COLORADO WATER

Newsletter of the Water Center at Colorado State University

OCTOBER 2001

From left: Jennifer Lee, CSU graduate student in Civil Engineering, and Colorado Senator Jim Isgar, rancher and former member of the State Board of Agriculture, share their perceptions of Colorado water issues at the Colorado Water Workshop. The workshop was held July 25-27, 2001, at Western State College in Gunnison, Colorado.

See page 14.

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Knowledge to Go Places

WATER ITEMS AND ISSUES . . .

COLORADO WATER

Vol. 18, No. 5 **October 2001**

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

Published by the

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EDITORIAL

COORDINATING WATER RESEARCH

by Robert C. Ward, Director

As the tragic events of September 11, 2001 continue to reverberate through our souls, individually and collectively, the Colorado Water Resources Research Institute (CWRRI) strives to maintain normal operations. Our thoughts and prayers are with those whose family, friends and colleagues were directly affected.

Normal activity for CWRRI, at this time of the year, includes working with Congress in support of appropriations for the Water Resources Research Act. CWRRI is one of 54 state-based institutes that receives a portion of its funding through the annual Congressional appropriation administered by the U.S. Geological Survey. As of this writing, both the Senate and House include water institute funding in the Department of Interior Appropriation bills. The amounts are different, thus negotiations must take place.

The August 2001 *Colorado Water* editorial summarized the recently published National Research Council (NRC) report on a water research agenda for the 21st century (http://www.nap.edu/books/0309075661/html/). The NRC report called for additional water research coordination and investment; but, beyond recommending creation of a National Water Research Board, the report did not provide specifics on the institutional mechanisms to implement such coordination.

The House Interior Appropriations Subcommittee, in House Report 107-103, calls for the National Academy of Sciences to examine current water research activities, coordination of water research, and levels of investment in water research.

> *The Committee directs the Survey to contract with the National Academy of Sciences to examine water resources research funded by all Federal agencies and by significant non-Federal organizations that fund water resources research…. The Academy's report should suggest the content and coordination mechanisms for a comprehensive water research program for the Nation, as well as examination of the adequacy of current coordination mechanisms. The report should respond to the question of whether the Nation is making an adequate level of investment in water resources research and describe how the Nation can benefit from water resources research.*

Given that the institute program receives partial federal support, its water research activities and investments would be a part of the proposed study.

The water institute program provides water research coordination among local, state, university and federal water interests, not only through collaborative research projects, but also through operation of state-based water research advisory committees. The program also supports the education of large numbers of future water managers. An update on current program accomplishments is presented on page 4 of this issue of *Colorado Water*.

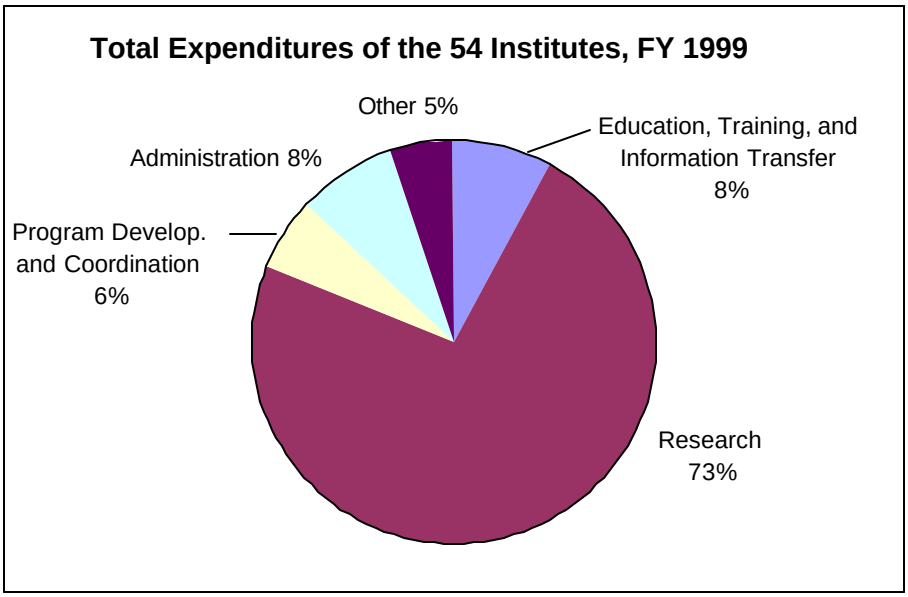
As the NRC report notes, the investment in water research is not adequate. Funding for the institutes created under the Water Resources Research Act is a fraction of what it was initially provided, greatly limiting the ability of all institutes to successfully implement their water research coordinating and investment roles. As a water institute director with 10 years of experience in trying to implement the Water Resources Research Act, with very limited funding, I see a great need for the type of examination of water research coordination and investment called for in House Report 107-103.

While I may be accused of bias, I strongly believe the horizontal (across states and universities) and vertical (across local, state and federal agencies) water research coordination potential, represented by the water institute program, if properly funded, could be a significant part of a renewed national water research coordination and investment effort.

RESEARCH

THE STATE WATER INSTITUTE PROGRAM: Current Program Highlights

In 1964, in response to concerns about the quantity and quality of water resources in the United States, The Water Resources Research Act of 1964 was passed by Congress and signed by President Lyndon B. Johnson (P.L. 88-379 codified at 42 U.S.C. 10301 et seq.). The Act authorized the establishment in each state of a water resources research and technology institute or center to promote state, regional, and national coordination of water resources research and training. The Institutes were also directed to facilitate research coordination and information and technology transfer. The USGS has administered the State Water Institute Program since 1983.



The Water Resources Research Act of 1984 reauthorized the program, which was further amended by the 101st, 104th, and 106th Congresses. The 1984 Act established a federal-state partnership in water resources research, education, and information transfer through a matching grant program that authorizes State Water Resources Research Institutes at land grant universities across the Nation. With its matching requirements, it is also a key mechanism for promoting state investments in such research and training.

Section 104 of the Act authorizes a maximum of 57 Water Resources Research Institutes. There are currently 54 Institutes: one in each State, the District of Columbia, Puerto Rico, the Virgin Islands, and Guam, which also serves the Federated States of Micronesia and the Commonwealth of the Northern Mariana Islands. The law requires a non-Federal to Federal cost sharing ratio of 2:1 and specifies that federal funds cannot be used to pay indirect costs. In fact, the Institutes have developed constituencies and programs that exceed the support provided by direct Federal appropriation. According to a 2000 report of the National Institutes for Water Resources, in 1999 the Institutes collectively generated over $17 in support for each dollar appropriated to them through this program, with $6 coming from other Federal funds and $11 from non-Federal sources.

Each Institute operates a program of multi-year research, education, and information transfer projects focused on state and regional water resource priorities. In 1999, the Institutes supported more than 800 research projects nationwide, at an average cost of about $54,000 per project. Depending upon state and regional priorities, the most common topics were concerned with surface-water and ground-water quality, toxic substances, and non-point source pollution. The Institutes collaborated with 123 other universities, 148 State agencies, and over 270 private-sector or local-government entities. In addition, the Institutes cooperated with over 170 federal agency contacts. On average, each Institute worked with about 15 state and federal agencies, or other organizations, on research projects.

A primary source of trained water scientists and engineers, in 1999 approximately 1,000 students received training by participation in Institute-supported research and information transfer projects. Students trained under this program provide the talent needed to meet the mandates of the many new programs for water resources protection that have come into existence in recent years, and to support the water management initiatives of federal, state, and local agencies.

Institute Evaluations – The Water Resources Research Act, as amended, requires that each Institute

be evaluated at least every 5 years. Detailed evaluations of all 54 Institutes were conducted in 1999, to determine their eligibility to receive grants. The independent panel that conducted the evaluations concluded that: "the institute program, with its federal-state matching requirements, is an important and significant component of the Nation's water resources research infrastructure" and that "the program as a whole is vigorous and surprisingly productive, especially in light of the very limited Federal support that it receives." The panel noted, "There are few Federal programs that leverage Federal dollars with non-Federal dollars to the extent that the Water Resources Research Institute program does."

During FY 2001 – Congress directed that $4.2 million of the funds appropriated in FY 2001 be used to support in each state a program in research, education, and information and technology transfer that was developed in collaboration with each Institute's state advisory panel. These funds were allocated equally among the Institutes (with the Institute in Guam receiving grant shares for itself, Micronesia, and the Northern Mariana Islands). The remaining $1.0 million was allocated among the Institutes under a national competitive grant program authorized by Section 104(g) of the Water Resources Research Act. Under Section 104(g), research priorities are developed jointly by the Institutes and the USGS, and funds must be matched on a 1:1 basis.

Recent Accomplishments

Nationally, the Institutes support several hundred projects each year that involve approximately 1,000 students. Project research results appear initially in Institute reports and scientific journals, and much of this work results eventually in changes in water management practices. The following are examples of recent accomplishments that have had, or may soon have, management applications.

Speeding Up TMDL Assessments – The Pennsylvania Environmental Resources Research Institute has developed a methodology to assist the Commonwealth of Pennsylvania in the total maximum daily load (TMDL) assessment efforts required by the USEPA. As mandated by a recent court case, Pennsylvania must complete a significant number of TMDL assessments over the next few years or relinquish primacy for all state water quality programs to the USEPA. The assessment methods used by many states are not possible in Pennsylvania due to very tight time constraints. To assist Pennsylvania in its TMDL assessment efforts, investigators at the Institute developed an alternative methodology that allows researchers to rapidly estimate pollutant loads within and between watersheds anywhere in the State. Training on this methodology has been provided to the Pennsylvania Department of Environmental Protection, and staff within the Department's six regional offices is now using it to complete TMDL assessments at the rate of about 34 TMDL assessments per month Statewide.

Evaluating USEPA Guidelines – Section 303 (d) of the Clean Water Act (the TMDL provision) requires States to develop and implement plans to improve the quality of waters that are impaired. USEPA guidelines require a State to designate a stream as impaired if greater than 10 percent of the monitoring samples violate water quality standards. The Virginia Water Resources Research Center conducted an evaluation of the USEPA guidelines and of alternative statistical procedures for evaluating water quality monitoring data. The Center reported that the USEPA method is likely to result in costly mistakes in making water quality impairment determinations. An approach that controls such errors was proposed by the Center, adopted in Virginia, and is now being actively considered for national application by the USEPA.

Bioremediation at INEEL – The Idaho Water Resources Research Institute has been involved in several research projects funded by the U.S. Department of Energy (DOE) that contributed to the development of an enhanced in-situ bioremediation process to degrade tricholorethene in a contaminant plume underlying the Snake River Plain aquifer at the Idaho National Engineering and Environmental Laboratory. The success of this innovative technology has led to a reversal of the record of decision in the CERCLA cleanup action at the site. As a result, traditional pump and treat technology has been replaced by this new bioremediation process, saving approximately $8 million in costs to DOE.

Coal Ash Policy – The West Virginia Water Resources Research Institute assisted in the development of the West Virginia Coal Ash Policy, which provides the necessary guidance and required criteria for the beneficial use of coal combustion by-products (CCBs) regulated under State statute. The Policy recognizes specific beneficial uses for CCBs and includes guidance as to amounts deemed beneficial under specific geological settings. The Director of the Institute worked closely with the State's Office of Mining and Reclamation in developing this guidance and developed the formula, embedded in the policy, by which such amounts are calculated.

Reuse of Residential Graywater – The Arizona Water Resources Research Center conducted a study of residential graywater reuse in which it found that 13 percent of the single family residences in the Tucson area are making use of one or more sources of their graywater and that the health risks associated with graywater systems are within acceptable limits. The Center is currently developing, with support of the Arizona Department of Environmental Quality, simplified performance-based rules for residential graywater use.

Mine Waste Detoxification – The Alaska Water and Environmental Research Center is moving into the pilot phase of a project to develop an inexpensive, biological process with which gold mines could detoxify cyanide-contaminated water. Cyanide from mine waste is an increasing threat to human and ecological health. A sequencing batch biofilm reactor was designed, built and tested. The project included basic bench-top research, as well as scale up to a pilot system ready for installation.

Effect of Salinity on Crop Production – The Colorado Water Resources Research Institute cosponsored an investigation of salinity in the Arkansas River basin that can be used to estimate the effect of salinity on crop production in the basin. An interdisciplinary team of researchers from engineering, soil and crop science, watershed sciences, and economics is working closely with agricultural leaders in the basin to develop options for mitigating the negative economic impacts of salinity on agricultural production.

Water-quality Assessment by Satellite Imagery – Research conducted by the Minnesota Water Resources Center has resulted in the development of a procedure for routine assessment of lake water quality on a regional scale by use of satellite (Landsat) imagery. The procedure has been endorsed by State agencies (Department of Natural Resources, Pollution Control Agency) and regional agencies (Metropolitan Council Environmental Services), which are expected to adopt it on a routine basis in the near future.

Contaminants in the Tropics – Long-term research by the Hawaii Water Resources Research Center has led to recognition that certain USEPA fecal indicators and water-quality standards are inappropriate in tropical environments. In March 1999, this problem was listed in the USEPA's "Action Plan for Beaches and Recreational Waters." As a result, the USEPA has funded a workshop in Hawaii to address the problem with current indicators and to consider alternatives.

Viral Contaminants in Water – The New Mexico Water Resources Research Institute sponsored research that has led to an agreement to assist in the commercial development of a disposable hollow fiber filter for concentration of pathogens from water. This same research has led to a Cooperative Research and Development Agreement with the Centers for Disease Control and Prevention to develop a method to concentrate and detect human secretory IgA, a major type of immunoglobulin, from water as an approach to assess whether water has been contaminated with human fecal material.

Detecting Toxicity Using Microorganisms – Dr. James Botsford of New Mexico State University developed a simple, inexpensive method to measure toxic chemicals using bacteria. With funding from the New Mexico WRRI, Dr. Botsford tested the toxicity of 30 commercial herbicides. Recently, Dr. Botsford was invited by the F.I.S.E.A., a European Foundation dedicated to minimizing the use of animals in the laboratory, to use the method he developed to test for the presence of toxic chemicals, thus reducing the use of animals in research.

