on Thursday and discussed how irrigators need to view their roles in the evolution of irrigated agriculture. Beyond the need to better explain how irrigated agriculture contributes to our society, he noted how irrigators must look carefully at their own thoughts and opinions regarding irrigation and seek opportunities to work with others in ensuring the future of irrigated agriculture in the new millennium.



John Wilkins-Wells thanks Council members for his award, saying it renews his enthusiasm for the USBR-sponsored study of western states irrigation districts and mutual irrigation companies.

During a session titled “Visions for the Next Decade,” representatives from each state described the current issues being faced by water managers and users. Hal Simpson, Colorado State Engineer, described the three emerging ‘demands’ facing Colorado’s water resources as follows:

- ◆ Demand for water to support population growth;
- ◆ Demand for water to meet habitat health needs; and
- ◆ Demand for water by downstream states.

Hal then indicated how Colorado is addressing each of these demands in light of existing uses and rights.

Jeff Fassett, Wyoming State Engineer, noted that water development in Wyoming is evolving from a case-by-case approach toward a systematic, basin-by-basin planning process that will be updated every five years. Wyoming is spending \$1 million per year on the new water planning initiative. The water planning effort in Wyoming is a powerful water education tool as it engages water users and basin advisory groups. Basic research into options for enhanced water conservation options is being integrated

into the planning process and Wyoming water laws are being examined for possible adjustments that permit a water market to serve as an incentive for water conservation.

Roger Patterson, Director of Nebraska’s Department of Water Resources, reviewed the lawsuits involving Wyoming and Kansas and noted the need for time to bring people along with the endangered species agreements being studied on the Platte River. He commented on the need for better science as various negotiations are undertaken to solve the water conflicts.

The meeting concluded with the Bureau Area Managers from the Great Plains Region discussing the issues they see as critical in the coming years. Aging infrastructure, conversion of agricultural water to urban/ecosystem uses, meeting tribal water rights commitments, and financial integrity were themes running through the presentations.

Next year’s Four States Irrigation Council meeting will be held January 10-12, 2001, in Fort Collins.



Report Highlights “Restorative Redevelopment” *Approach to Wet Weather Management*

A new report makes the strongest case yet for alternative solutions to chronic sewer overflows and stormwater problems. “Re-Evaluating Stormwater: The Nine Mile Run Model for Restorative Redevelopment,” shows how low-cost stormwater management measures, incorporated into retrofit programs and redevelopment projects, can not only economically reduce runoff and sewer overflows but also bring a veritable flood of other benefits. The report recounts the work of design and policy experts who devised a restorative redevelopment model for Pittsburgh’s densely developed Nine Mile Run watershed. The approach of restorative redevelopment is to manage precipitation as close to where it falls as is physically and economically feasible, using freely available natural processes to do the work of stormwater storage and treatment. The Pittsburgh panel integrated many such techniques into sample designs for four sites in the Nine Mile Run watershed. The techniques included:

- Capturing runoff in tanks or cisterns for irrigation or indoor graywater use;
- Disconnecting pavement and roof drainage from sewer lines and directing it to adjacent vegetated soil or to infiltration basins;
- Engineering infiltration basins to collect runoff and percolate it into the soil;
- Planting trees to intercept a portion of rain water;
- Reconfiguring driveways, parking lots, and streets to turn more of a site over to pervious, vegetated soil;
- Replacing impervious pavements with porous ones;
- Routing runoff through swales to slow its velocity, remove pollutants, and infiltrate it into the soil.

The panel’s designs handle runoff at costs comparable to those of conventional projects in the area (\$2 per gallon of hydraulic capacity). But unlike conventional solutions, they also provide other community and environmental benefits, such as watershed restoration, community and economic revitalization, educational opportunities and neighborhood street and park enhancement. Therefore, the costs of these measures can be shared across multiple agencies and budgets, and absorbed into the incremental retrofitting and redevelopment of urban areas. Although the sample designs are site-specific, together they illustrate patterns of restorative redevelopment that can be adapted for other sites throughout the country. Significantly, the report concludes with a section on policy objectives and action plans to support restorative redevelopment through institutional coordination, infrastructure management, watershed restoration, and community economic development.

“Re-Evaluating Stormwater: The Nine Mile Run Model for Restorative Redevelopment” was written by Richard Pinkham, a water-efficiency consultant with the Rocky Mountain Institute, Bruce Ferguson, a nationally recognized expert on infiltration techniques for stormwater management at the University of Georgia’s School of Environmental Design; and Timothy Collins of Carnegie Mellon University’s Studio of Creative Inquiry. The publication may be ordered directly from Rocky Mountain Institute (970-972-3851; canw.rmi.org). It costs \$24.95 plus shipping and handling (\$5.50 for one copy).

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
Best Management Practices - Arkansas River Valley	Valliant, James C	Cooperative Ext.	CWCB
Snow Deposition Studies in Two National Parks of the Rocky Mountain Cordillera	Elder, Kevin J	Earth Resources	DOI-NPS
Assessing the Consequences of Climate Change...	Hobbs, N. Thompson	NREL	EPA
The Effects of Fire Intensity on Olive-Sided & Hammond's Flycatchers	Wunder, Michael B	FWB	DOI-USGS
Application of a Statistical Dynamical Water Balance Model to Regional Scale Integrated Impact Assessment ...	Ramirez, Jorge A	Civil Engr.	Tulane Univ.
Experiments To Determine The Effects Of N Deposition On High Elevation Lakes In RMNP	Baron, Jill	NREL	Natl. Park Fdn.
Watershed Erosion Modeling for the Actinide Migration Studies -- Rocky Flats	Julien, Pierre Y	Civil Engr.	Kaiser - Hill Co., L.L.C.
Colorado BLM/FS Sensitive Species Information & Service Project	Baker, Barry B	FWB	DOI-BLM
Survey of Critical Biological Resources for the Upper Arkansas Ecosystem	Kettler, Stephan M	FWB	EPA
Assessment of Urban Residential Exposure to 2, 4-D	Bigelow, Philip L	Environ. Health	EPA
Consortium for Agriculture Soils Mitigation of Greenhouse Gases (CASMGs)	Paustian, Keith H	NREL	Iowa State Univ.
Ecological, Climatic, Economic, & Socio-Cultural Drivers of Land Use Changes...	Ojima, Dennis	NREL	University of Nebr.
Agroecosystem Boundaries & C Dynamics with Global Change in the Central United States	Paustian, Keith H	NREL	University of Nebr.
Regional & Global Estimation of Terrestrial CO ₂ Exchange from NIGEC Flux Data	Denning, A Scott	Atmos. Science	Tulane Univ.