Treating Produced Water – The New Mexico WRRI supported research under the direction of Dr. Michael Whitworth of New Mexico Tech, which resulted in a reverse osmosis waste reduction system that significantly cuts waste disposal costs, thus improving on the commercial viability of the method. As a follow up to this project, Dr. Whitworth has received a $1.2 million grant from the Department of Energy for a project entitled Development of a Modified Reverse Osmosis System for Treatment of Produced Water.

Sources: Excerpted from 2000 and 2001 Program Executive Summaries, The National Institutes for Water Resources; Annual Performance Report, Fiscal Year 2000 and Annual Performance Plan, Fiscal Year 2002, U.S. Geological Survey.

Descriptions of the research projects funded under the State Water Resources Research Institute program are provided on the Internet at:

http://water.usgs.gov/wrri/projects.html

HYDROLOGIC RESPONSE OF A MONTANE RIPARIAN ECOSYSTEM TO LIVESTOCK GRAZING

by

W. C. Leininger and M. J. Trlica, Professors and G.W. Frasier, Research Scientist
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Department of Rangeland Ecosystem Science
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Livestock grazing effects on infiltration, runoff, and water quality in uplands have been well studied. However, information on specific livestock impacts for a riparian landscape and subsequent effects on riparian hydrologic processes is limited. This area of rangeland hydrology is particularly important, since riparian areas link streams with their terrestrial catchment and have the potential to decrease water pollution by trapping sediments and utilizing nutrients from upland sources before they reach streams or lakes.

Research was conducted in a montane riparian ecosystem along a small (3 - 4 m wide) headwater stream in northern Colorado. The objective of this research was to study how a single heavy grazing event would change runoff and overland flow characteristics by physically affecting both soil and vegetation properties. In addition, runoff rates and concentrations and fluxes of nitrate-N, ammonia-N, phosphate-P, and fecal coliform in runoff were also quantified. Treatments included vegetation mowing to a 10 cm stubble height, cattle trampling without grazing (i.e., muzzled), cattle grazing plus trampling, and a control. A rotating boom rainfall simulator was used to apply water to plots (3 m x 10 m) at a rate of 100 mm hr^{-1}. Concurrently, overland flow was introduced at the upper end of the plots at a rate of 25 mm hr^{-1}. Sixty kg of sediment was introduced to overland flow in each plot. Water samples were collected as runoff from the base of each plot and from the rainfall simulator to compare with water from the creek.

Reduction in vegetation stem density and aboveground biomass by cattle decreased microchannel sinuosity and drainage density (Table 1, next page). Cattle-treated plots had greater flow velocities and depths in microchannels compared with mowed and control plots. Reduced stem density and aboveground biomass by grazing left fewer obstacles to divert flows, which decreased microchannel sinuosity and drainage density. Flows were concentrated into fewer microchannels with deeper flows. Microchannel characteristics were not significant factors affecting total runoff. Stem density and rainfall intensity were the most important factors in predicting runoff characteristics and total runoff (Flenniken et al. 2001).

Runoff rates from grazed plots was 70 percent greater than runoff rates from control plots (Fig. 1). Concentrations of nutrients and fecal coliform in runoff from gazed plots were significantly greater than concentrations from control plots (Table 2, next page). Only nitrate-N and phosphate-P showed significant time dependence. Concentrations of these 2 nutrients were significantly greater for samples taken during the first 13 min of the runoff event as compared with samples taken at 70 min. Fecal coliform concentrations were fairly constant over the duration of the runoff event. Concentrations of nitrate-N and ammonia-N in runoff from grazed plots did not exceed EPA criteria of 10 mg/L and 5.1 mg/L, respectively, but fecal coliform from both grazed and control plots exceeded the EPA standard of 1000 CFU/100 mL for secondary water contact (Trlica et al. 2000).

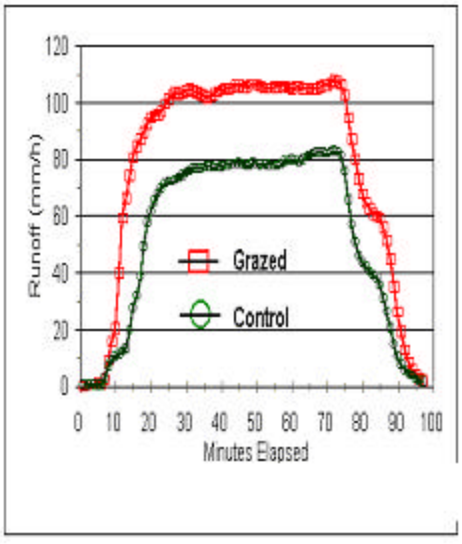


Fig. 1. Average runoff rates from grazed and control plots. Runoff Rates were measured using a bubble gauge at 1 min intervals.

Most sediment deposition occurred within the first meter downslope from application. About 90 percent of the

applied sediment was filtered from runoff within 10 m in the control and mowed plots, while approximately 84 and 77 percent of the applied sediment was trapped in the trampled and grazed treatment plots, respectively. Stem density was the most important variable that affected sediment filtration (McEldowney et al. 2002).

The increased runoff rates on the grazed compared to control plots may have been caused by soil compaction at deeper depths (>10 cm), reductions in plant stem density and microchannel sinuosity, or their combinations. Manure and urine deposited during grazing increased the concentrations and fluxes of nutrients and fecal coliform in runoff. These results suggest that heavy cattle grazing use of riparian areas adjacent to montane streams could result in non-point source pollutants reaching the stream. However, cattle grazing can be an effective and important tool of change to manipulate vegetation cover and species composition (Peck 1999), if managed to reduce impacts to soil, surface hydrology and water quality.

Table 1. Summary data for selected variables for each of the 4 treatments applied to a montane riparian community.

	TREATMENT			
Parameter	Control	Mowed	Trampled	Grazed
Plot area (m^2)	28.8b	27.3ab	26.8a	27.4ab
Slope (%)	3.8a	3.6a	4.2a	3.8a
Overland flow intensity (mm $hour^{-1}$)	102b	89a	89a	102b
Spray bar run on intensity (mm/$hour^{-1}$)	25.7a	26.6a	27.4a	27.8a
Soil moisture prior to simulation (%)	36a	36a	38a	36a
Soil organic matter 0-5 cm (%)	19.3a	20.6a	19.5a	22.4a
Soil organic matter 0-10 cm (%)	10.1a	10.8a	12.2a	11.3a
Bulk density 0-5 cm (g cm^{-3})	0.6a	0.6a	0.7a	0.6a
Bulk density 0-10 cm (g cm^{-3})	0.9a	0.9a	0.9a	0.9a
Stem density (# stems m^{-2})	5275bc	5525c	4650b	3300a
Litter ground cover (%)	63a	65a	61a	62a
Aboveground biomass (kg ha^{-1})	2330b	1725a	*	924a
Microchannel sinuosity	1.24c	1.17b	1.04a	1.04a
Drainage density (m^{-2})	2.1b	2.4b	1.7a	1.7a
Flow depth in microchannels (mm)	18a	24ab	26b	32c
Accumulated runoff after 60 min (%)	45.2ab	35.0a	48.8b	67.3c
Time to runoff initiation (min)	14.3b	22.2c	12.8ab	9.0a
Slope of the rising limb (%)	8.4a	9.0ab	7.0a	16.6b
Time to equilibrium runoff (min)	20.9b	34.4d	28.3c	15.8a
Slope of the falling limb	-6.7ab	-7.8a	-5.3bc	-5.1c

Different letters following means in a row indicate significance at $p \leq 0.10$. An * indicates missing data. Adapted from Flenniken et al. 2001.

Table 2. Reduction in vegetation stem density and aboveground biomass by cattle decreased microchannel sinuosity and drainage density

Treatment	Nitrate-N (mg/L)	Ammonia-N (mg/L)	Phosphate-P (mg/L)	Fecal coliform (CFU/100 ml) $*10^6$
Grazed	0.063^a	1.10^a	0.39^a	31.25^a
Control	0.035^b *	0.11^b	0.03^b *	0.33^b
Sheep Creek	0.033_b *	0.15^b	0.01^b *	0.0014^b

* All values below 0.05 mg/L were outside of the instruments calibration range for the standards utilized.

Colorado State University Cooperative Extension

AN OVERVIEW OF WATER OUTREACH ACTIVITIES IN THE ARKANSAS RIVER BASIN

by Jim Valliant, Extension Specialist

Water flowing down the Arkansas River, from the mountains to the plains of Colorado, continues to be the life blood of southeast Colorado. With a 98-year average rainfall of 11.79 inches, crop production and the economy of the region could not "survive" without this additional source of water for irrigation. Because of the need to protect this resource, Colorado State University teams are working throughout the basin on projects to develop and improve on practices that will "stretch" this water to it's maximum use and provide water for municipal, recreational and wildlife interests as well as agriculture.

Since the construction of Pueblo and John Martin Reservoirs, agriculture has benefited from the ability to store runoff water and release it downstream as needed. But, having water essentially year-round has also caused many problems. Salinity damage throughout the Basin has increased substantially because of:

From center left, above: Phil Burkhalter,CSU Graduate Student; Keith Kepler, Division Engineer's Office, Pueblo; Jim Valliant, Cooperative Extension Irrigation Specialist; Marshall Frasier, Agricultural and Resource Economics, CSU; Melinda Laituri, Earth Resources, CSU; Tim Gates, Civil Engineering, CSU; Lorenz Sutherland, Natural Resource Conservation Service; and Pat Edelman, U.S. Geological Survey, Pueblo.

- seepage from almost continual water in many of the canals, laterals and ditches, and
- a rising water table due mainly to
  - over-irrigation,
  - sediment deposits raising the level of the riverbed and
  - a period of unusual amounts of runoff from above-average rainfall and snowpacks.

The effect of this increase in salts — loss of cropland and severely reduced yields on thousands of acres — is being studied by a team headed by Tim Gates, Professor of Civil Engineering at Colorado State University. The team is comprised of personnel from the CSU Departments of Civil Engineering, Agricultural Engineering, Soil and Crop Science, Agricultural and Resource Economics, Bioresource Engineering, and Earth Resources. Also included are Cooperative Extension and Agricultural Experiment Station personnel. The project, "Identification and Solution of Waterlogging and Salinity Problems in the Lower Arkansas River Valley, Colorado," is being conducted along the Arkansas River and surrounding cropland in parts of Otero and Bent counties.

Data from approximately 100 monitoring wells located strategically over the area "reveal average water-table depths less than five feet below the ground surface over about 70 percent of the region…the average measured salinity (as electrical conductivity, EC) of the water table in the study region was about 4 dS/m (3200mg/l)". However; water samples taken from seven major canals in the area averaged only 0.93 dS/m (700 mg/l), which indicates low to moderate restriction in use for irrigation. This would suggest that capillary movement of salts from the shallow water tables is the main cause for soil-salinity levels measuring an average of 2.8 dS/m (2000 mg/l) on at least 70 percent of the 68 fields sampled throughout the project area. This base information is being used to support modeling and decision-making to help reduce salinity problems in the area.

Funding for the project is provided by the Colorado Agricultural Experiment Station, the U.S. Bureau of Reclamation, Cooperative Extension, the Colorado Water Resources Research Institute and Catlin Canal, with cooperation from the Natural Resources Conservation Service, the U.S. Geological Survey, the State Engineer's Office, local Soil Conservation Districts, the Farm Service Agency, the Agricultural Research Service and many of the farmers in the area.

Another study team headed by Dr. Luis Garcia, and involving personnel of the Integrated Decision Support Group at CSU as well as Cooperative Extension, is looking at conditions in select fields where multiple observation wells are being drilled to monitor water table depth and salinity. The team is locating sources and points of seepage and studying the movement of water and salinity throughout the year. Results of the study indicate that seepage from canals and laterals and over-irrigation are two of the main sources of the increased water table and resulting increase in salinity.

These studies are being expanded in 2002 to include the Lamar/Holly area with new grants from several sources.

Dr. Garcia and his group are also involved in an EPA-funded 319 Project in the Wild Horse Watershed near Holly. The project is being coordinated by Jim Valliant, regional irrigation specialist, under the sponsorship of the Northeast Prowers Soil Conservation District. The project is demonstrating different Best Management Practices (BMPs) with several local farmers and monitoring several aspects of crop production. Current BMPs include:

- the use of surge irrigation,
- PAM as a soil stabilizer,
- PAM as an additive to reduce seepage from dirt water conveyance systems,
- surface and subsurface drainage to lower water tables which will allow for leaching of salts through the soils, and
- the use of drag hoses as compared to sprinklers on a center pivot system.

Salinity mapping is being done using an EM-38 furnished by the Natural Resource Conservation Service, and by the USDA-ARS Water Management Team from Ft. Collins using its VERIS equipment.

Additional BMP demonstrations have been done in the Holly area over the past few years with funding from the Colorado Water Conservation Board. Field days, tours and workshops featuring results from the different demonstration projects are annual events. Surge irrigation increased grain sorghum yields by 504 pounds per acre, and when combined with the use of PAM — a soil-stabilizing polymer — increased yields of grain sorghum 722 pounds per acre. PAM alone increased yields on corn by 5 bushels per acre with a single application of one pound per acre at a cost of $5 per acre.

The use of PAM is also being studied at the Arkansas Valley Research Center, where corn yields have been increased from an average of 198.3 bushels per acre on the untreated area to 204.8 bushels per acre on the PAM-treated area. PAM was applied at the top of the irrigation furrow at the rate of one pound per acre on every other row at germination irrigation and after layby cultivation for a total cost of $5 per acre. Past work with PAM on onions resulted in a substantial increase in yield of up to 4800 pounds per acre, and work with PAM on different crops is being continued in 2001.