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
Evaluation of the National Hydrogeomorphic Slope Wetland Guidebook Applied to the...	Steingraeber, David A	Biology	CDNR
Interdisciplinary Approaches to Identification & Mitigation of NPS Water Quality Impacts	Stednick, John D	Earth Resources	Univ. of Wyo.
Overland Flow in Microchannels on Rangelands	Leininger, Wayne C	RES	USDA-USFS-RMRS
Delivery, Deposition, and Effects of Land-based Sediment on Corals in St. John, US Virgin Islands	Macdonald, Lee H	Earth Resources	Univ. of Virgin Isl.
Coping with Flash Floods	Eis, Kenneth E	CIRA	NATO
Wetlands Management Field Support	Shaw, Robert B	Forest Sciences	DOD-ARMY
GOCO FY2000 Wildlife Funds - Amendment	Klein, Mary	FWB	CDWL
Risk Management Needs Assessment	Bigelow, Philip L	Environ. Health	DOI-NPS
Interdisciplinary Science Investigation of Clouds & the Earth's Radiant Energy System	Randall, David A	Atmos. Science	NASA
Top-down Influences on Water Quality in Front Range Reservoirs	Johnson, Brett M	FWB	N. Front Range Water Qlty Planning Assoc.
Numerical Simulation & Analysis of Mesoscale Convective Systems & Severe Storms	Cotton, William R	Atmos. Science	NSF
CO2 Budget & Rectification Airborne Study--North America (COBRA--NA)	Denning, A Scott	Atmos. Science	Harvard University
Integrated Modeling & Assessment for Balancing Food Security, Conservation, & Ecosystem Integrity	Coughenour, Michael B	NREL	Univ. of CA-Davis
Identification, Public Awareness, & Solution of Waterlogging & Salinity in the Arkansas River Valley	Gates, Timothy K	Civil Engr.	DOI-USBR
Developing a Decision Support System for the South Platte Basin	Ward, Robert C	CWRRI	Various "Non-Profit" Sponsors
Towards a Multisensor Approach to Improve on Current Tropical Rainfall Measurement Mission . . .	Stephens, Graeme L	Atmos. Science	NASA
Hydrologic Characterization to Design/Develop a "Natural Hydrograph"	Garcia, Luis	CBE	DOI-USBR
Channel Restoration Project	Watson, Chester C	Civil Engr.	Univ. of Nottingham, England
Measuring Stakeholder & Forest Service Employee Perceptions about Fire Risk Management in the Colorado Front Range	Kling, Robert W	Economics	USDA-USFS-RMRS
Developing Sustainable Dryland Cropping Systems in SW Colorado	Berrada, Abdelfettah	SW CO. Res. Ctr.	Utah State Univ.
Channel rehabilitation Design Guidance Manual	Watson, Chester C	Civil Engr.	Univ. of Nottingham, England
Integration of Geological and Ecological Indicators for Assessment of Impacts on Stream and Riparian...	Gutkowski, Richard M	Civil Engr.	No.Dakota State Univ.
USDA National Needs Fellowships in Water Science	Clements, William H	FWB	DOI-USGS

**UNIVERSITY OF COLORADO
BOULDER, COLORADO 80309**

Title	PI	Dept.	Sponsor
Investigation of Soil Aquifer Treatment for Sustainable Reuse: Characterization of Effluent Organic Matter	Amy, Gary	CEAE	AZ State Univ.
Isotopic Measurements on the Wais/Siple Dome Ice Cores	White, James	IAAR	NSF

Title	PI	Dept.	Sponsor
Environmental Changes and Human Responses in the North Atlantic Iceland and Greenland Sectors During the Last 2,000 Years	Ogilvie, Astrid	IAAR	NSF
Testing Earth System Models with Paleoenvironmental Observations	Elias, Scott	IAAR	NSF
Controls on the Structure, Functions and Interactions of Alpine and Subalpine Ecosystems of the Colorado Front Range	Bourgeron, Patrick	IAAR	NSF
Lithosphere Structure and Evolution of the Rocky Mountain Transect of the Western U.S.: An Integrated Geological and Geophysical Investigation	Farmer, G. Land	CIRES	NSF
Investigation of Photochemical Transformations Within Snow and Their Effects on Snow and Atmospheric Composition	Steffen, Konrad	CIRES	NSF
Snow and Ice Distributed Active Archive Center	Barry, Roger	CIRES	NASA
Quantification of Humic Electron Transfer Reactions in Natural and Contaminated Marine Sediments	McKnight, Diane	IAAR	DON
Carbon Cycle Atmospheric Gas Collection	Losleben, Mark	IAAR	NOAA
Profiling CO2 and Water Vapor Through the Atmospheric Boundary Layer and Lower Troposphere in Support of the Ameriflux	Birks, John	CIRES	Univ. of Nebraska
Decision Support for Watershed and River Systems Management	Zagona, Edith	CADSWES	DOI
Aerosol-Cloud-Climate Interactions	Steffen, Konrad	CIRES	NASA
International Research Workshop on Integrating GIS and Environmental Modeling: Problems, Prospects, and Research Needs	Parks, Bradley	CIRES	NASA
Human Ecology of the Rio Verde Drainage Basin, Oaxaca, Mexico	Joyce, Arthur	Anthropology	NSF
Stable Nocturnal Boundary Layer: Observations and Interpretation of Mesoscale Instability Processes and Small-Scale Turbulent Breakup in the Absence/Presence of a Nocturnal Jet	Balsley, Ben	CIRES	NSF
Tree-Ring Based Records of Temperature and Glacial Fluctuation Spanning the Past Two Millennia, Prince William Sound, Alaska	Calkin, Peter	IAAR	NSF
Late Quaternary Ice Sheet Extent, Chronology, and Paleooceanography, East Greenland Margin/Denmark Strait: Implications for the Arctic and North Atlantic Oceans	Jennings, Anne	IAAR	NSF
Paleoglaciology of Alaska -- Climate Parameters During the Last Glacial Maximum From GIS Determination of Equilibrium Line Altitudes	Manley, William	IAAR	NSF
Forest/Atmosphere Carbon Fluxes in a Colorado Subalpine Ecosystem	Monson, Russell	EPOB	Tulane Univ.
Hydrology, Hydrochemical Modeling and Remote Sensing of Seasonally Snow-Covered Areas	Williams, Mark	IAAR	Univ. of CA, Santa Barbara



SPONSORED BY: Water Resources, Hydrologic and Environmental Sciences Division Civil Engineering Department; Water Resources Planning and Management Civil Engineering Department; Hydraulics and Wind Engineering Civil Engineering Department; Agricultural Engineering Program Chemical and Bioresource Engineering Department; Watershed Science Program Earth Resources Department;. For information: JORGE A. RAMÍREZ, Associate Professor (970) 491-8650/7621, Water Resources, Hydrologic and Environmental Sciences.

COLORADO STATE UNIVERSITY Spring 2000 Seminar Series in Water Resources, Hydrologic and Environmental Sciences and Engineering		
Date/Time	Title & Speaker	Location
Jan. 27, 12:10PM	Interdisciplinary Modeling at Shasta Lake Using Hydrodynamics, Bioenergetics, and Food Web Modeling with Stable Isotopes -- DR. LAUREL SAITO, Post-doctoral Research Associate, Civil Engineering Department, CSU	LSC 208
Feb. 3, 12:10 PM	Soil hydrology and space-time variability in dryland cropping systems -- DR. TIMOTHY R. GREEN, Research Hydrologic Engineer, USDA/ARS, Ft. Collins	LSC 208
Feb. 10, 12:10 PM	Use of Artificial Neural Networks in Water Resources, DR. JOSE D. SALAS, Professor, Hydrologic Science & Engineering, Civil Engineering Dept., CSU	LSC 220
Feb. 17, 12:10 PM	Optimal Control of Irrigation Distribution Networks, DR. J. MOHAN REDDY, Research Associate, Civil Engineering Dept., CSU	LSC 208
Feb. 24, 12:10 PM	Integrated Urban Water Management in Metropolitan São Paulo, DR. BENEDITO BRAGA, President, International Water Resources Association, IWRA	LSC 230
Mar. 2, 12:10 PM	Are Stormwater BMP Design Criteria Environmentally Friendly?, DR. LARRY ROESNER, Professor, Civil Engineering Department, CSU	LSC 208
Mar. 9	Spring Break (No Seminar)	
Mar. 16, 12:10 PM	River Forecasting for the Panama Canal, MR. MICHAEL KANE, Riverside Technology, Inc., Ft Collins	LSC 208
Mar. 23, 12:10 PM	Mapping and Measuring Channel Incision in New Mexico, DR. RAY WATTS, Affiliated Scientist, CIRA, CSU	LSC 208
Mar. 30, 12:10 PM	Applied 3-Dimensional Modeling of Sedimentation on the Lower Mississippi River, , DR. DAN GESSLER, Research Associate, Civil Engineering Department, CSU	LSC 208
Apr. 6	AGU Hydrology Days (No Seminar)	
Apr. 13, 12:10 PM	TBA	LSC 208
Apr. 20, 12:10 PM	TITLE TBA, DR. DAVID YATES, Research Scientist, NCAR, Boulder	LSC 208
Apr. 27, 12:10 PM	Changing Water Quality and Quantity: Impacts on Fish and Wildlife DR. ALAN COVICH, Professor, Department of Fish and Wildlife Biology, CSU	LSC 208
May 4, 12:10 PM	TBA	LSC 208

SEMINARS



COLORADO STATE UNIVERSITY AGRICULTURAL AND RESOURCE ECONOMICS DEPARTMENT LUNCH TIME SEMINAR SERIES		
March 22	A Spatial Land Allocation Model Based on the Comparative Advantage Principle	Doug Rideout, Dennis Dean, CSU
March 29	Estimating the Cost of Storing Carbon in Ag Soils	Mark Sperow, NRED
April 5	Analyzing Uncertain Contingent Valuation Responses: the Case of Noxious Weeds in Colorado	Patty Champ, U.S. Forest Service
April 12	Externalities in Canal Irrigation: Coasian and Pigouvian Approaches to their Abatement	Anil Shishodia, Sardar Patel Univ., India
April 19	Conjoint Analysis of Public Preferences for Forest Ecosystem Management	Kevin Boyle, University of Maine
April 26	Farmer Exemptions and Agricultural Pollution	Marie Livingston, Univ. of No. Colorado

Seminar meets Wednesdays, 12:10 to 1:00, 107 Forestry Building.

COLORADO STATE UNIVERSITY EARTH RESOURCES DEPARTMENT SEMINAR SERIES, SPRING SEMESTER, 1999		
Feb. 23 5:10 pm	NGWA Darcy Lecture - Ground-Water Recharge in Arid Regions	Scott Tyler, Desert Research Institute
March 1	Active Deformation of an Accretionary Wedge Margin Determined by Fluvial Terraces, Olympic Mountains, WA	Frank Pazzaglia, Univ. of New Mexico CSU Distinguished Speaker
March 8	No Speaker - Spring Break	
March 15	TBA	
March 22	Faults and Fluids	Stuart Rojstazer, Duke University GSA Birdsall Lecture
March 24 12:10	The Big Stretch in the Basin and Range	Mark Anders, Columbia University
March 29	TBA	
April 5	Floods and Mass Wasting in the Nepal Himalaya and Effects in the Lowlands: Whose Fault is it?	Dick Marsten, Univ. Wyoming
April 12	TBA	
April 19	Ancient Earthquakes in the Middle Crust	Jerry Magloughlin, CSU
April 26	Plants and the Cretaceous/Tertiary Boundary: Fossil Evidence for One Very Bad Day in the Woods	Kirk Johnson, Denver Museum of Natural History
May 3	TBA	

All seminars are on Mondays and begin at 4:10 PM in Room 316 of the Natural Resources Building, with snacks at 4:00 PM (except where noted). For questions call (970)491-5661.

COLORADO STATE UNIVERSITY DEPARTMENT OF ENVIRONMENTAL HEALTH SEMINAR SCHEDULE FOR SPRING 2000		
March 20	Resurgence of Mycobacterial Disease: Epidemiology, Identification and Control of Mycobacterial Illness	Dr. Chuck McCammon, Dr. John Martyny, Tri-County Health Dept.
March 27	Data Analysis of Chemical Mixtures	Dr. Chris Gennings (tentative)

Mondays at 12:10 p.m. - Room A 108 Microbiology Building. Coordinator: Del Sandfort 491-6462

SEMINARS



**COLORADO STATE UNIVERSITY
DEPARTMENT OF ATMOSPHERIC SCIENCE
SEMINAR SCHEDULE FOR SPRING 2000**

Feb. 24	Observing dynamic-convective synergies in the South Asian Monsoon: Interpretations of the Joint-Air-Sea Monsoon Interaction Experiment (JASMINE). Host: Prof. Richard Johnson	Dr. Peter J. Webster, Program in Atmospheric and Oceanic Sciences, Univ. of Colorado
April 6	The Asian Monsoon as a coupled ocean-atmosphere system. Host: Prof. Richard Johnson	Dr. Peter J. Webster, Program in Atmospheric and Oceanic Sciences, Univ. of Colorado.

CWRRI

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CU Water News



**UNIVERSITY OF COLORADO
IBS ENVIRONMENT AND BEHAVIOR PROGRAM
SPRING 2000 WORKSHOP SERIES**

Feb. 21 st	The Boulder Watershed Program	Mark McCaffrey
March 6	His newly published book critiquing development policies	Joe Stepanek
March 20 th	Environmental Quality in the Workplace	David Pellow
April 3	The Computerized Watermarkets in the San Joaquin Valley	Janis Carey
April 17	New Initiatives in the Natural Hazards Area	Dennis Mileti and Mary Fran Myers

All workshops take place in IBS #3 (two doors down from Starbuck's coffee shop on Broadway) at noon on Mondays. Feel free to bring your lunch.

**UNIVERSITY OF COLORADO
COOPERATIVE INSTITUTE FOR RESEARCH IN ENVIRONMENTAL SCIENCES (CIRES)
SPRING 2000 WORKSHOP SERIES**

Feb. 25	Title TBA	Roger Pielke Jr. (NCAR)
March 23	Title TBA	Michael Dettinger, USGS, Scripps
April 28	Pacific Northwest Assessment	Ed Miles, University of Washington
May 26	Title TBA	William Easterling, Pennsylvania State University

This Spring, NOAA/CIRES Western Water Assessment Seminars will be held every fourth Friday of the month, 12:00-1:30 pm in the CIRES Auditorium, except as noted below. Feel free to bring your brown bag lunch. For information contact Diana L. Perfect at Phone: 303/735-2377, FAX 303/ 492-1149, Email: dianap@cires.colorado.edu. The CIRES web page can be found at <http://cires.colorado.edu/www>.



Colorado Water
Resources Research Institute

CU Water News

UNIVERSITY OF COLORADO
NATURAL RESOURCES LAW CENTER

June 7-9, 2000 GROWTH AND WATER IN THE WEST

The Natural Resources Law Center at the University of Colorado School of Law will hold its annual conference on June 7-9, 2000, in Boulder, Colorado. The title of the conference is Growth and Water in the West. For further information please call the Center at 303/492-1286 or visit our website at www.colorado.edu/law/NRLC

April 14-15, 2000 ENVIRONMENTAL JUSTICE WORKSHOP

The Center's Environmental Justice Project will culminate in a workshop in the Denver/Boulder area. Through support from the Ford Foundation, the Center has invited a wide variety of scholars and practitioners who have worked in either the traditional environmental justice or natural resources fields to think and write about issues of discrimination and inequity as they relate to the use and misuse, development and preservation of natural resources. For further information about the project or workshop contact Kathryn Mutz at (303) 492-1293 or kathryn.mutz@colorado.edu.