PAM was also used as a flocculent to reduce seepage from a dirt lateral in a demonstration project funded by the Bureau of Reclamation in cooperation with the Catlin Canal Company. Four applications of 10 pounds of PAM throughout the irrigation season in 1998 and 1999 have reduced seepage losses up to 95 percent by sealing the ditch bottom and partially the sides with the sediment removed from the water by flocculation. Seepage loss was reduced from 0.76 gallons per minute per foot of ditch (gpm/ft) to 0.36 gpm/ft (43 percent) by the first application of PAM in 1998 while, in 1999, seepage loss was reduced from 0.44 to 0.02 gpm/ft (95 percent) when comparing the untreated area of the lateral with the PAM-treated area of the lateral.

In 2000, some natural sealing was seen from floodwaters containing up to 15 tons of sediment per acre-foot, and still 10 pounds of PAM applied once during the year reduced seepage loss from 0.13 to 0.01 gpm/ft. From the beginning of the demonstration in 1998 until the end in 2000, the addition of PAM to “muddy” water in the Suburban Lateral and some natural sealing reduced seepage from 0.76 to 0.01 gallons per minute per foot of ditch over a 450 foot length of dirt ditch.

PAM is now being used to reduce seepage on two canals in the area, the Buffalo Canal north of Holly and the portion of the Ft. Lyons Canal just north of La Junta. Observation wells have been drilled in each of these locations to determine the effect, if any, on the water table.

Water relocation is another possibility being explored by Jim Valliant and interested irrigators, including Tom Pointon near Las Animas, Jim Moreland and Bart Mendenhall near Rocky Ford, and Bob Arambel near Holly. Relocating the water to new, non-saline land above and below current outer-perimeter canals and using new irrigation technology such as center-pivot and drip

irrigation would offer multiple benefits. These would include:

- significantly increased irrigation efficiency using center pivot or drip irrigation,
- substantially increased yields on non-saline soils,
- reduced production costs because of larger fields and fewer, if any, field ditches to maintain,
- reduced seepage by using pipelines to carry the reduced amounts of irrigation water needed by the more efficient irrigation systems,
- reduced runoff carrying salts back to the river from more efficient irrigation systems,
- plant present saline fields with salt-tolerant grasses to provide better wildlife habitat and,
- since the water would still be used in an area close to the present communities, the economy of the area could be improved as a result of the higher yields and lower production costs.

Bob Arambel installed a permanent sub-irrigation drip system in the winter of 2000-2001 on 30 acres of land just above the Amity Canal north of Holly, and EM-38 readings indicated salinity levels were far below those recorded on the same soil type just below the canal. Even with groundwater salt levels higher than desirable being pumped through the drip system, tomatoes and peppers are being grown in 2001 with success.

Additional water-related programs are being conducted throughout southeast Colorado by county agents and specialists, as well as the water research being done at the Arkansas Valley Research Center just east of Rocky Ford, and the Plainsman Research Center near Walsh. Because of it's diverse capabilities, Colorado State University is using all of its resources to seek solutions to problems such as salinity, and is partnering with federal, state and local organizations to work toward "stretching our water" and improving the economy of agricultural and rural areas in the Arkansas River Basin.

GRANT WILL FUND SELENIUM REMEDIATION, PUBLIC EDUCATION

Jim Loftis is the principal investigator on a three-year, $399,500 grant for the project, "Selenium in the Upper Colorado River Basin: Public Education and Remediation." Working on the project with Jim will be Karla Brown, Extension Water Quality Specialist, Montrose County; and Luis Garcia, Associate Professor of Civil Engineering at Colorado State. The project will integrate research, extension and education to provide support for the improved management of water and soil resources that will help reduce selenium loads to the Upper Colorado River and its major tributaries, the Uncompaghre and Gunnison Rivers.

Selenium naturally occurs in high concentrations in Mancos Shale derived soils which are common to the Lower Gunnison and Grand Valley areas. In July 1997, the Colorado State Water Quality Control Commission adopted a 5 ppb (parts per billion) aquatic life standard for selenium in the Lower Gunnison Basin. Several stream segments within the basin did not meet this new standard, including segments of the Uncompahgre and Lower Gunnison rivers. Following this ruling, the Gunnison Basin Selenium Task Force was formed as a group of private, local, state and federal representatives committed to reducing selenium while maintaining the economic viability and lifestyle of the area. The task force oversees Clean Water Act 319(h)-funded grant projects including water and soil monitoring to target selenium hotspots, investigating phytoremediation techniques to remove selenium from the soil, and evaluating the effects of changing land use on selenium loading in the Whitewater area.

Partial Sources: *Extension Echoes, September 2000; Colorado Water, October 2000*.

WATER QUALITY, QUANTITY AND USE HIGHLIGHTED AT THE COLORADO STATE FAIR

by Joseph Kerski, U.S. Geological Survey, and
Katherine Timm, Colorado State Forest Service

When most people think of the State Fair, they think of agricultural exhibits, 4-H projects and the carnival. This year, thanks to the efforts of 17 federal, state and local agencies, fairgoers also learned about the importance of water to everyday life in Colorado.

"Water Resources of Colorado" was the theme of the exhibit in the Natural and Cultural Resources Building at the 2001 Colorado State Fair. Water resources are increasingly important in Colorado and other parts of the West, and the growing population in many Western states is putting additional pressure on those resources. The object of the exhibits was to help fair visitors understand that every person is responsible for the preservation of water resources.

Construction on the water resources exhibit began in January 2001. The goal was to relate water use, quality and availability to the issues each agency faces on a daily basis—from urban growth to wildfire prevention. The entire Natural and Cultural Resources Building was filled with murals, dioramas, scientific instruments and hands-on activities to help the general public understand the importance of water quantity and quality. The exhibit included ponds, a flowing stream, animals and birds, native and agricultural plants, and irrigation systems. The displays were used to help fair visitors understand their role in preserving water quality and quantity. In addition, experts from several agencies gave presentations on geology and minerals; water resources; the use of maps, compasses and GPS; and fire prevention.

To determine the effectiveness of the exhibits and activities, visitors were given a pre-test and post-test via a "Water Wonders" booklet and passport. The booklet asked participants to respond to the following:

What is the definition of a watershed?

What watershed do you live in?

How you can protect your home from wildfire?

Identify one part of the water cycle.

Participants learned the answers by studying the displays throughout the building. Staff and volunteers from participating agencies were stationed at strategic locations to provide additional information and stamp the passport as visitors progressed through the building.

Several activities also were developed specifically for school-age children, including the more than 1,300 students from Pueblo School District 60 who enjoyed a special tour designed especially for them. In addition to the water activities, the 5th graders were treated to an interactive entomology exhibit developed by Whitney Cranshaw, entomology specialist, Colorado State University Cooperative Extension, and the Gillette Entomology Club. Cranshaw and agency staff worked with District 60 teachers to develop curriculum that linked activities in the building with lessons in the classroom. Funding for the exhibits and building rental was provided by grants from National Geographic, the National Fire Plan, and the 17 partnering agencies.

Students filled out their passports and participated in numerous hands-on water activities.

A display about irrigation, an important component of water education. This is one of many displays illustrating water use in Colorado.

District 60 students choose a prize for completing their passport and water quiz.

Joseph Kerski, USGS, was one of many agency volunteers who helped staff the information center

Staff from 17 participating agencies were available to answer questions and provide information about the building and theiragencies.

This diorama shows Colorado's central mountains, plains, plateaus and rivers and provides a lesson on the main source of Colorado's water supply.

MEETING BRIEFS

WHO'S IN CHARGE?

The 26th annual Colorado Water Workshop's theme, as stated above, produced a number of excellent presentations and generated spirited discussion around several of today's key water issues, such as recreation flows, elections of conservancy district boards, and reserved water rights. Over 200 people attended the three-day meeting held July 25-27, 2001 on the campus of Western State College in Gunnison, Colorado, including five state legislators and a number of county commissioners from both the West Slope and the Front Range.

Lucy High, Director of the Colorado Water Workshop, welcomes Colorado Senator Lewis Entz

Colorado Attorney General Ken Salazar opened the meeting with a review of the success Colorado has had in recent years addressing some of its water problems. He also noted, however, the need to remain vigilant in the face of other problems -- particularly regarding the meeting theme of "Who's in Charge" -- in Colorado's state-to-state and state-to-federal relationships involving water.

Paul Frohardt, Administrator, Colorado Water Quality Control Commission, following the meeting theme, examined the state role in water quality management in Colorado, particularly when the Clean Water Act provides the U.S. Environmental Protection Agency with extensive 'approval' authority. Paul's remarks are included in this issue of Colorado Water on pages 18.

Ken Salazar reviews Colorado's successes with its water problems.

The meeting provided considerable opportunity for the traditional 'networking' among water professionals, legislators, private citizens, water managers, university faculty and students, ranchers, and environmental activists. The picture collage accompanying this article provides an indication of the 'mixing' that took place in Gunnison in late July.

University students attending the meeting noted the excellent opportunity to meet key water leaders in Colorado and learn, first hand, of the latest issues facing Colorado water managers and strategies being employed to address particular problems.

From top left, clockwise: 1) John R. Hill, Bratton & McClow, LLC; 2) Greg Trainor, City of Grand Junction, and Dan Smith, Professor of Soil & Crop Sciences, CSU. 3) _____, Larry Dirks, Denver Water; and Greg Silkensen, Northern Colorado Water Conservancy District.

4) Cat Shrier, Civil Engineerng graduate student at CSU; Ray Wright, President, Rio Grande Water Conservation District; and Marian Flanagan, Recreation Resources student at CSU. 5: Karla Brown, Extension Specialist, Montrose, CO; Lloyd Walker, Extension Specialist, Water Quality; CSU, and Mike Baker, Bureau of Reclamation. 6) Glenn Porzak, Porzak, Browning & Bushong.

COLORADO WATERSHED ASSEMBLY CONVENES SECOND ANNUAL MEETING IN FRISCO

by Reagan Waskom, Water Resources Specialist
Colorado State University Water Center

The Second Annual Conference of the Colorado Watershed Assembly (CWA) was held on September 7-8 at the Holiday Inn – Summit County in Frisco, Colorado. More than 110 people from across Colorado attended, including watershed coordinators, government agency staff, and water and river protection activists.

CWA President Richard Fox convened the conference on Friday morning, which began with observations by Colorado Senator John Evans. Senator Evans told participants that the Colorado Watershed Assembly and individual watershed groups are critically important to the future of Colorado's rivers, streams and other natural resources. He noted that the CWA has a unique opportunity to impact state and federal legislation because it is locally-driven and best knows the issues in individual watersheds. He also said that Colorado's legislators need to be better educated by their constituents on water issues, and that the CWA is in a great position to make that happen.

CWA President Richard Fox opens Second Annual Conference of the Colorado Watershed Assembly

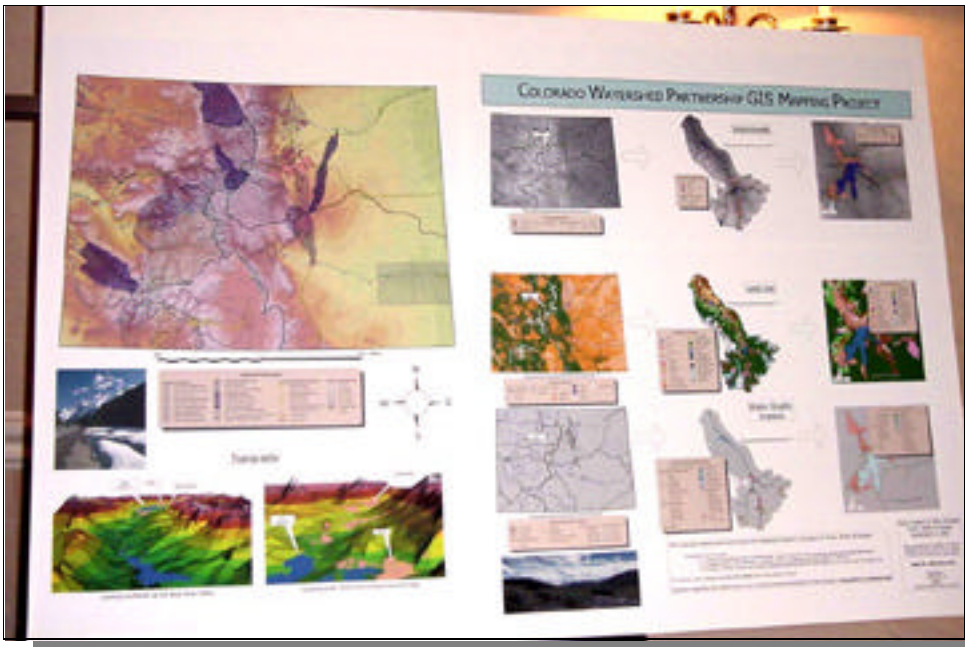
The two-day conference featured workshops and a chance for watershed groups and agencies from across the state to network – something geographically diverse groups often don't get a chance to do.

RobBuirgy of the Big Thompson Watershed Forum led the first panel session on what local and regional watershed activities are occurring

"I think that the conference was a tremendous success," said CWA president Richard Fox. "We have been greatly impressed with the multitude of offers from so many people willing to step forward and work with us to protect Colorado's rivers and streams."

The conference featured a panel discussion on what local and regional watershed activities are occurring in Colorado. Most of the groups reported having coalesced around a local issue such as stream restoration, but each watershed group has evolved in a different way and direction, according to local needs. Fund raising, partnering, and local participation were the common themes expressed by local representatives.

The conference also included presentations and panel discussions on financing watershed activities, water quality, land-trust activities, involving partners, and the triennial review process, among others. A number of government agencies with an interest in watershed protection were represented and presented information on programs they could offer in support of local watershed causes. It was estimated that there are 25 government agencies that offer some service relevant to watershed groups.



On display at the meeting, the map above illustrates the Colorado Watershed Partnership GIS Mapping Project

CWA President Richard Fox reported that there are now approximately 45 local initiatives in Colorado involving citizen-based watershed groups, but this still represents less than 50 percent of the state's land area. It was also reported that there are over 20 non-profit organizations with watershed interests.