UNC Water News

UNIVERSITY OF
NORTHERN COLORADO

During June, Dr. Jared Morrow, Assistant Professor of Geology, and Dr. Lee Shropshire, Emeritus Professor of Geology, will co-teach GEOLOGY OF THE RED ROCKS COUNTRY. The course features a week-long canoe trip down the Gunnison and Colorado Rivers in western Colorado and eastern Utah. No previous canoeing experience is necessary. For further information contact Dr. Morrow at jrmorro@unco.edu, 970/351-2483, Department of Earth Sciences, University of Colorado, Greeley, Colorado 80639.

Also, on some Saturdays this spring, training seminars will be presented for teachers at the Poudre Learning Center on the River west of Greeley. Contact Ray Tschillard, rltschi@unco.edu, 970/351-2291, Lab School, University of Northern Colorado, Greeley, Colorado, 80639.



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

Less than Obvious : Statistical Methods for Data below Detection Limits	MAR 16-17	\$ 650	\$750 after 13/1
Calibration and Uncertainty of Ground-Water Models	May 22-25	\$1195	\$1395 after 15/15
Polishing Your Groundwater Modeling Skills	JUN 6-9	\$1345	\$1545 after 16/16
Applied Environmental Statistics	JUN 19-23	\$1295	\$1495 after 16/16

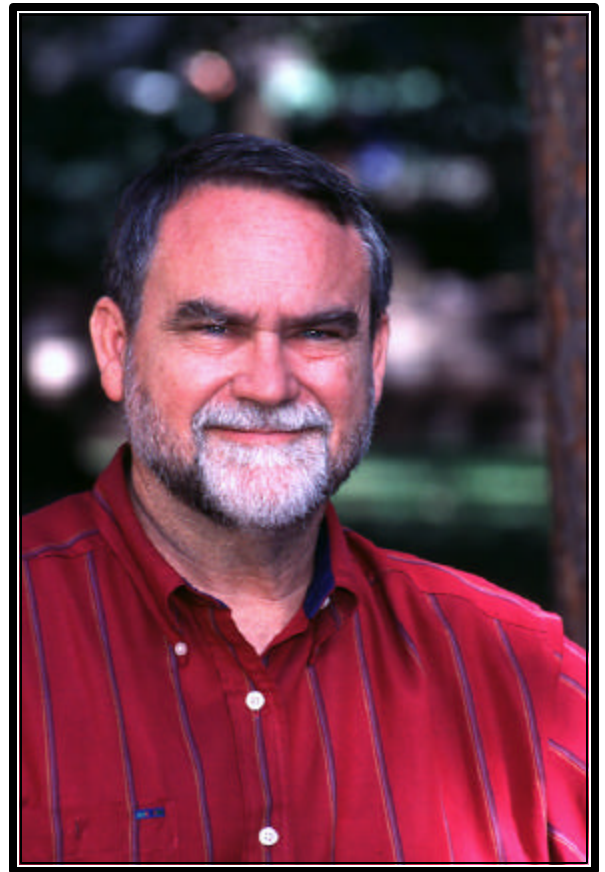
FOR INFORMATION CALL (303) 273-3103
FOR REGISTRATION CALL (303) 273-3321
VISIT <http://www.mines.edu/igwmc/> FOR MORE INFORMATION

NEW FACES AND NEW IDEAS IN CSU'S DEPARTMENT OF FISHERY AND WILDLIFE BIOLOGY

Colorado State University's Fishery and Wildlife Biology Department has recently brought on board three new faculty members, including new Department Head H. Randall (Randy) Robinette, and Assistant Professors Julie Savidge and Mallory McDuff. The addition of these faculty members will bring new skills, new experience, and new leadership to the department, and enhance CSU's ability to address Colorado's fishery and wildlife concerns and educational needs.

Leading the helm will be Randy Robinette, who comes to Colorado after 26 years as a scientist and professor at Mississippi State University, serving as Department Head for MSU's Wildlife and Fisheries Department for the last six years. Randy received his BS from Harding College in his native state of Arkansas, and then completed his master's and doctoral degrees in Zoology at Southern Illinois University. He is a Certified Fisheries Scientist.

While at MSU, Randy played a key role in the development of aquaculture in Mississippi. When Randy joined MSU, aquaculture was just beginning to be recognized as a potentially viable sector of Mississippi's economy. The scientific research and outreach efforts by Randy and his Department provided crucial support to the state's entrepreneurial farmers who he describes as "pioneers willing to take a risk and turn Cesoybean farms into catfish farms." By the time he left Mississippi,



H. Randall (Randy) Robinette, Head, Department of Fishery and Wildlife Biology

farm-raised catfish added about \$2 billion a year to the state's economy. Although the lack of abundance of water in Colorado presents some challenges towards the development of aquaculture, Randy sees potential for this emerging market in this state.

In this area and many other areas of concern related to fishery and wildlife science, Randy recognizes the importance of understanding of the human dimensions involved in interactions between man and nature. In Colorado, there are several areas where the increasing human population is impacting wildlife habitat and increasing opportunities for contact and conflict between wildlife and humans. As Head of the department, he looks forward to integrating social science aspects into the Department's core studies so that students will be better prepared to understand and work to resolve these conflicts. Randy will also seek to strengthen the Department's partnerships with the many state and federal agencies in the Fort Collins area, including the Colorado Division of Wildlife, U.S.



*New Fishery and Wildlife Biology faculty member
Mallory McDuff.*

Forest Service, National Park Service, and National Wildlife Research Center.

An important resource for Randy's efforts to improve CSU's role in educating the community will be new Fishery and Wildlife Biology faculty member Mallory McDuff. Mallory completed her doctoral research on environmental education programs at the University of Florida, where she served as the Project Director of a research project on participatory evaluation with the Wildlife Clubs of Kenya. Mallory completed her undergraduate degree with majors in both Human Biology and English at Vanderbilt University before joining the Peace Corps, serving in the Central African Republic. Her Peace Corps experiences as a biology teacher and environmental education coordinator led her to the pursuit of a master's degree in Instructional Design and Development at the University of South Alabama. While completing this program, Mallory conducted an external evaluation of an environmental education program at Weeks Bay National Estuarine Research Reserve in Fairhope, AL. She also developed a curriculum guide on non-point source pollution that has been used in schools throughout Alabama and Florida.



New faculty member Julie Savidge

Mallory is teaching a graduate course on negotiation skills in environmental conservation this spring. She plans to conduct research on the human dimensions of natural resource conservation and has an interest in stakeholder participation in natural resource management.

decline of Guam's native birds, and co-authored recovery plans for endangered bird species. Her agency experience also provided her with opportunities to review and comment on pending legislation and other matters of environmental concern.

New faculty member Julie Savidge traveled a much shorter distance to come to CSU, just crossing the border from Nebraska, where she taught at the University of Nebraska in Lincoln. In joining the CSU faculty, Julie is actually returning to Fort Collins, having received her bachelor's degree in Zoology from CSU. Julie also has a master's degree in Wildland Resources Science from the University of California at Berkeley and a doctoral degree in Biology from the University of Illinois. Before she started teaching at the University of Nebraska, Julie also had experience working overseas, serving for five years with the Division of Aquatic and Wildlife Resources in Guam. In her position as a Wildlife Biologist with this agency, Julie developed and executed research programs to determine the cause of the

While at the University of Nebraska, Julie was involved with a variety of different projects including research sponsored by EPA on factors affecting bird distribution in Sandhills wetlands in the Platte River Basin. Through funding provided by the U.S. Fish and Wildlife Service, she investigated the biodiversity of wet meadows along the Platte River, sandhill crane use of these areas, and helped collaborate on a Platte River GIS. As part of a regional project, she also completed research for the University of Nebraska Agricultural Research Division on bird species in diverted farmland. Julie hopes to continue research in Colorado in grassland and wetland ecosystems.





WATER NEWS DIGEST

by Emile Hall

◆◆ WATER TRANSFERS/WATER BANKING

Aurora looks to future in water planning

The City of Aurora, with a population of 260,000 looks 30 years ahead in its water planning, and tries to develop projects yielding roughly 10,000 acre feet per decade, said Doug Kemper, Aurora's water resources manager. Aurora gets roughly half its water supply from the South Platte River Basin. Approximately one-quarter comes from the Colorado Basin and one-quarter from the Arkansas Basin. Seventy-five percent of this water originally was agricultural and the rights have been transferred to municipal use — a process Aurora is seeking to repeat with 289 shares of the Rocky Ford Ditch. Only consumptive use — the amount actually used by crops — may be transferred. The amount that historically has run off fields and back into ditches or percolated into the ground and returned to the stream must be maintained. Kemper said the projected yield for this purchase of Rocky Ford Ditch water is 5,000 acre-feet. Average annual yield of all the city's water resources is 75,000 acre feet (less in a dry year), 50,000 acre feet of which is treated and 10,000 acre feet which is kept in reserve for population spikes. Another 10,000-12,000 acre-feet is lost to evaporation and stream transit losses. Aurora water originating in the Arkansas and Colorado basins is pumped from the Otero Pumping Station at Twin Lakes, over the mountains and into Spinney Mountain Reservoir in South Park. It is released into the South Platte River and runs downstream to Strontia Springs Reservoir. From there it travels 25 miles by pipeline to the city. Kemper said Aurora's use of water from the Arkansas and Colorado basins is limited by the capabilities of the Otero Pumping Station. The maximum amount of water that can be pumped is 55,000 acre-feet annually — "and that's pumping wide-open, 365 days a year." Now, approximately 40,500 acre-feet annually are pumped through the station.

The Pueblo Chieftain 12/28/99

Water bank could ease ditch sales

This fall Aurora struck a deal to buy much of the remaining water in the Rocky Ford Ditch. The sale isn't complete because it still must be approved in water court. But if it is, in a few years approximately 3,000 acres of farmland could be dried up, shrinking the region's tax base and the amount of money farming puts into local coffers. The Rocky Ford deal is small compared to others in the past, especially deals in the 1970s and 1980s that dried up tens of thousands of acres in Crowley County. And it pales in comparison to an attempted purchase of the huge Fort Lyon Canal in the early 1990s. Yet no one denies that water sales affect more than just a few farmers' balance sheets. Dry rangeland is worth just 2 percent of what irrigated farmland is valued at for property taxes in Otero County. When irrigated farms are dried up, tax collections drop and the money doesn't flow down Main Street. So, as they have during all the other water sales and proposed sales, community leaders are asking if there isn't a better way. There is, at least in theory. It is called "interruptible supply" or "drought leasing" or "water banking." Farmers and cities agree to share water: Farmers get to use it in wet years to grow their crops; cities get it in dry years and pay the farmers not to grow anything. Aurora offered to consider setting up some kind of interruptible-supply arrangement with farmers when it negotiated for its last Rocky Ford Ditch purchase, according to Gerry Knapp, the city's renegotiation official here. But Rocky Ford Ditch farmers wouldn't consider it, mostly because there were no specifics.

One of the ditch's owners, who spearheaded the sale, said the details would be important. He said it might be hard to grow a crop on irrigated land that hasn't been irrigated for a year or two. An interruptible-supply deal might be hard to structure, too, because farmers all run their operations differently, and what works for some may not work for others. But he thinks the idea is a positive version of the future of rural/urban water struggles. Others from areas where water has been sold agree that interruptible supply deserves some attention. At least two groups are trying to flesh out some sort of interruptible-supply notion, spurred by the Rocky Ford Ditch sale. A local group and the Southeastern Colorado Water Conservancy District are looking into how such a scheme would work. The district even has asked an engineering firm to study the idea. Bill Milenski, a real estate appraiser with water and farm expertise who is part of the local group, said there are no specifics yet, but he thinks the idea is worth study. A water engineer hired by the Southeastern district said California cities have used something like interruptible supply during droughts, although those plans often used surface storage, such as a lake. Colorado has few, if any, examples of true interruptible supply, especially examples in which the water still is owned by local entities. Many examples of interruptible supply, especially those termed "water banking," involve water storage, either in the earth or surface lakes, the engineer said. That could complicate the idea in the Arkansas Valley, where water storage space already is short.

There are other potential problems, according to Tom Simpson, the Southeastern district's water resources manager. For example, any continued use of interruptible supply could affect the water that seeps to downstream users, which is called "return flow." The use of the Arkansas River literally is built on return flows: Most of the water that irrigates one farm washes back to the river to irrigate another farm or supply another town downstream. An interruptible-supply plan also could run counter to the state's time-honored system of allotting water, which is by the date when someone started using the water. Simpson said casually allowing water to go unused so that someone else, such as a city, can use it may not stand legal challenges by the owners of junior water rights. Clearly, any interruptible supply plan would have to be tailor-made to fit the Arkansas Valley's own water history and uses, the water experts agreed.

Pueblo Chieftain 12/28/99

Struggling farmers often forced to sell water, then lease it back

Some cities and entities that have bought water - but don't actually need it yet - are selling it back to farmers to use for crops. It's not the utopian version of interruptible supply because the water owners control it completely. Farmers whatever water the owners will spare - at whatever price they name. Matt Heimerich farms along the Colorado Canal in Crowley County, on land from which the water was sold years ago. Each winter he goes shopping for water like other farmers shop for fertilizer, weighing how much he might need and how cheap he can get it. Heimerich often buys water from Colorado Springs, which offers the water several times during the year, as well as from Pueblo, Pueblo West and Aurora - whatever entities have water to spare. Farmers like Heimerich often have to pay for their water up front - months or even a year ahead of when they'll be harvesting a crop. And even when he doesn't have to pay before delivery, Heimerich must leave a blank check in the water office to pay for what he uses - a far cry from how most people buy things. The system works for him, though. "You have to do some planning," he said. "I've always made a crop." But it won't work forever, he said. And he's worried that cities eventually will need all of the water they've bought, leaving little or no surplus to sell. Like others, Heimerich said interruptible supply should probably be studied for the future of water in the valley. The alternative doesn't leave much hope for rural communities and creates unnecessary friction between urban and rural residents. "Somewhere, there's got to be a place where we recognize that we both need each other," he said. "The whole us vs. them thing doesn't do anybody any good."