CWA participants got a chance to network during the two-day conference and learn about watershed efforts in other areas

The Colorado Watershed Assembly**,** a recently formed umbrella organization of the various watershed and river protection groups from across the state, was founded last year to support collaborative efforts to protect and improve the conservation of land and natural resources in Colorado's watersheds.

For more information about the Colorado Watershed Assembly or to join as a member, contact Richard Fox, President, at (970) 484-3678; Carol Ekarius, Treasurer, at (719) 837-2737; Chris Rowe, Secretary, at (303) 291-7437; or go to: www.coloradowater.org

WATER QUALITY MANAGEMENT: IS THERE STILL A STATE ROLE?

by Paul Frohardt, Administrator
Water Quality Control Commission

Water Quality Control Commission Administrator Paul Frohardt

I would like to start with an overview of the basic state and federal authorities regarding water quality management. Although people often talk in simple terms about federal water quality programs that are delegated to states, in reality there is a complex relationship between federal and state water quality management authorities. It is important to understand the relationship between the authorities in each of the separate areas of water quality management.

With respect to water quality standards, the Environmental Protection Agency has an initial role to develop water quality criteria under Section 304(a) of the federal Clean Water Act which identify protective levels of water quality for particular uses for individual pollutants. States then have the principal responsibility to adopt water quality standards, which identify uses to be protected and accompanying narrative or numerical standards or criteria to protect these uses. Under EPA's "Alaska Rule," adopted in 2000, water quality standards adopted by states do not become effective for federal purposes until approved by EPA. The timing of the federal approval process can become complicated, due to EPA's obligations to consult with the Fish and Wildlife Service under the Endangered Species Act. Finally, if EPA disapproves the standards adopted by states, EPA has the authority to step in and adopt federal standards that will apply in the state.

Section 303(d) of the federal Clean Water Act requires that states list waters that will not meet water quality standards with technology-based controls alone. These are typically referred to as "impaired waters." Once a list of impaired waters is created, states must prioritize the listed waters and prepare "total maximum daily loads" (TMDLs), which identify the reductions in pollution loadings to a water body that will be needed to attain standards. There is often an important role for local entities in developing waste-load allocations for TMDLs; that is, determining how the total load is divided up among sources. If a state fails either to identify impaired waters or to develop TMDLs, EPA is legally responsible for doing so. Currently, the specific nature of the federal-state interaction with respect to Section 303(d) requirements is subject to great uncertainty, due to the uncertain status of EPA regulations for this program. EPA adopted major new regulations in 2000; however, Congress delayed the effective date of these regulations until October 1, 2001. In addition, the new Administration recently has proposed an additional 18-month delay in the effective date of the new regulations while it reviews the options.

Unlike water quality standards and Section 303(d) provisions, the National Pollutant Discharge Elimination System (NPDES) permit program starts under the Clean Water Act as a federal program that may be delegated to states. Colorado, along with about 40 other states, has been delegated authority to implement the point-source discharge permit program. However, once the permit program is delegated to a state, EPA retains a substantial oversight function. In addition to overall program approval, EPA retains authority to veto individual discharge permits, and retains enforcement authority with respect to individual permits issued by states.

As a final example of federal-state interaction, Section 401 of the federal Clean Water Act requires that states certify that the issuance of a federal permit which may result in a discharge to waters of the United States will comply with applicable state water quality standards. Such a federal permit cannot be issued if a state does not provide this certification. If a particular state lacks the authority to provide the Section 401 certification, EPA is required to undertake the certification.

The theme of this conference is, "Who's in Charge?" Concerns have periodically been raised that the realities of federal oversight leave little flexibility for the state in establishing and implementing its water quality management program. My intent is to offer you my perception of the current reality, based on two case studies: (1) water quality standards; and (2) Section 303(d) implementation.

Water Quality Standards

Recreation

I will consider three separate examples of water quality standards. The first is recreation classifications and standards. The federal Clean Water Act establishes a goal that all waters of the United States attain what is commonly referred to as "fishable, swimmable" water quality. The "swimmable" aspect of this goal states that water quality should be attained that provides for "recreation in and on the water." EPA has implemented this goal by establishing a presumption that all waters should be classified for primary contact recreation uses. A decision not to classify a particular water body for primary contact uses must be supported by a "use attainability analysis" (UAA) which demonstrates that such uses are not attainable. Within these parameters, at present there appears to be considerable room for judgment by states in determining precisely what uses will be considered "primary contact uses" and receive a higher level of water quality protection. To date, in Colorado the Water Quality Control Commission has focused on activities that involve the likelihood of ingestion of small quantities of water. At the moment, within Colorado there is considerable debate regarding what specific activities involve a significant risk of ingestion and warrant the higher level of protection.

A second issue regarding recreational use classifications and standards relates to how bacteriological standards are implemented. To protect a recreation classification, numerical standards are typically adopted for a bacteriological indicator such as fecal coliform or E. coli. These parameters are intended initially as indicators of human waste, but will also be present where animal waste impacts a water body. EPA's current policy essentially provides that animal sources of fecal pollution do not pose a human health risk, therefore indicating that elevated levels of the bacteriological indicators are not a concern if there is no source of human sewage present. However, EPA has issued new draft guidance that would state that bacteriological standards must apply to all sources except "uncontrollable natural sources." Is this proposed policy meant to suggest that all available efforts should be undertaken to keep waterfowl off ponds in wildlife refuges if such waters have also been used for primary contact recreation? Do we also need to undertake measures to keep terrestrial wildlife, such as deer and elk, out of all streams and riparian areas where any recreation has occurred?

I would suggest that neither EPA's existing policy nor its proposed guidance provides a satisfactory answer to this dilemma. Clearly, there is now information available that animal sources of fecal pollution can sometimes cause human health concerns. At the same time, a policy of keeping wildlife and waterfowl out of all water bodies is neither feasible nor desirable. This is a complex issue that will require more analysis to develop a realistic and practical approach. The current uncertainty regarding future federal policy in this area creates challenges for states in adopting appropriate recreation classifications and standards at present. It is currently uncertain when EPA will finalize its new guidance regarding these issues. Based upon recent comments from the director of EPA's Office of Science and Technology, it now appears that this guidance will not be finalized during this calendar year.

Nutrient Criteria

A second water quality standards example to consider is nutrient criteria. EPA is currently developing "ecoregional nutrient criteria documents" addressing both phosphorus and nitrogen compounds. The new criteria are unique among EPA water quality criteria. Typically, EPA water quality criteria are tied to levels of water quality necessary to protect specific uses of water bodies. The nutrient criteria have been developed based on a "reference water-body" concept. That is, EPA has looked at the level of nutrients present in relatively unimpacted water bodies, and then suggested that those levels establish appropriate nutrient criteria for other water

bodies. EPA has currently stated that it expects states to adopt numerical nutrient criteria into state water quality standards by 2004. Our experience to date in Colorado is that the development of appropriate numerical nutrient criteria is an extremely time-consuming and site-specific exercise. For example, this past year the Water Quality Control Commission conducted a lengthy hearing with extensive and divergent technical input regarding appropriate nutrient criteria for Cherry Creek Reservoir.

What will be EPA's response if states fail to adopt numerical nutrient criteria by the 2004 deadline? Currently, it is unclear exactly how EPA will proceed with its oversight role in this area. The director of the EPA Office of Science and Technology has recently signaled that EPA is planning to back off a bit on this issue. EPA is now exploring concepts of requiring states to stage the nutrient criteria development effort, starting with the development of criteria for waters listed as impaired. How this will play out in practice is still unknown.

Ammonia Criteria

A third water quality standards topic relates to ammonia criteria. Colorado's current ammonia standards, which have been approved by EPA, differ significantly from the EPA ammonia criteria that were in effect at the time Colorado adopted its standards in the mid-'80s. The differences in the Colorado standards result in a substantial treatment cost savings for municipal dischargers. In December 1999, EPA published revisions to its ammonia criteria document for freshwater aquatic life. If Colorado dischargers were required to meet the new EPA criteria, this could result in substantially increased municipal wastewater treatment costs, particularly to meet chronic aquatic life standards for warm-water streams at low pH levels. Currently, there are work-group efforts underway in Colorado to analyze the new EPA criteria and consider how these criteria should be applied in Colorado. Will there be a basis for applying different criteria in Colorado, as was the case with the earlier EPA criteria?

Although EPA has stated a goal that states implement the new ammonia criteria by 2004, Colorado's implementation of the new criteria is scheduled to be addressed in a July 2005 rule-making hearing regarding the Basic Standards and Methodologies for Surface Water. Following that rulemaking, any new Colorado criteria will be implemented into Colorado water quality standards in the subsequent round of triennial reviews for the individual river basins.

Section 303(d) Listings and TMDLs

As noted above, the first step in the Section 303(d) process is for states to list impaired waters – i.e., those that will not attain water quality standards with technology-based controls alone. Through an extensive stakeholder work-group process, Colorado is currently developing criteria that will be used for the determination of which waters to include on the required 2002 list of impaired waters. A Water Quality Control Commission hearing on the proposed listing criteria now has been postponed to March 2002, due to a recent postponement of the EPA deadline for submission of the 2002 list. The general trend in the proposed listing criteria resulting from the work-group process is toward requiring more rigorous documentation of the basis for listing waters as impaired. The policy challenge here is where to err in the face of uncertainty. Is it more important to avoid the potential undue costs of listing waters that may not warrant listing by including relatively fewer water bodies, or to assure protection of waters that may be impacted by including relatively more water bodies? No separate, explicit EPA approval of the state's listing criteria is required, although EPA will be required to approve the 2002 Section 303(d) list that is developed utilizing the criteria.

The second major step in the Section 303(d) process is the development of Total Maximum Daily Loads (TMDLs). Colorado's 1998 Section 303(d) list of impaired waters includes approximately 85 water body segments requiring a total of 198 TMDLs for individual pollutants. A 1999 settlement of a lawsuit brought by the Colorado Environmental Coalition and the Biodiversity Legal Foundation requires that these TMDLs be completed by 2008, with milestones specified at two-year increments. To date, Colorado has finalized and submitted 33 TMDL actions for EPA approval – 12 TMDLs and 21 delistings of segments. EPA has approved all of the TMDLs submitted. A major question mark for this program is whether state resources will continue to be adequate to meet TMDL development obligations following finalization of a 2002 Section 303(d) list.

How significant is the potential for EPA to step in if the state has difficulty continuing to develop TMDLs for all listed waters in a timely manner? The significance of this potential will inevitably turn on whether new or continuing litigation challenges the state or EPA actions in this regard. One thing is certain: if EPA should step in to develop TMDLs where the state has failed to do so, EPA resource constraints are likely to result in much more blunt solutions than those that would be developed at the state level.

I want to mention one specific TMDL issue that is pending, because of the interesting water quality/water quantity issues that it poses. EPA has approved a TMDL adopted by the State of Kansas for sulfate on the lower Arkansas River that calls for a reduction of current sulfate levels in the Arkansas while recognizing that the 250 mg/l criterion is unattainable. This TMDL calls for "alternate operations and delivery of water from Colorado to Kansas that improves water quality, but does not increase consumption or depletions in violation of the Arkansas River Compact." In short, Kansas would like to receive cleaner water, but it doesn't want to receive any less water. The Kansas TMDL also calls for development of a "long-term plan for irrigation return-flow management to reduce sulfate and selenium loadings."

An important technical issue posed by this situation is whether it is feasible to reduce the sulfate and/or selenium loadings in return flows to the Arkansas River while not reducing the quantity of flows crossing the state line. In addition, the situation poses an interesting policy issue related to the theme of "who's in charge?" Will water quality management decisions made in Kansas affect water quality or.quantity management options in Colorado? The underlying legal issue is whether there is a legal mechanism by which Kansas can impose controls within Colorado. Although I believe this is highly questionable, I certainly also believe that it is extremely important for Colorado interests to monitor the development of this issue. Finally, there is uncertainty regarding the extent of the potential for EPA to step in if the two states are unable to resolve these issues.

Conclusions

From looking at these examples, I offer several conclusions regarding the current status of the interaction between federal and state water quality management roles. First, there clearly is a federal "floor" that creates a limitation on the range of state flexibility in formulating and implementing the state's water quality management program. I would suggest that that, after all, is what the federal Clean Water Act is all about: establishing a nationally applicable, minimum level of water quality protection.

Above this federal floor, it appears to me that there still is substantial flexibility for the state to determine the extent of water quality protection to be provided, as well as to formulate important details affecting how that protection is provided. Recreation classifications, past ammonia standards, and Section 303(d) listing decisions offer important examples of state flexibility regarding the extent of water quality protection provided. The development of TMDLs and waste-load allocations provide important examples of state flexibility in formulating the details as to how protection is provided. One thing that is certain is that the continuing effectiveness of the state role in exercising its flexibility will be directly dependent on the adequacy of the resources made available for the state's water quality management program.

A third conclusion that I offer is that uncertainties regarding the precise location of the federal floor – due both to changes in federal policy over time and to the inherent complexity of the subject matter – will continue to place pressures on state policymakers as they develop and implement the state's water quality management program. There is seldom, if ever, a fixed federal reference point to react to. The expectation for states to begin to develop nutrient criteria is a good example of an area in which federal uncertainties create a challenge for state implementation.

Finally, I would suggest that for state interests to be served in the water quality management arena, it will continue to be important for the state to provide input into EPA's policy development initiatives as they unfold. Colorado has done this actively, for example with respect to EPA's proposed TMDL rules and its proposed bacteriological standard implementation guidance. It will of great importance for Colorado to continue to provide this input in the future.

NEW FACULTY PROFILES

by Marian Flanagan

Mary E. Schutter
Department of Soil
and Crop Sciences
Colorado State University

Mary E. Schutter joined Colorado State University's Department of Soil and Crop Sciences in August this year. She graduated Summa Cum Laude in 1994 with a Bachelor of Science degree in Biology/Microbiology from West Chester University, earned a Masters degree in Soil Science from the University of Delaware in1996, and obtained a Ph.D. in Soil Science from Oregon State University, Corvallis in 2000.