Pueblo Chieftain 12/28/99

CSU will continue operating 'crop lab' in Rocky Ford

The Arkansas Valley Research Center comprises 97 acres, plus 7 acres of leased land, and it is watered by 12 shares of the Rocky Ford Ditch - the only water it has. The center is one of the holdouts in the current move to sell ditch water to Aurora. Frank Schweissing, superintendent of the center, said, "Our problem here was the station has been established for 111 years. We have our historical perspective. "We have an advisory board with community members on it," Schweissing said. "We compile our results and distribute them to the growers. We're always dealing with growers on a one-to-one basis."

Pueblo Chieftain 12/28/99

Rocky Ford Ditch water sale challenged

The Southeastern Colorado Water Conservancy District board voted on Jan. 20, 2000 to file two objections in water court to the proposed sale of Rocky Ford Ditch water to Aurora. By filing objections in water court, the district will be a party to the sale's two water court cases involving the change in water use, points of diversion and exchange rights. In negotiating the transfer, Aurora was going to use the consumptive-use figure from its early 1980s' purchase of Rocky Ford Ditch water. However, other water owners, including the district, think that portion may be too high and might demand that Aurora leave more water behind. Aurora is reportedly willing to negotiate the sale's consumptive use figure with the valley's other water owners. The consumptive use is the proportion of water from the sale that Aurora can take out of the Arkansas River and pump over the mountains to the Platte River Basin. The board also discussed the potential hydroelectric power project at Pueblo Dam. Colorado Springs and the district became interested in generating power at the Pueblo Dam after another out of state company filed an application with the Federal Energy Regulatory Commission for a license to do so. However, Colorado Springs apparently has lost interest in trying to generate hydroelectric power at the Pueblo Dam. Instead, Colorado Springs may partner with the Western States Power Association or the Loveland Area Customers Association.

Pueblo Chieftain 1/21/2000

Crowley County acts to save water

Water is the key to the future in the arid Arkansas Valley and now two local entities are willing to pay to keep it here. Crowley County's board of commissioners has started a modest water-buying program to make sure the county has enough water for future needs and to stop the flow of water rights out of the area. The Crowley County Community Foundation has been doing that for a few years and may step up those efforts by attempting to form a self-taxing water and sanitation district. Several of the ideas presented so far involve some local entity buying the rights to irrigation water so that it doesn't leave the area forever. The water could be leased to farmers in wet years and perhaps to cities in dry years, but the rights to the water would stay locally owned. The local effort is tiny compared to what it would take to really hold the region's water in place. The county and foundation have bought less than 120 shares of Colorado Canal water out of the hundreds of shares that exist. The county bought 10 shares of Colorado Canal and Lake Henry water this fall and now is in the process of buying another 10 shares, according to commissioners Matt Heimerich and Tobe Allumbaugh. "We could use millions, but you have to start someplace," Allumbaugh said. "We're a small player, but at least we're a player."

Pueblo Chieftain 1/22/00



ENDANGERED SPECIES/FISHERIES

Chub begins swim off endangered list

Federal officials early next year will begin the process of potentially removing an endangered Colorado native fish from federal protection. For now, though, the U.S. Fish and Wildlife Service is looking at "down-listing" rather than "de-listing" the humpback chub from an endangered species to threatened species under the guidelines of the Endangered Species Act. Federal officials said the population of the chub has remained constant enough in the past few years that the process to lessen protections can now begin.

Grand Junction Daily Sentinel 12/27/99



River district objects to Denver reservoir plan

The Colorado Water Conservation District will oppose a water application by Denver Water and the Northern Colorado Water Conservancy District for water to help save endangered fish near Grand Junction. The Front Range entities late last year applied for 16,000 acre feet of water for a \$19.2 million reservoir at Sulphur Gulch, near DeBeque. A Denver water official says the proposal to build the reservoir is intended primarily to get the dialogue going about the best way for the Eastern Slope to help endangered fish. The river district contends it has several drawbacks, including using Western Slope water to meet an Eastern Slope obligation and increasing Colorado River salinity. Under a recently announced biological opinion of the U.S. Fish and Wildlife Service, an equal amount of water for recovery of four endangered fish -- the humpback chub, bonytail chub, razorback sucker and Colorado pikeminnow -- is required annually from western and eastern Colorado water users to improve habitat along a 15-mile stretch of the Colorado River. Altogether, 10,825 acre-feet of water are to be provided annually by Eastern and Western Slope water users. The river district has agreed to provide about 5,400 acre feet from Wolford Mountain Reservoir in the short term, while looking for a long-term solution. As for the Eastern Slope, it will temporarily meet its part of the deal with water from Williams Fork Reservoir, which also is on the Western Slope. While that's OK with the river district for the time being, it objected to developing a new Western Slope reservoir to replace the water coming from Williams Fork.

Grand Junction Sentinel 1/24/00, *The Glenwood Post* 1/2600

4-H clubs and the Gunnison Angling Society join forces to combat whirling disease.

Plans are underway for the two groups to build and operate a hatchery that would raise native cutthroat trout free of whirling disease for local distribution. The cooperative project will be the only one of its kind in the state and involves a wide array of hands-on learning opportunities for the 4-H members. Before the site can even be used as a hatchery, studies must be conducted to determine soil and water quality and identify potential parasites and other threats to fish survival. Entomology and plant studies must be completed to assure an abundance of the insects that are a staple of the trout diet. The site must be surveyed, and the dams and ponds constructed. The 4-H'ers will be expected to participate in this process, picking up a little science and engineering along the way. When the hatchery is up and running, 4-H'ers will feed and care for the fish, run the business of the hatchery and help with stocking projects. Anyone interested in becoming involved on any level is invited to attend either of the meetings or to contact Kim Fabrizio at the CSU Extension Office, 641-1260.

Gunnison County Times



WATER QUALITY

Louisiana-Pacific joins effort to reduce selenium

Selenium is creating problems and forcing changes in the Uncompahgre and Gunnison river basins. Federal, state and local officials have formed a task force to develop and evaluate measures for reducing the amount of selenium being transported from the Gunnison River Basin into the Colorado River system. Involved in the task force are the Bureau of Reclamation, U.S. Fish and Wildlife, U.S. Geographical Survey, CSU Cooperative Extension, National Park Service, Bureau of Land Management, U.S. Forest Service, environmental groups, soil conservation districts, water users and citizens. Joining the effort recently was Louisiana-Pacific Corporation, which provided a contribution of \$1,100 for one possible solution that involves a hybrid poplar tree, very similar to an aspen, which is expected to reduce the selenium in the soil while providing local growers with a cash crop which L-P can use in production. Other remediation measures being studied by the task force include lining or piping irrigation canals, laterals and drains; purchasing and retiring high selenium lands; eliminating irrigation on adobe lands; and retaining water in upstream reservoirs to provide flushing flows.

Denver Post 1/13/00

Contamination cleanup at Rifle site could take more than 100 years

A "surprise" finding of how much vanadium is in the groundwater under the New Rifle uranium mill tailings site could limit future development of a 33-acre parcel west of town in the years to come, said Garfield County and Rifle officials. Restoration of the vanadium levels to acceptable standards may take more than 100 years, according to one federal project consultant. Rifle Mayor Dave Ling said the vanadium present was three or four times more than the DOE expected, with the shallow aquifer the chief concern. DOE officials have approved the expenditure of up to \$500,000 over the next three years, as part of the cost of extending a "limited scope" water line to the West Rifle Interstate 70 interchange. The money might be used instead to help pay for individual reverse osmosis units. However, local officials have said that amount is not enough to entirely address the issue. An environmental assessment is due to be released for public comment in May or June, which would include a recommended plan to address the groundwater contamination.

Glenwood Springs Post 1/23/00

Colorado lakes face problems

In Fort Collins, changing water demands are causing water quality concerns for local lakes. The lakes, built to store irrigation water, until recently had regular flows keeping the reservoirs healthy, with flush and flow getting rid of the nutrients. But with changing uses, the reservoirs are aging more rapidly -- a process called eutrophication -- which makes lakes cloudy, hurts fish populations, and causes an unpleasant odor. Sheldon Lake also has contamination from an underground gasoline tank, the growing number of resident gees, and fertilizer runoff from nearby lawns. The city of announced approval of a \$42,500 grant to install an aeration system there in the spring. The same problems plague Shadow Mountain Reservoir, Grand Lake, Lake and Lake Granby. The problem, beginning at shallow Shadow Mountain, is exacerbated by street runoff and erosion from public and

private land, which feeds greenery in the lakes with nutrients. The USBR and Northern Colorado Water Conservancy District have contributed money to study the changing water quality, and the Forest Service now clears Grand Lake with a \$100,000 underwater weed harvester. Other high mountain lakes across the state also have been contaminated by growth. Studies in the Mount Irkel wilderness near Steamboat Springs found elevated acid levels in streams and snow pack.

Fort Collins Coloradoan 1/10/00

◆◆ FLOWS ON FOREST LANDS

River district opposes change for White River National Forest

The Colorado River Water Conservation District has opposed Alternative D of the White River National Forest Plan. The primary concern to river district officials relates to the federal agency's contention it can impose bypass flows on forestlands. The river district asked the forest service to rewrite the goal so that the federal agency would work within Colorado water laws for leaving water in a stream.

Grand Junction Sentinel 1/22/00

◆◆ WATER DEVELOPMENT/SUPPLY

Fort Morgan to pipe in mountain water

Fort Morgan has joined other northern Colorado cities that get municipal water delivered via the Colorado-Big Thompson project. The switch means residents and business no longer use groundwater from 14 municipal wells, which has become increasingly polluted by nitrates from agricultural fertilizers. Fort Morgan is the easternmost municipality to receive Colorado-Big Thompson water. To finance the town's new water system, monthly water rates will nearly quadruple from an average of \$15 to \$55 per month. These rates are in line with some other cities and towns that get CBT water. The water project was financed primarily with low-interest federal loans, which will be repaid through the hike in water rates.

Denver Post 1/3/00

Colorado exceeds Rio Grande obligation

Colorado delivered about 3,700 acre-feet of water more than its obligation under the Rio Grande Compact in 1999, division engineer Steve Van diver told directors of the Rio Grande Water Conservation District. Van diver said that because of credits in storage in Elephant Butte Reservoir in south-central New Mexico, his office hoped to under deliver 10,000 acre-feet from the Conenose River and over deliver 10,000 acre-feet from the Rio Grande. However, the expected over delivery on the Rio Grande is 8,100 acre-feet and the under delivery on the Conenose is 4,400 acre-feet; hence, the difference of 3,700 acre-feet. Total expected delivery to the downstream states of New Mexico and Texas by the Rio Grande (the Conenose runs into the Rio Grande) is 474,400 acre-feet. The conservation board lauded Van diver and his office for its water watch. Van diver said his office imposed a "fairly severe curtailment on the Rio Grande" in 1999, but it came at a good time when the San Luis Valley had substantial rain, so the farmers didn't need ditch water. Van diver said this year is dry and he doesn't expect the saving rains that came last spring. Van diver said the Rio Grande Basin had only 19 percent of average snow accumulation on Jan. 1, which is 18 percent of the amount recorded at the same time last year. Lack of water could severely affect New Mexico water users north of Elephant Butte Reservoir, which holds a two-year storage supply for downstream users. Above the reservoir, some areas of the river may dry up if there is no moisture and Colorado doesn't over deliver water. A drying up of the river could mean an end to the Rio Grande silvery minnow, an endangered species which is the subject of seven pending court cases, Van diver said. While Colorado is not part of the silvery minnow suits now because the species is not found here, the tiny fish could create a problem because Colorado controls the water needed for its existence, Van diver indicated.

The Pueblo Chieftain 1/ 23/00

◆◆ DAM SAFETY/FLOODING

Horsetooth Dam study almost done

U.S. Bureau of Reclamation and Northern Colorado Water Conservancy District officials say three years of geo-technical work on Horse tooth Reservoir's four dams is nearly complete. When the work is completed (estimated date is mid-May) the data will be incorporated into the design process to modernize the four dams over the next three years. Funding for the project will be split 85-15 percent between the USBR, which owns the dams, and the NCWCD and its users. Congress must approve the funding. Construction likely would begin in Oct. or Nov.

Fort Collins Coloradoan 1/27/00

Federal funds will help prevent flood problems

Colorado will receive more than \$6 million in federal money to help prevent flooding problems like those in the southern part of the state last spring. Thirteen local governments — including Fort Collins, Colorado Springs, Manitou Springs and Pueblo — have applied for a share of the funds.

Denver Post 1/8/00



CALLS FOR PAPERS



DEADLINE EXTENDED TO FEBRUARY 28

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: 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. 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 28, 2000. Guidelines will be provided on request (contact Prof. Ramirez as early as possible). 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>).



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 gregt@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 cathyc@ci.grandjct.co.us or downloaded from the same website above. DEADLINE: April 1, 2000.



FRAGMENTATION 2000 -- A Conference on Sustaining Private Forests in the 21st Century

September 18-20, 2000, Radisson Hotel, Annapolis, MD

The conference will have three functions: (1) Sharing: Bringing diverse experts together to examine what we know about private forests of all sizes, ranging from small bits to mega-hunks, (2) Comparing: To identify areas of agreement, disagreement or just-don't-know situations regarding prospects for sustaining private forests in the 21st century, (3) Reporting: Quickly assembling a proceedings that makes the conference papers and discussions widely available through as many communications channels as possible. Oral presentation should be 20 minutes. Include the following with your abstract: paper/poster title, author name(s), proposed presenter(s), affiliation(s), mailing address, phone, fax and e-mail for all authors and presenters. Submit abstracts of not more than 250 words, by **February 29, 2000** to: Terri Bates, 3325 Rose Lane, Falls Church, VA 22042, 703/538-1134, e-mail: Bates-Stasny@erols.com <<mailto:Bates-Stasny@erols.com>> (please include your abstract in the text of the message or fax: 703/538-1135 (please call first).



Water Research Symposium'2000 — Advances in Water and Land Monitoring

Technologies and Research for Management of Water Resources

November 8-10, 2000, Virginia Tech, Blacksburg, Virginia

Abstracts (500 to 750 words in length) should be submitted by mail, fax, or electronic means by May 30, 2000 to: Dr. T. Younos, Virginia Water Resources Research Center, 10 Sandy Hall, Virginia Tech, Blacksburg, VA 24061. FAX: 540-231-6673, E-mail: tyounos@vt.edu. For more information visit the Website <http://www.vwrrc.vt.edu>.