Mary was employed by the USDA-ARS, in Fresno, California, as a post-doctoral research associate prior to coming to CSU. In that position, she was responsible for field and laboratory studies to evaluate chemical and non-chemical alternatives to methyl bromide for strawberries, vegetable crops, perennials, nurseries, and cut flowers. She recognizes the value of collaboration, having spent 31/2 years involved in a multi-disciplinary research program comprised of soil scientists, entomologists, crop specialists, and commercial vegetable growers. She was responsible for determining the impacts of alternative management practices on vegetable crop production and soil microbial communities.

Mary's research at Oregon State University focused on identifying alternative management practices for vegetable growers in the Willamette Valley. Winter cover crops, in particular, were examined for their potential to protect soils from water runoff and soil erosion and to capture soil NO_3-N that otherwise might leach into the groundwater. For her dissertation, Mary examined the impact of winter cover cropping and reduced tillage systems on the diversity and community structure of soil microorganisms.

Mary's research will help address environmental and agricultural issues important to Colorado and the nation. For example, her research interests include the impact of land-applied animal and municipal wastes on soil microbial C- and N-cycling processes, and the long-term effects of no-tillage agriculture on soil fungal communities and their activities related to nutrient storage and soil aggregation. She looks forward to collaborating with other scientists to study soil microorganisms and how changes in their activities, due to environmental disturbances or amelioration efforts, will affect soil and groundwater systems.

Mary will enjoy Colorado's Rocky Mountain lifestyle, with her recreational hobbies of hiking and cross-country skiing.

SEMINARS

Department	Web Site
Agricultural & Resource Economics	**http://dare.agsci.colostate.edu/**
Atmospheric Science	**http://www.atmos.colostate.edu/dept/seminar/semschedf01.htm**
Biology	**http://www.biology.colostate.edu/seminars.htm**
Bioresource & Agricultural Engr.	*
Chemical Engineering	**http://www.engr.colostate.edu/cheme/seminars/seminars_fall2001.html**
Chemistry	**http://www.chm.colostate.edu/**
Civil Engineering	**http://www.engr.colostate.edu/ce/** Click on "New and Notable"
Graduate Degree Program in Ecology	**http://www.colostate.edu/Depts/GDPE/weekly.seminars.htm**
Earth Resources	**http://www.cnr.colostate.edu/ER/seminars/index.html**
Environmental Health	**http://www.cvmbs.colostate.edu/cvmbs/thiswk.html**
Fishery & Wildlife Biology	**http://www.cnr.colostate.edu/FWB/grad_fac.pdf**
Forest Sciences	*
Horticulture & Landscape Arch.	**http://lamar.colostate.edu/~jcroissa/seminar.html**
Natural Resources Ecology Lab	**http://www.nrel.colostate.edu/news/calendar.html**
Soil & Crop Sciences	*
Statistics	**http://www.stat.colostate.edu/seminars.html**
*Not listed on the internet. See below.	

Listed below are some seminar highlights. If any of these programs arouse your interest, see the web page listed above for more information.

Agric. & Resource Economics -- **http://dare.agsci.colostate.edu/** -- Meetings are held from 12:00-1:00 in Room C364 Clark Bldg.

Nov. 7	Randy Walsh, Univ. of Colorado	Analyzing Open Space Policies in a Locational Equilibrium Model with Endogenous Landscape Amenities
Nov. 14	Marshall Frasier and Heath Byrd, CSU	Evaluation of Groundwater Institutions in the High Plains Aquifer

Atmospheric Science — **http://www.atmos.colostate.edu/dept/seminar/semschedf01.htm** – Meetings begin at 3:30 in Room 101, Atmospheric Science Bldg.

Nov. 1	Mr. Jan Curtis, Wyoming State Climatologist	Climate Change Metadata Resources Available in Wyoming. Host: Prof. Bill Cotton.
Nov. 8	Dr. Jim Fleming, Colby College	History of Climate Change. Host: Prof. Tom VonderHaar
Dec. 6	Dr. Richard Carbone, NCAR	Mesoscale and Microscale Meteorology Division. Title TBD. Host: Prof. Steven Rutledge

Bioresource and Agricultural Engineering — Locations are listed below. For information contact Ramchand Oad at 491-7682 or E-mail oad@engr.colostate.edu

Oct. 26	Stephen Smith, President, Aqua Engr., Inc.	Water Topics with Landscape Engineering **B214 Engineering Bldg.**
Nov. 2	Sarah Legoza, Grad. Student	Applications of the DGPS Underwater Video Mapping System For Coral Reef Surveys – **234 Lory Student Center**
Nov. 16	Jim Loftis, Civil Engr., CSU	Supporting Local Water Providers and Watershed Groups Through Applied Research at CSU – **234 Lory Student Center**
Nov. 30	Robert Ward, Director, CWRRI/CSU Water Center	Advancements in Water Quality Monitoring System Design – State, National and International Perspectives – (Location not provided yet)

Chemical Engineering — **http://www.engr.colostate.edu/cheme/seminars/seminars_fall2001.**html — Fridays 12.00-1.00 pm, Natural Resources 109.

Oct. 26	Professor Christian Kummerow Department of Atmospheric Sciences, CSU	Global Rainfall Distributions - What Have We Learned From Satellite Missions & What Does the Future Hold?

Fishery & Wildlife Biology — **http://www.cnr.colostate.edu/FWB/grad_fac.pdf** — Graduate Faculty Seminar (FW692v) meets Friday afternoons in Room 231, Wagar Building, at 3:10 p.m. The seminars are open to the public and all are welcomed.

Oct. 19	Julie Scheurer, MS candidate	Habitat Requirements and Systematics of Brassy Minnow in Intermittent Plains Streams in Eastern Colorado
Oct. 26	Cory Sipher, MS candidate	The Effects of Whirling Disease on Growth and Survival of Snake River Cutthroats and Colorado River Rainbows

Forest Sciences.

Nov. 1	Tom Stohlgren	Invasive Species in Natural Areas
Nov. 8	Tom Thompson	The Significance of Current Natural Resource Management and Leadership
Nov. 15	Virginia Burkett	Southern Forested Wetlands: Climate Change, Development and Future Prospects

Natural Resources Ecology Lab — **http://www.nrel.colostate.edu/news/calendar.html** — 1:00 am - 12 noon NREL Seminar – Room B215, NESB

Oct. 26	John Tschirhart, Dept. of Economics and Finance, Univ. of Wyoming	Toward merging economics and ecology
Nov. 2	Mohammed Kalkhan, NREL Research Scientist	Using Spatial Information and Spatial Statistics to Model Landscape-Scale-Pattern Characteristics
Dec. 7	Paddy Sullivan, NREL Graduate Research Associate	Root Dynamics in Low Arctic Tussock Tundra and the Potential Consequences of Climate Change

Soil and Crop Sciences – Departmental Seminar is held 12:10-1:00 Thursdays in C213 Clark Bldg.

Nov. 8	Lee Panella	USDA-ARS Sugarbeet Research in Fort Collins
Nov. 15	Bruce Bosley, Wayne Cooley and Ron Meyer	Successful Agronomy Programs from Extension Field Staff
Nov. 29	Howard Schwartz	Technology Transfer in the 21st Century

Research Experiences For Undergraduates Program In Water Research at Colorado State University Summer 2002

PROGRAM DESCRIPTION

The Water Center at Colorado State University is seeking applications for its 2002 NSF Research Experiences for Undergraduates program in Water Research at Colorado State University. Fifteen selected undergraduate students will undertake an individual research project in water research under the supervision of a Colorado State University faculty member. The research will be performed at Colorado State University during 8 weeks in the summer (June and July).

In addition to their research experience, students will participate in weekly workshops, seminars and discussions on topics in water research, and field excursions to introduce them to important water issues. Students will present the results of their research (in the form of papers or posters) at an end of program symposium. Students will be encouraged to present their work also at the CSU Student Water Symposium during Fall Semester 2002, and to participate in the 2003 edition of the AGU Hydrology Days at Colorado State University.

REU students will receive a stipend of $2,400 for participation in the program. Students will be provided with housing during the 8-week summer program. Reimbursement for child care expenses may be available on request.

ELIGIBILITY REQUIREMENTS

- At least a junior standing in an appropriate major at the time of application with good academic standing. Students must have at least one semester left prior to graduation as of June 1, 2002.
- Application form completed and submitted on-line with a copy of transcripts and two letters of reference.
- One to two page essay describing student's interest in water research.

APPLICATION PROCEDURE

Only on-line applications will be accepted. In order to apply, point your web browser to the following URL: **http://WaterREU.colostate.edu/** and follow the directions provided. The process includes filling out a short on-line form, providing copies of official transcripts, and obtaining two letters of reference.

APPROPRIATE MAJORS FOR THE PROGRAM

The following is an incomplete list of the majors that are appropriate for this program. If you are not sure if you are in an appropriate major, contact one of the individuals listed below.

Agricultural Economics, Agricultural Engineering, Agricultural Science, Atmospheric Science, Biochemistry, Biological Science, Bioresource Engineering, Civil and Environmental Engineering, Chemical Engineering, Chemistry, Ecology, Environmental Science, Fishery Biology, Forestry, Geology, Water Resources and Hydrologic Science and Engineering, Microbiology, Natural Resources Recreation and Tourism, Range and Forest Management, Range Ecology, Soil and Crop Sciences, Watershed Science, Wildlife Biology.

For more details about the program, including a list of previous research topics, point your web browser to the following URL: **http://WaterREU.colostate.edu/**. For additional questions you may contact:

Dr. Jorge A. Ramirez
Colorado State University
Civil Engineering Department
970-491-7621
ramirez@engr.colostate.edu

Dr. Judy Hannah
Colorado State University
Earth Resources Department
970-491-5661
jhannah@cnr.colostate.edu

Ms. Marilee Rowe
Colorado State University
Civil Engineering Department
970-491-5247
mrowe@engr.colostate.edu

CWRRI

HAPPENINGS AT CU

For listings of seminars scheduled at the University of Colorado, consult the following web sites. Seminar highlights related to water topics are also listed.

http://instaar.colorado.edu/other/seminar_mon.html — Institute for Arctic & Alpine Research. INSTAAR Noon Seminars are held 12-1 PM Mondays, RL-3, 6th Floor Auditorium, Room 620For directions to RL-3, see INSTAAR Map pages. These seminars are open to the public. All are welcome!

Nov. 05	**Kevin Bishop,** Swedish University of Agricultural Sciences	Natural Dynamics and Unnatural Impacts in Boreal Catchments: A hydrologists perspective on acidification, mercury, and forestry in the humic waters of northern Sweden.

http://paos.colorado.edu/seminars.html — Program in Atmospheric & Oceanic Sciences. PAOS series seminars are on Wednesdays at 4:00 p.m. in the Duane Physics Building, 11th Floor, Gamow Tower Lounge. There is a short reception prior to the seminar, starting at 4:00 pm.. Food and beverages are provided.

http://www.mmm.ucar.edu/sem/seminars.html — Mesoscale and Microscale Meteorology, National Center for Atmospheric Research. Unless otherwise noted, seminars will be held in the Main Auditorium, Foothills Lab, Building 2, 3450 Mitchell Lane, starting at 3:30pm (Coffee and cookies are served at 3:15pm. Come early and talk with the speaker!). The MMM seminar coordinator is Wojciech Grabowski, 303-497-8974.

http://bechtel.colorado.edu/web/grad/environ/seminars.htm — Dept. of Civil, Environmental and Architectural Engineering, Fall 2001 Environmental Engineering Seminar Series. Seminars are held Wednesdays, 11 am to 12 pm, Engineering Center CE 1B41. Administered by Prof. JoAnn Silverstein.

Nov. 7	**Dr. Tammy Taylor**, Los Alamos National Lab	Subsurface Biobarriers
Nov. 14	**Joe Ryan,** Associate Professor, CEAE	Investigating the Inactivation of Attached Viruses in an Iron Oxide-Coated Sand Aquifer: Field and Laboratory Experiments

http://www.colorado.edu/GeolSci/colloquium.html — Geological Sciences Colloquium Schedule: Fall 2001. All talks are held in the Benson Earth Sciences lecture hall (180) at 4pm.. Refreshments are served at 3:30 on the 3rd floor.

Nov. 14	John Suter, Conoco, APG Distinguished Lecturer	Deltas of the World

http://www.colorado.edu/epob/events/colloq.html

http://www.colorado.edu/che/homepage/patten/seminar.html — Department of Chemical Engineering James and Catherine Patten Seminar Series, Fall 2001, meets Thursdays and some Tuesdays at 2:00 pm in ECCR 150 in the Engineering Center.

Nov. 1	**Ted Watson**, Chemical Engr., Colorado State University	Developing Nuclear Magnetic Resonance Imaging Methods for Engineering Applications
Nov. 29	**Meyer Steinberg**, Brookhaven National Lab	From Los Alamos to Global Warming

http://www.colorado.edu/Law/NRLC/events.html
Nov. 16, 2001, FLPMA Symposium — This year marks the 25th anniversary of the Federal Land Policy and Management Act (FLPMA), perhaps best known for providing the multiple-use mandate of the U.S. Bureau of Land Management(BLM). In

conjunction with the BLM and the Center of the American West, the Center is hosting a one-day event examining the changing uses and demands placed on BLM lands, and the role in FLPMA in guiding management actions. Secretary of the Interior Gale Norton is expected to deliver the keynote address. Other speakers will include academics, federal land managers, and stakeholders. The event is free and open to the public, and will take place on the University of Colorado-Boulder campus.

http://nit.colorado.edu/remsens/
The Remote Sensing Seminar, meets on Tuesdays, 3:30-4:30, in Muenzinger E064.

30-Oct	Chris Rocken, UCAR	Atmospheric Sensing with GPS
6-Nov	various	Microwave Remote Sensing Specialists Meeting
13-Nov	Sergey Matrosov, NOAA/ETL	Polarimetic Radar Measurement of Rainfall
27-Nov	Ed Westwater, NOAA/ETL	Radiometric Sensing of Temperature/water Vapor/cloud Liquid

NSIDC Celebrates 25 Years

October 11, 2001 marked the 25th anniversary of the National Snow and Ice Data Center (NSIDC) at the University of Colorado, Boulder. The National Snow and Ice Data Center (NSIDC) is an information and referral center supporting polar and cryospheric research. It distributes data and maintains information about snow cover, avalanches, glaciers, ice sheets, freshwater ice, sea ice, ground ice, permafrost, atmospheric ice, paleoglaciology, and ice cores. The NSIDC was established by NOAA in 1982, and is one of eight archives participating in the National Aeronautics and Space Administration's (NASA) Earth Observing System Data and Information System (EOSDIS). Many satellite image and satellite derived products are contained within the NASA Distributed Active Archive Center (DAAC). NSIDC is funded by the National Science Foundation's Office of Polar Programs as the Data Coordination Center for all components of the Arctic System Science program. It is part of the Cooperative Institute for Research in Environmental Sciences (CIRES) at the University of Colorado, Boulder.

ANNOUNCEMENTS FROM THE NATURAL RESOURCES LAW CENTER

Public Lands Symposium
The Federal Land Policy and Management Act (FLPMA)
and the New West: A Balancing Act Turns 25

November 16, 2001

8:00 a.m. to 5:00 p.m.
Glenn Miller Ballroom
University Memorial Center
University of Colorado, Boulder

Join us for a fascinating look at the big impact an ambitious law has on today's West during a one-day symposium at the University of Colorado in Boulder.

This year marks the 25th anniversary of the Federal Land Policy and Management Act of 1976 - the organic act of the Bureau of Land Management. In the 25 years since FLPMA's passage, the West has seen increasing populations and changing demands for more and varied uses of the public lands. Does the FLPMA still give the Bureau of Land Management the tools it needs to manage the public lands for the benefit of present and future generations?

Website: **http://www.colorado.edu/Law/NRLC/FLPMA_Symposium.html**

Conference Announcement and Call for Papers
ALLOCATING AND MANAGING WATER FOR A SUSTAINABLE FUTURE:
LESSONS FROM AROUND THE WORLD
Natural Resources Law Center, University of Colorado School of Law -- JUNE 11-14, 2002

The Natural Resources Law Center of the University of Colorado School of Law, Boulder, Colorado, will celebrate its 20th anniversary in June 2002 with a conference examining innovative water allocation laws, policies and institutions from around the world. The conference will focus on problems of sustainable water management in the American West. Sessions will consider innovative legal and institutional developments and lessons from around the world that can be transferred across different regions, countries, cultures, economies, and water systems. The lessons will provide examples from a variety of geographic scales, ranging from international rivers to irrigation systems and watersheds. International speakers and case studies will be drawn from world regions that share the American West's challenges of managing uncertain and variable water supplies.

CONFERENCE PROGRAM -- Plenary sessions on June 12–14 will present invited speakers organized around 3 themes:

THE ROLE OF MARKETS AND POLICY: LESSONS IN WATER ALLOCATION AND USE. Plenary Session 1 will focus on the interaction of market-based approaches to allocating water, such as water transfers, banks, and other market instruments, with planning approaches such as watershed and river governance, and other ways of allocating water. Session Coordinators: Chuck Howe, Department of Economics, University of Colorado and Helen Ingram, Social Ecology of Peace and International Cooperation, School of Social Ecology, University of California, Irvine.

INTEGRATING ENVIRONMENTAL, CULTURAL, AND OTHER VALUES. Plenary Session 2 will examine how water law and policy integrates a variety of values and interests. It will emphasize environmental protection and the treatment of indigenous peoples as well as the balancing of local/national and public/private interests. Session Coordinators: David Getches, University of Colorado School of Law, and Sarah Van de Wetering, Writer/Attorney, Missoula, Montana.

TRANSBOUNDARY WATER CONFLICTS AND COOPERATION. Plenary Session 3 will address not only international boundary issues but also transboundary conflicts and allocation issues within national borders. Session Coordinator: Aaron Wolf, Department of Geosciences, Oregon State University.

Other confirmed speakers at the conference include:

· Don Blackmore, Director-general, Murray/Darling Basin Commission, New South Wales and Victoria, Australia
· Joachim Blatter, Political Science Department, University of Konstantz, Germany
· John Briscoe, Senior Water Adviser, The World Bank
· Antonio Embid, Director, Seminario de Derecho del Agua, Universidad de Zaragoza, Spain
· Peter Gleick, President, Pacific Institute for Studies in Development, Environment, and Security, Oakland, California
· Lakshman Guruswamy, University of Colorado School of Law
· Bob Hitchcock, Department of Anthropology, University of Nebraska at Lincoln
· Jeff Jacobs, National Research Council
· Miki Nakayama, Tokyo University of Agriculture and Technology
· Miguel Solanes, UN Economic Commission Latin America
· A. Dan Tarlock, Chicago-Kent College of Law
· James Wescoat, Department of Geography, University of Colorado

CALL FOR PAPERS

June 11, 2002, the first day of the conference, will be free and open to the public. This day will be organized around concurrent sessions of contributed papers addressing the three major themes of the conference. Those interested in presenting should submit a one-page abstract a brief biographical note and information on your current affiliation by **November 30, 2001**. Contributed paper authors wishing to attend the plenary sessions will be required to register. Registration scholarships (full or partial) will be available on the basis of need. Foreign-based presenters of contributed papers will be given priority for available scholarship funds.

FOR MORE INFORMATION OR TO SUBMIT AN ABSTRACT, PLEASE CONTACT THE NRLC AT:
General information phone: 303-492-1272 —Abstract information phone: 303-492-1293 (Kathryn Mutz)
Fax: 303-492-1297 Email: NRLC@spot.Colorado.edu Website: **www.colorado.edu/law/NRLC/2002Conference.html**
Mail: NRLC, 401 UCB, University of Colorado Law School, Boulder CO, 80309-0401

Belize water project installed by CU group

A University of Colorado group has installed a water system in a small Belize village. The project by CU-Boulder faculty and students is bringing drinking and irrigation water to 250 Maya Indians. The San Pablo water project, supported by private donations and university grants, is the first initiative by the new nonprofit group "Engineers Without Borders," led by Civil Engineering Professor Bernard Amadei with assistance from local industry representative Denis Weaver.

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Denver Post, 9/23/01

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HAPPENINGS AT CSM

http://www.mines.edu/Academic/envsci/about/fall2001.pdf — Division of Environmental Science and Engineering. This seminar series takes place in Coolbaugh Hall, Room 219, from 4:00 to 5:00 p.m. For further information, contact Tissa Illangasekare **tillanga@mines.edu** or Christy Woodward **cwoodwar@mines.edu**.

Jörg E. Drewes
Environmental Science and Engineering Division
Colorado School of Mines

Jörg E. Drewes joined the Environmental Science and Engineering Division at the Colorado School of Mines as an Assistant Professor in August of 2001. Dr. Drewes received his M.S. and PhD in Environmental Engineering from the Technical University of Berlin, Germany.

Dr. Drewes has been actively involved in research in the area of water reclamation and water reuse for approximately nine years. As a research associate, he spent four years at the Technical University of Berlin.

In 1997, Dr. Drewes joined the Department of Civil and Environmental Engineering at Arizona State University as a Visiting Professor. In 1999, he was appointed Associate Director of the National Center for Sustainable Water Supply at Arizona State University, where he served as project coordinator of a tailored collaborative multi-university research project on soil-aquifer treatment funded by American Water Works Association Research Foundation (AwwaRF) and the U.S. Environmental Protection Agency (EPA).

Dr. Drewes' research interests are water and wastewater-treatment engineering; potable and non-potable water reuse (soil-aquifer treatment and microfiltration-reverse osmosis); state-of-the-art characterization of natural and effluent organic matter; contaminant transfer among environmental media; and fate of endocrine disrupting compounds and pharmaceuticals in natural and engineered systems. His prior research in these areas has been funded in Europe and in the U.S. by AwwaRF, US EPA, the National Water Research Institute, the German National Science Foundation (DFG), and the German Ministry of Research and Technology (BMBF).

Dr. Drewes has published more than 45 journal papers, book contributions, and conference proceedings. He was awarded the Willy-Hager Award in 1997 and the Quentin Mees Research Award in 1999.

Dr. Drewes can be reached at 303-273-3401 or via E-mail at jdrewes@mines.edu.

RESEARCH AWARDS

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

COLORADO STATE UNIVERSITY, FORT COLLINS, CO 80523
Awards for period July 27-September 24, 2001

Title	PI	Dept	Sponsor
CAREER: Genetic Engineering Approaches for the in Vivo Study of Plant Metabolism of Selenium & Other Oxyanions	Pilon-Smits, Elizabeth	Biology	NSF
Convective Cloud Systems in Climate Models	Randall, David	Atmos. Sci.	NSF
Structure & Function of Northern Ecosystems & Their Response to Global Change	**Binkley, Daniel**	**Forest Sci.**	**USGS**
Calibration of Reese Creek Flume Structure, Yellowstone National Park	**Thornton, Christopher**	**Civil Engr.**	**NPS**
Integration of Geological and Ecological Indicators for Assessment of Impacts on Stream & Riparian…	Clements, William	FWB	USGS
Watershed Research in the United States National Parks	Binkley, Daniel	Forest Sci.	USGS
Effects of Brook Trout on Colorado River Cutthroat Trout	Fausch, Kurt	FWB	CDWL
Distribution, Habitat & Life History of Brassy Minnow	Fausch, Kurt	FWB	CDWL
Willow Persistence in Yellowstone National Park: Interactive Effects of Climate, Hydrology & Herbivory	Hobbs, N. Thompson	NREL	USGS
Explaining Broad-scale Fire Patterns in the Western & Southern United States	**Omi, Philip N**	**Forest Sciences**	**USDA**
West Slope Native Fishes Status & Trends Assessment	Bestgen, Kevin	FWB	CDWL
Rio Grande Chub Limiting Factors Research and Genetic Assessment (segment II, ecology)	Bestgen, Kevin	FWB	CDWL
Suckermouth Minnow Genetic Assessment	Douglas, Marlis	FWB	CDWL
2001 Basinwide Field Verification Proposal, FY01: Project Phase: Upper Yampa, Upper White, & Little Snake Rivers	Stevens, Joseph	FWB	CDWL
Improving Performance of the Middle Rio Grande Irrigation System	Oad,Ramchand	Civil Engr.	State of NM
Yampa River Native Sucker Hybridization	Douglas, Marlis	FWB	CDWL
Rio Grande Chub Genetic Assessment/Limiting Factors Research	Douglas, Marlis	FWB	CDWL
Investigation of Environmental Factors Limiting Suckermouth Minnow Populations	Beyers, Daniel	FWB	CDWL
Patterns of Biodiversity in the Southwest	**Wilson, Kenneth**	**FWB**	**USDA-USFS-RMRS**

FEDERAL SPONSORS: BLM-Bureau of Land Management, COE-Corps of Engineers, DOA-Department of the Army, DOD-Department of Defense, 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, , USAID-US Agency for International Development, 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, NREL-Natural Resource Ecology Lab, NRRT-Nat. Resources Recreation & Tourism, RES-Rangeland Ecosystem Science. University of Colorado: ACAR-Aero-Colorado Center for Astrodynamic Research, 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
Wetland Project Design to the State for Wetland Conservation & Protection	**Culver, Denise**	**FWB**	**CDWL**
Eutrophication of Reservoirs on the Colorado Front Range	Loftis, Jim C	Civil Engr.	"Non-Profit"
Landscape-scale Fire Patterns in the Ponderosa Pine/Upland Shrub System	**Savidge, Julie**	**FWB**	**USGS**
Evaluation of Enhanced Bank Stabilization Structures for Reducing Nutrient Contamination	**Carlson, Kenneth**	**Civil Engr.**	**USDA-ARS**
Landscape Level Assessment of Wildland Fires, Rare Species & Exotic Plants: Implications for Fuel Management	**Noon, Barry**	**FWB**	**USDA-USFS-RMRS**
The Extension of the TRMM Microwave Rainfall & Vertical Structure Algorithm to Other Radiometers	**Kummerow, Christian**	**Atmos. Sci.**	**NASA**
Energy & Water Cycles within Hurricanes Determined from High-Resolution Simulations	**Montgomery, Michael**	**Atmos. Sci.**	**NASA**
White River National Forest Boundary Analysis: Blue River Basin	Wallace, George	NRRT	NW CO Council of
The Ecology of Fishes in McKittrick Creek, Guadalupe Mountains National Park, Texas	Bergersen, Eric	Coop Fish & WL	USGS
Assessment of the Benefits & Costs of Pressurized Dual Water Systems in Colorado	**Wilkins-Wells, John**	**Civil Engr.**	**Colorado Water Conservation Board**
Fire Patterns in the Ponderosa Pine/Upland Shrub System	**Savidge, Julie**	**FWB**	**NPS**
Applied Research in Support of Implementation of National Weather Service's Advanced Hydrologic Prediction	Adams, Christopher	CIRA	NOAA
The Response of the North American Monsoon to Boundary & Regional Forcing Mechanisms as Simulated by ClimRAMS	Pielke, Roger	Atmos. Sci.	NASA
Collaborative Research: Isotopic Characteristics of Precipitation …	Welker, Jeffrey	NREL	NSF
Hierarchical Strategies for Recovery of a Salinity-Threatened Irrigated Valley	**Gates, Timothy**	**Civil Engr.**	**USDA-CSREES**
Land Application of Sewage Biosolids	**Barbarick, Ken**	**Soil & Crop Sci.**	**City of Littleton**
Mechanisms of Tamarisk Dominance in Western Riparian	Poff, N. Leroy	Biology	Nature Conservancy
Boreal Toad Surveys Throughout Colorado	Siemers, Jeremy	FWB	USFS
An Assessment of Public Perceptions of Fuel Reduction/Restoration Activities on National Forests	**Bright, Alan**	**NRRT**	**USDA**
Vegetation Classification & Mapping of Rocky Mountain National Park	**Stevens, Joseph**	**FWB**	**NPS**
The Extension of the TRMM Microwave Rainfall & Vertical Structure Algorithm to Other Radiometers	Kummerow, Christian	Atmos. Sci.	NASA
Long-Term Ecological Measurements in Loch Vale Watershed, Rocky Mountain National Park	Parton, William	NREL	USGS
A Study of Boater Recreation on the Upper Colorado River, Colorado	Titre, John	NRRT	BLM
Responses of Hydrologic & Aquatic Ecosystem Processes to Potential Climate Change	Parton, William	NREL	USGS
Geomorphic Assessment of Fisheries Enhancement Features on the Big Sandy River, Wyoming	**Bledsoe, Brian**	**Civil Engr.**	**USBR**
Preble's Mouse Surveys in Trout Creek	Schorr, Robert	FWB	USFS
Mesa County Seeps & Springs Survey	**Culver, Denise**	**FWB**	**BLM**
Ecological Effects of Reservoir Operations on Blue Mesa Reservoir	Johnson, Brett	FWB	USBR
Quantification of Federal Reserved Water Rights for National Park Purposes	Sanders, Thomas	Civil Engr.	NPS
Using Biological Databases to Improve Biodiversity Assessments: New Methods for Geographic-based Analysis	**Wilson, Kenneth**	**FWB**	**NSF**
Inventorying & Monitoring Natural Resources	Loftis, Jim	Civil Engr.	NPS
Watershed Restoration in Degraded Pinyon-Juniper Woodlands	Redente, Edward	Rangeland Ecosystem Sci.	NPS
Do Riparian Habitat Disturbances That Alter Cross-habitat Resource Subsidies Magnify Effects of Nonnative Fish …	**Fausch , Kurt**	**FWB**	**NSF**