**Evaluation and Remediation of Low Permeability And Dual Porosity Environments
January 25-26, 2001, Reno, Nevada**

Papers are invited on the following topics: Measurement of the hydraulic properties of the environmental medium; Evaluation of the long-term flow conditions of the medium; Monitoring of the hydraulic properties in low permeability environments; Vadose zone monitoring issues in dual porosity systems; Saturated zone monitoring issues in dual porosity systems; Issues of scale in dual porosity systems; Remediation of low permeability geologic systems; Remediation of dual porosity systems; Numerical modeling of low permeability and dual porosity geologic media. Submit title, a 250-300 word preliminary abstract, and ASTM Paper Submittal Form by **February 25, 2000**. More information is available from symposium co-chairmen: Martin N. Sara, Phone 847/318-0627, FAX 847/318-1368, e-mail msara@geomatrix.com; of Lorne G. Everett, Phone 805/687-7559, ext. 236, FAX 805/687-0838, e-mail leverett@gmw.com.

MEETINGS



**ARKANSAS RIVER BASIN WATER FORUM
March 16-17, 2000 Colorado Springs, Colorado**

The Fountain Creek watershed will headline this year's Arkansas River Basin Water Forum. The two-day event is scheduled for March 16-17 in Colorado Springs. The forum has been an annual event in recent years and has focused attention on river management, water distribution and its interaction with the communities that are dependent on its water. Fountain Creek is a major tributary of the Arkansas River. It collects water from the mountains and plains in the area surrounding Colorado Springs. The water flows south, roughly parallel to I-25 and becomes a part of the Arkansas at Pueblo.

The spring 1999 flooding that originated in the Fountain Creek basin highlighted in a dramatic way the importance of this tributary. The affects of water rights transfers for urban use and the affects of Colorado Springs' rapid growth are now being seen in the flows in Fountain Creek. Changes in the normal historic flow rates are now recognized. The historically dry streambed now runs constantly from the city's return flows, and rooftops, roads and parking lots shed water that once soaked into the hills.

Streambank erosion, sediment and higher peak flow rates are just a few of the issues that will be addressed at the forum. Participants will also have an opportunity to see how Colorado Springs delivers, uses and treats its water before returning it to Fountain Creek. A field trip to the Pikes Peak north-slope watershed is also being planned on Saturday after the forum. The forum will also address many broader issues in the basin. An update on the Kansas v. Colorado lawsuit will detail recent events in this continuing saga. The issues of salinity, TMDL (daily pollutant load) regulations, fluoridation proposals and future water needs are being discussed as well.

The program is not all work, however. Mini-presentations on the history of basin development are planned throughout the program. Stories on topics, ranging from General Palmer to early western ranching, will bring focus to the achievements of the persons who laid the foundation for the Colorado of today. Ventriloquist Greg Claassen, will highlight the Thursday evening program, which is also a recognition time for the photograph, art and essay contests sponsored by the forum.

For further information and registration materials, visit the forum website at www.ruralnet.net/~arkriver or phone (719)336-9421. There is an earlybird registration fee of \$35 and \$40 at the door that covers meals and entertainment for the entire forum.



**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**

For 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).



◆ ◆
NWQMC NATIONAL MONITORING CONFERENCE -- Monitoring for the Millennium
April 25-27, 2000, Austin, Texas

In 1997, the Interagency National Water Quality Monitoring Council (NWQMC) was established to implement a voluntary, integrated, nationwide strategy to improve water resource monitoring, assessment and reporting. The Council sponsored its first conference in Reno, Nevada in 1998. Over 400 attendees participated in workshops and discussions on a variety of topics related to water monitoring issues. The NWQMC invites you to participate in this conference and share your perspectives and experiences. For additional information about the conference see the website <http://nwqmc.site.net/NationalConference/2000Conference/agenda.htm>

◆ ◆
The Culture, Economics, and Ecology of Ranching West of the 100th Meridian
Thursday-Saturday, May 4-6, Colorado State University, Fort Collins, CO

National experts and policy makers will address the culture, economics, and ecology of western ranching as it undergoes enormous changes and pressures from many directions. Speakers include [Professor Tom Bartlett](#) of the CSU Rangeland Ecosystem Science Department. Registration costs: \$60, \$40 for students. For registration information, contact the CSU Office of Conference Services (970) 491-6714. For content information, contact [Wendell Gilgert](#) (970) 491-4340, [Rick Knight](#) (970) 491-6714, or [Ed Marston](#) (970) 527-4898.

◆ ◆
National Mitigation Banking Conference -- A How-To for Both Bankers and Newcomers to Banking
May 27-20, 2000, Denver, Colorado

The conference offers general sessions on mitigation banking for wetlands, habitat and conservation, as well as introductory sessions for people wanting to know more about mitigation banking and advanced sessions for practicing bankers. For more information contact the Terrene Institute at <http://www.terrene.org>, or terrinst@aolmcom, or 1-800-726-4853.

◆ ◆
**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>.

◆ ◆
Colorado Water Congress Summer Convention
Manor Vail Lodge, 595 East Vail Valley Drive, Vail, CO 81657
August 24-25, 2000

Two days of information and education on water issues in the beautiful Vail Valley.

Colorado Water Congress 43rd Annual Convention
Holiday Inn - Northglenn, I-25 & 120th Avenue, Northglenn, CO
January 25-26, 2001

Two full days of information and educational workshops regarding water issues in Colorado.

Full details and registration forms will be published on the CWC web page at <http://www.cowatercongress.org> as they become available. Check this page for information on upcoming CWC specialty conferences.

CALENDAR



Feb. 22-25	COLORADO RURAL WATER -- 19th Annual CONFERENCE AND EXHIBITION, Colorado Springs, CO. Contact: CRWA Office at Phone 719/545-6748, FAX 719-545-6788.
Feb. 24-25	18th ANNUAL WATER LAW CONFERENCE, New Rules of the Game -- Are Water Law Fundamentals Really Changing?, San Diego, CA. For information call 312/988-5724 or FAX 312/988-5572.
Mar. 6-8	29TH ANNUAL NEBRASKA WATER CONFERENCE - NEBRASKA WATER 2000 MANAGEMENT FOR THE FUTURE, Lincoln, NE. For information. call 402/472-7530 or FAX 402/472-1608.
Apr. 25-27	NWQMC NATIONAL MONITORING CONFERENCE 2000, Monitoring for the Millennium, Austin, TX. See the NWQMC webpage at http://nwqmc.site.net/NationalConference/2000Conference/agenda.htm .
Apr. 30-May 4	WATER RESOURCES IN EXTREME ENVIRONMENTS, Anchorage, Alaska. See AWWA webpage at http://www.awwa.org .
May 17-18	SOUTHWEST FOCUS GROUNDWATER CONFERENCE 2000, Austin, TX. Information and on-line registration at http://www.ngwa.org/education ; or contact an NGWA representative at 800/551-7379.
June 7-9	WATER AND GROWTH IN THE WEST, Boulder, CO. See the Natural Resources Law Center, Univ. of Colorado webpage at http://www.colorado.edu/Law/NRLC/ , Phone 303/492-1272, FAX 303/492-1297, or e-mail NRLC@spot.Colorado.edu .
June 20-24	INTERNATIONAL CONFERENCE ON THE CHALLENGES FACING IRRIGATION AND DRAINAGE IN THE NEW MILLENIUM, Fort Collins, CO. Contact: Larry Stephens at e-mail stephens@uscid.org , Phone 303/628-5430, FAX 303/628-5431, webpage at http://www.uscid.org/~uscid .
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. 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 .

25th Anniversary
COLORADO
WATER WORKSHOP
July 26-28, 2000
Western State College,
Gunnison
Lucy High, Director 970/
641-8766

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.

April 25	Denver-Thornton Case: Water Quality Issues	TBD
May	Student Scholarship Presentations	