Title	PI	Dept	Sponsor
A Geodesic Climate Model with Quasi-Lagrangian Vertical	Randall, David	Atmos. Sci.	DOE
Ecosystem Controls on C & N Sequestion Following Afforestation of Agricultural Lands	**Paul, Eldor**	**NREL**	**DOE**
Collaborative Objectives-based Planning on the Grand Mesa, Uncompahgre & Gunnison (GMUG) National Forest	**Cheng, Antony**	**Forest Sci.**	**USDA-USFS-RMRS**
Carbon Allocation in Coniferous Forests	Smith, Frederick	Forest Sci.	USDA-USFS-RMRS
Landscape Level Assessment of Wildland Fires, Rare Species & Exotic Plants: Implications for Fuel Management	Noon, Barry	FWB	USDA-USFS-RMRS
Modeling the Effectiveness of Waterfall-Type Barriers to Upstream Movement of Brook Charr	**Myrick, Christopher**	**FWB**	**USFS**
Enhancing the Integration of Diverse Perspectives on Conserving Natural Resource Values Across Multiple Landscape Scales	**Cheng, Antony**	**Forest Sci.**	**USDA-Forest Service-Pacific NW**
Dryland Agroecosystems	Peterson, Gary	Soil & Crop Sci.	USDA-ARS
Fort Bend & Beaver/Badger Watershed Plans	Smith, Freeman	Earth Resources	USDA-NRCS
Monitoring of the Little Snake River & Tributaries	Bledsoe, Brian	Civil Engr.	3 Forks Ranch Corp.
Establishing the Status & Trends of Impaired, Threatened, & Outstanding National/State Resource Waters…	Loftis, Jim	Civil Engr.	NPS
Provide the Latest Information Technology	**Loftis, Jim**	**Civil Engr.**	**NPS**
Assessment of the Benefits & Costs of Pressurized Dual Water Systems in Colorado	**Wilkins-Wells, John**	**Civil Engr.**	**St. Vrain & Left Hand Water Cons.**
The Effects of Prescribed Burning on Stream Water	**Stednick,John**	**Earth Resources**	**NPS**

UNIVERSITY OF COLORADO, BOULDER, CO 80309
Awards for period July-August, 2001

Title	PI	Dept	Sponsor
Merging Infrared Sea Surface Temperature with Satellite Altimetry to Map Ocean Currents in Two Coastal Domains	Emery, William	ACAR	Jet Propulsion Lab
Riverware Requirements and Design Plan	**Zagona, Edith**	**CADSWES**	**DOD**
Spatial Analysis and Calibration of Glacier-Climate Relationships Across Alaska	Manley, William	IAAR	NSF
A Regional, Integrated Monitoring System for the Hydrology of the Pan-Arctic Land Mass	Serreze, Mark	CIRES	NASA
Durango Riverware Enhancements	**Zagona, Edith**	**CADSWES**	**USBR**
Hydraulic Geometry of Gravel-Bed Rivers	**Pitlick, John**	**Geography**	**USFS**
The Effects of Rainfall Exclusion on an Amazon Forest	Asner, Gregory	Geological Sci.	Woods Hole
Evaluation of Oceanic Cool-Skin and Warm-Layer Models Using Long-Term Measurements	Wick, Gary	CIRES	Univ. of WA
Requirements Definition for Modeling Systems Associated with the NASA Global Earth Satellite System	**Rundle, John**	**CIRES**	**NASA**
Community Sedimentary Model Science Plan for Sedimentology and Stratigraphy	**Syvitski, James**	**IAAR**	**NSF**
River Ware Model System Improvement	**Zagona, Edith**	**CADSWES**	**USBR**
Validation of AMSR-E Snow Products	**Armstrong, Richard**	**CIRES**	**NASA**
Detecting Future Trends in Ozone - Looking for Initial Signs of Recovery in TOMS and SBUV/2 Records	**Weatherhead, E.C.**	**CIRES**	**NASA**
Evaluatiing the Ability to Build 3-Dimensional Cloud Fields from Time-Height Observations…	**Pincus, Robert**	**CIRES**	**NASA**
Retrieval of Hydrometer Size Distributions from TRMM Field Campaign Profiler Doppler Velocity Spectra Observations	Williams, Christopher	CIRES	NASA
Spatial and Temporal Response to Anthropogenic Nitrogen Deposition in a Heterogeneous Rocky Mountain Watershed	Carrasco, David	CIRES	NASA
A High-Resolution Ablation Study Near Jakobshavan on the Greenland Ice Sheet	**Steffen, Konrad**	**CIRES**	**NASA**

Title	PI	Dept	Sponsor
Climatic Variability, Human Agency and Environmental Change Across an Altitudinal Transect, Andes-Amazon Interface…	**Barry, Roger**	**CIRES**	**NASA**
Satellite Gravity and Large-Scale Hydrology	Wahr, John	CIRES	NASA
Linking Landsat TM Data and Evapotranspiration in Two Humid Tropical Watersheds in Panama	Asner, Gregory	Geological Sci.	NASA
Snow Slope Stability: Modeling and Investigations	**Pfeffer, Tad**	**IAAR**	**NASA**
Investigations of Clouds and Aerosols in the Stratosphere and Upper Troposphere	**Toon, Owen**	**LASP**	**NASA**
In Situ Measurements of Carbon Dioxide in the Upper Troposphere and Lower Stratosphere	Avallone, Linnea	LASP	NASA
Monitoring Large-Scale Water Storage Variability in Egypt	**Wahr, John**	**CIRES**	**NSF**
Application of Sheba Data to Understanding and Simulating the Cloud-Radiation Feedback: Climate Model Perspective	Lynch, Amanda	CIRES	NSF
obilization and Transport of Particles and Particle-Associated Contaminants in the Unsaturated Zone	Ryan, Joseph	CEAE	NSF
Scaling and Allometry in River Networks--Coupling Rainfall, Topography, and Vegetation with Hydrological Extremes	Gupta, V.K.	CIRES	NSF
Patagonian Lake Drilling Project, Phase II	Markgraf, Vera	IAAR	NSF
Regional Updating and Expansion of the Global Historical Climate Network Database: High Mountain Areas of Central Asia	**Williams, Mark**	**IAAR**	**NSF**
A Bench-mark Record of Temperature for the Last 4 Glacial Cycles in Sediments of the Bermuda Rise	Lehman, Scott	IAAR	NSF
Linking Subglacial Hydrology and Sliding Dynamics Through Variations Along the Glacial Length	**Pfeffer, Tad**	**IAAR**	**NSF**
Developing a 480,000-Year Climate Record for West Antarctica	White, James	IAAR	NSF
Arctic Acoustics Monitoring for Ocean Climate Change	Naugolnykh, K.	CIRES	No. Atlantic Treaty Organization
Did the Laurentide Ice Sheet Cause Abrupt Climate Changes?	Lynch, Amanda	CIRES	Ohio State Univ.

WATER SUPPLY

As a whole, water supply conditions are better across the state than they were at this time during 2000, which was quite dry. The negative SWSI values indicate the west central and northern portions of the state are the driest areas of the state. Much of the west slope and the San Luis Valley received rain during August, which was welcome in some areas but hindered harvesting of crops in others. The summer rains have not resulted in an increase in stream flows to the extent that may have been expected, with stream flows for the most part below normal. Flows in the Rio Grande, which were well above normal during the runoff, have now dropped significantly. Both the South Platte and Arkansas basins report stored reservoir water is being used to meet much of the irrigation demand.

Basin	9/1/01 SWSI Value	Change from the Previous Month	Change from the Previous Year
South Platte	0.9	-0.7	-1.0
Arkansas	0.2	-0.1	0.0
Rio Grande	0.5	+0.4	+2.8
Gunnison	-1.7	-0.5	+0.6
Colorado	-0.6	+2.1	0.0
Yampa/White	-1.4	+0.8	+0.8
San Juan/Dolores	1.3	+2.0	+1.4

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

The Surface Water Supply Index (SWSI) developed by the State Engineer's Office and the USDA Natural Resources Conservation Service is used as an indicator of mountain-based water supply conditions in the major river basins of the state. It is based on streamflow, reservoir storage, and precipitation for the summer period (May through October). During the summer period, streamflow is the primary component in all basins except the South Platte basin, where reservoir storage is given the most weight. The following SWSI values were computed for each of the seven major basins for September 1, 2001, and reflect the conditions during the month of August.

WATER NEWS DIGEST

by Marian Flanagan

ENDANGERED SPECIES

Endangered fish climb ladder on Gunnison

When two razorback suckers navigated their way to the top of a fish ladder on the Gunnison River in August, they might have let managers of the upper Colorado River Basin off a hook that resembled the one on which the residents of Klamath Falls, Ore., found themselves. The U.S. Fish and Wildlife Service this summer cut off water to farmers in the Klamath River Valley in hopes of keeping alive endangered native fish. The action prompted an outcry that the federal government placed the lives of fish higher on the scale than the lives of people. The Grand Valley and the Klamath Valley have important similarities — both are home to endangered fish and both depend on rivers for irrigation. Price-Stubbs, built to feed water into ditches for irrigation, isn't a major supplier of water to the Grand Valley, but losing it would create a problem for agriculture in Palisade. Ute Water Conservancy District also relies on the dam to raise the river's water level enough that it can take water out for agricultural and residential customers in the Grand Valley. Ute's primary water supply is from Grand Mesa, but it uses the river intake as a backup. The backup plan, though, poses a serious impediment to the Colorado River's endangered pikeminnow and razorback, neither of which can vault the crest of the Price-Stubbs dam. Removing the dam would involve achieving consensus from the Upper Colorado River Endangered Fish Recovery Program (UCREFRP). Other complicating factors are a pending application before the Federal Energy Regulatory Commission to turn Price-Stubbs into a generator of hydroelectricity, and whitewater aficionados who see Price-Stubbs as the cornerstone of a world-class kayak course. If the fish couldn't find a way past Price-Stubbs, it would have to go, sooner or later, but if razorbacks could swim around the structure everything would change. "We just got the big question answered," said the project leader for UCREFRP. That shifts the issue from biological questions to economic issues. Barring outside considerations, it will be up to the recovery program to decide how to deal with Price-Stubbs

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GJ Daily Sentinel, 8/13/01

Consensus isn't the right way to manage fish, authors say

U.S. Fish and Wildlife Service ought to brandish its authority more frequently in the name of endangered fish in the Colorado River, says a team of scientists from the University of California, Berkeley. The scientists criticized the Colorado River Endangered Fish Recovery Program in the August issue of the journal *Conservation Biology*, along with its consensus-based management program. "The program demonstrates how consensus-based management can be exploited to circumvent the Endangered Species Act, " the authors wrote, and it "has allowed water development, but the fish seem likely to remain on the endangered-species list for the indeterminate future." The program's consensus method might be cumbersome, said Dan Luecke, director of the Environmental Defense Fund in Boulder, "but it's also resulted in changes to the way the federal government operates dams and makes available funding for fish ladders and extensive research." "The report also mischaracterizes the peril of the fish," said Frank Pfeifer, program leader for the U.S. Fish and Wildlife Service. Water developers as well as environmentalists are looking to help the fish, said Larry Clever, general manager of the Ute Water Conservancy District.

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The GJ Daily Sentinel, 8/13/01

Endangered fish coming back

Colorado River endangered fish could be restored within a quarter of a century to populations great enough that they would no longer be threatened with extinction, according to the U.S. Fish & Wildlife Service. The program is already well on the way to recovery of the Colorado pikeminnow, formerly known as the Colorado squawfish, which could be upgraded to threatened status as soon as 2006 and could be removed from the list by 2013. It could, however, take until 2020 to revive the razorback sucker and the bonytail chub. The humpback chub could be upgraded to threatened status by 2007 and removed from the list as soon as 2010, according to draft recovery goals proposed by the service. The fish, said Robert Muth, director of the Upper Colorado River Endangered Fish Recovery Program, are "indicator species" whose health is "indicative of the overall environmental health in the river system." Efforts to open up some 50-river miles above Palisade to the far-ranging pikeminnow and razorback could be crucial, requiring imitation of the species natural habitat. Recovery of the razorback will depend heavily on fish raised in Grand Junction hatcheries and stocked in the river. Upgrading the condition of the fish will require achievement of self-sustaining populations of at least 5,800 adults in the Green River and in either the upper Colorado or San Juan sub-basins over a five-year period to ensure the long-term survival of the species. The pikeminnow can be upgraded to threatened status once the self-sustaining population in the Green River exceeds 2,600 and 700 in the upper Colorado over a five-year period. Recovery of the

bonytail, which has disappeared from the upper Colorado, to threatened status will require minimum populations of 4,400 to sustain themselves over five years in the Green River and upper Colorado basins. The humpback could be listed as threatened if, for three years, the minimum viable population of 2,100 adults is exceeded. A bill by Sen. Wayne Allard last year called for additional spending of $100 million over 10 years on the fish, with $46 million to come from the Bureau of Reclamation and $54 million from hydropower revenues and the states in the Colorado River basin. The USFWS will accept comments on the draft proposal until Oct. 24.

The G J Daily Sentinel, 9/7/01

FLOODS

Study: More of Basalt is in danger of large flood

After three years of work, the town staff and consultants have results of a study that will help determine what Basalt property can be developed safely and which residents have to purchase flood insurance. The study analyzed what would happen to a two-mile stretch of the Roaring Fork River if a catastrophic flood struck and predicted bad news for specific properties if there was a 100-year flood. Basalt would incur millions of dollars of damage and possibly loss of life. Basalt has already allowed a significant amount of development in areas where the river has traditionally run in floods. Much of the property at risk is in the Southside area of town. The consultants and staff worked on a flood insurance study to be submitted to the Federal Emergency Management Agency. FEMA will review the results to determine Flood Insurance Rate Maps. The town will use the results to regulate the hazard areas. According to a lead water engineer consultant for the study, the stretch of the Roaring Fork through Basalt is "extremely unstable" and susceptible to encroachment from construction of buildings, bridges and roads. The council enacted "zero rise" regulations in May that has put several new projects on hold, maybe indefinitely.

Aspen Times, 9/11/01

RECREATION

A-Basin biologists begin fish monitoring work in North Fork

Arapahoe Basin representatives hope to go ahead with snowmaking next season, after a 5-year legal battle. Dundee Realty, which owns A-Basin, recently began preliminary work on Cinnamon Gulch as part of an agreement with Colorado Wild, one of two groups that filed lawsuits with the state 3 times to impede snowmaking at A-Basin. Concerns were about potential environmental impacts of diverting water from the Snake River's North Fork, where heavy metals from mine tailings are brought down from Peru Creek. Another part of the agreement was with Trout Unlimited (TU), whose representatives are concerned that drawing water for snowmaking out of the North Fork —a clean, healthy tributary to the Snake —will have a detrimental impact on fish habitat there. Representatives from the biological company hired by Dundee began mitigation work involving electro-fishing and keeping track of unusual occurrences on the North Fork, as compared to Deer Creek, for a 5-year study. Data will be compiled for 5 consecutive Septembers and given to TU to be published in a scientific journal. TU's concern about A-Basin snowmaking was that water would be taken from the river during traditional low-flow season, a time when fish populations were already stressed. Water diversion for snowmaking will take place from the end of Sept. through Dec. Minimal stream flows in the North Fork occur in Feb., according to the biologists. The agreement letter between Dundee, TU and all parties will be sent to the Army Corps of Engineers, which will then issue the basin a 404 permit to divert water for snowmaking.

Summit Daily News, 9/ 7/01

Reservoirs open back up to boats

The U.S. Bureau of Reclamation has reopened Ruedi Reservoir, Turquoise Lake and Twin Lakes to boating after closing them due to heightened security concerns that following the Sept. 11 terrorist attacks. Officials had concerns that large dams at those lakes might become terrorist targets and closed them as a precaution. There was no threat specific to Colorado and the USBR closed similarly-sized reservoirs across the nation. Green Mountain Reservoir, near Dillon, has also reopened to boating, said a USBR news release. All other boating closures in Colorado remained in effect, including Carter Lake and Pinewood Reservoir, in Larimer County, and Pueblo Reservoir.

Aspen Daily News / September 22, 2001

RIPARIAN VEGETATION

The San Miguel's 'Worst Weed' – *condensed from an article by Caroline Byrd, Program Director , Southwest Colorado Chapter of The Nature Conservancy*

The San Miguel River is one of the last free-flowing rivers in the Colorado River watershed. Because it has never been dammed, the river's natural processes and flows are still intact. One of the greatest threats to the health of the San Miguel's riparian habitat is the invasion of non-native species that out-compete and eventually replace the native vegetation. Tamarisk tops the list of dangerous invasive weeds. It has replaced most of the native vegetation of more than a million acres of riparian lands in the West, and scientists estimate that at its current rate of spread it will take over another million acres by 2006. One scientist estimated, back in 1970, that tamarisk sucked up as much water as two Lake Powells. Tamarisk also pulls salt out of deep soil levels and ground water and concentrates it in its small leaves. It then drops the leaves and poisons the surrounding soils with such high levels of salt that native cottonwoods and willows have no chance of germinating. Tamarisk can tolerate soil salinity up to 36,000 parts per million. It also increases the potential for fire because of the accumulation of leaf litter in tamarisk stands. While damaging to native riparian vegetation, fire is beneficial to tamarisk because it increases soil salinity and tamarisk actively re-sprouts after fire. Tamarisk chokes stream overflow and lateral channels, thus reducing the stream's abilities to handle and spread out floodwaters. Moreover, tamarisk is tremendously prolific, producing more than 100 million seeds in one season, and also sprouts new growth from existing roots. The Nature Conservancy, in partnership with the San Miguel Basin Weed Program, has embarked on an ambitious program to take out the tamarisk in the watershed. For information call TNC at 728-5291 or the San Miguel Watershed Coalition at 728-3275.

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Telluride Daily Planet, 8/29/01

WATER BANKING

Water-banking concept outlined at meeting in Buena Vista

State engineer Hal Simpson told Arkansas River water-right owners that water banking would enable them to lease their rights to others on a short-term basis. Simpson was gathering input from water-right owners and users of the Arkansas River, which was required as part of the recently passed legislation that created the water bank. Simpson outlined the thinking behind the water bank, calling it a state effort to preserve open space and give a financial boost to farmers and ranchers. A longtime rancher wondered how water banking could help area farmers and ranchers who have direct-flow rights that they use from March to October. Simpson said there is a possibility of developing a water bank that could help area water-right owners in the future. He also outlined a number of issues that need to be resolved before the water bank could begin operating on July 1, 2002. These issues include who should operate and market the bank and whether the interested parties could get the information they need from the Internet or newspapers. The meeting in Buena Vista was the first held to get public comment on the proposed water-bank regulations. Several more will be held before the rules are drafted for public comment in December and January. For information, contact Joseph Grantham, Division of Water Resources, 1313 Sherman Street, Room 818, Denver, 80203, phone (303) 866-8589. Grantham's e-mail address is jody.grantham@state.co.us.

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Pueblo Chieftain, 8/29/01

WATER DEVELOPMENT/SUPPLY

City water board hits on idea of A-LP consultant

A consulting firm would evaluate the cost-effectiveness of using water from the Animas-La Plata Project if the city of Durango accepts a recommendation from the Durango Water Commission. City residents currently have less than 10 days of water surplus should the Animas River suddenly run dry. In response, the city has budgeted $7.25 million in 2006 for a water-storage site. One proposed solution is to build a reservoir near Horse Gulch with an estimated price tag of $7.6 million. The other alternative is to partake of the $275 million A-LP Project, which will pump water from the Animas River to Ridges Basin south of Durango. The Water Commission has agreed to approach the city with the idea of hiring a consultant to determine the best scenario for utilizing water from the A-LP project while determining estimated cost for that option. Preliminary estimates show that the city could save money by buying water through the A-LP project. The Colorado Water and Power Authority has set aside more than $7.2 million for the project to be used by the A-LP district to buy 5,200 acre feet of water annually. The city of Durango has the option of taking half of that, which would cost about $3.6 million. The consulting firm could provide an unbiased, in-depth analysis, while estimating additional expenses to pay for things such as pipelines, a treatment plant and administrative costs. Consultants will pick

what they feel to be the best of the three following scenarios the city is considering: a) Build a pumping plant at Ridges Basin Reservoir, the reservoir built for the A-LP project, and run a pipeline to the city's existing reservoir, b) Build a water-treatment plant near Ridges Basin Reservoir with a pipeline from the reservoir to the plant, c) Pump water from the Animas River to a treatment plant and replace that water by draining water from Ridges Basin Reservoir back into the river three miles downstream. Based on the firm's findings, the city would then decide whether or not to share in the A-LP project. While there is no deadline for the city to make a decision, David Robbins, a lawyer and chief negotiator for the A-LP and Southwest water conservancy districts, suggested a six- to eight-month timeline.

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Durango Herald / ***September 11, 2001***

Water supply concerns expressed in unlikely places

Another dry summer in a string of drought years shows water shortages are appearing in areas that have never doubted the future of their supply. Near Chicago, a wetland has dried up in a township that gets as much rain every year as Seattle. A report by a regional planning commission says parts of six counties, in a region that borders one of the world's largest freshwater sources, Lake Michigan, could be in for serious water shortages within 20 years. Last December, federal researchers said in a report a gradually warming climate could reduce levels in the Great Lakes by 5 feet at the end of the century. They also noted that the lake levels fluctuate, regardless of climate changes. A strict agreement signed by the governors of all the states surrounding the Great Lakes and two Canadian provinces made it unlikely any new communities can tap into the fresh water. In Florida, reservoirs below and above ground are badly depleted and becoming briny with saltwater seepage. In Kentucky, more than half the state's 120 counties ran short of water or were near shortages this year before heavy rains brought relief. Major cities in the Southwest, including San Antonio, El Paso and Albuquerque, could go dry in 10 to 20 years. Hawaii is into its fourth straight year of lower-than-normal rainfall. In Montana, the Big Hole River is flowing 95 percent below normal. Hardest hit is the Klamath River basin of Northern California and southern Oregon. Nearly 200,000 acres that usually grow alfalfa, onions, horseradish, mint and potatoes are idle. Northwest power companies say the are "running on the ragged edge of being able to meet power supply needs." Regionally, the Northwest drought is shaping up as the second driest in 72 years of Northwest record-keeping. An Agriculture Department meteorologist says, however, that the Northwest drought is "something of a mystery and may be a one-year blip." Global warming is cited by many scientists as the biggest culprit in some of the emerging water shortages. Sprawl comes in for its share of blame as well, with hydrologists saying land that land that would normally soak in water and replenish aquifers has been paved over, effectively blocking water needed to refill underground basins.

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Denver Post, 8/12/01; *USA Today* 7/30/01

For Collins considers point system for allocating water

The City of Fort Collins is considering a point system for water allocation that would give preference to some farmers during surplus years. Currently, if there is a surplus – about 20,000 acre feet in an average year – it's disbursed on a first-come, first-served basis. In years when demand for the surplus exceeds supply, a lottery system is used. The point system would replace the lottery, giving preference to large, long-time agricultural operations. The Board of County Commissioners and Agricultural Advisory Board approved the point system earlier this spring. It also needs the approval of the Fort Collins City Council. The point system will be discussed by the city Water Board within the next two months. No date has been set for the council to hear the issue.

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Fort Collins Coloradoan, 8/8/01

City looks at growth's demands on water

Greeley's water situation might need to change to handle projected growth. Today, Greeley has rights to use enough water from the Rocky Mountains to serve nearly double the city's population, but the city might need to spend tens of millions of dollars to treat that much water and get it to residents' taps, because the city's aging water treatment plants are near capacity and need to be updated in coming years to meet new federal regulations. In the coming months, city officials will sort out how the city should pay for the staggering costs — the price tag for rebuilding treatment plants and adding to the pipeline capacity will be about $120 million over the next 17 years. The water department gets revenue from only two sources: one-time tap fees for builders and revenue from customers' bimonthly bills. In November the council is expected to approve a 20-year water master plan that will say how the city should handle new demands on the water system.

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Greeley Tribune, 8/01

WATER QUALITY

Waste spill kills thousands of fish in Poudre River

Thousands of fish were killed in the Poudre River near Greeley September 3 when organic matter from an unknown source flooded the water. "All the fish and some frogs were wiped out in a mile-long stretch of the river between Ash and Fern avenues," said Larry Rogstad, wildlife officer for the Colorado Division of Wildlife's Greeley north division. No one knows exactly where the organic material came from, but samples were taken from the river for testing. Most of the fish were minnows, carp and suckers; although, some game fish, including bass and sunfish, also were killed. Rogstad did not know exactly how many fish had died, along with some amphibians. Officials do know that Greeley's wastewater treatment plant was not responsible. Rogstad reported that the owner of the property who caused the discharge could face fines or a DOW civil suit, of up to $35 a fish.

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Greeley Tribune, 9/04/01

Grants will help efforts to restore Snake River

A collaborative effort to clean the mining-contaminated Snake River basin near Keystone has gained new with a $250,000 EPA grant from the Brownfields grant program. It is the first time a rural hardrock mining district has received such a grant, which is usually reserved for industrial sites in urban areas. Additionally, EPA has provided $85,000 in grants for a University of Colorado water study as well as the work of the Keystone Center, a nonprofit organization overseeing the cleanup effort. CU Professor Diane McKnight received the lion's share of the second EPA grant to continue a stream analysis. The U.S. Forest Service is providing $100,000 to survey and mark property boundaries, which have long been a source of confusion among the mining claims.

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Denver Post, 8/06/01

Deer Creek Mesa water analyzed

An analysis of high uranium levels found in 11 wells in a Jefferson County subdivision has shown that they are not caused by man-made radioactive by-products. The analysis was conducted by the Colorado Department of Health and Environment and the U.S. Environmental Protection Agency. The tests did confirm that water in most of the wells contained more uranium than what's considered safe for municipal drinking water systems. A spokeswoman for the CDPHE said uranium contamination is common in Jefferson County and other parts of the Front Range. Officials discovered that residents of a couple of homes were drinking radioactive water, and advised those residents about the results. Remedies include a filtration system that removes the minerals.

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Denver Post, 8/8/01

WATER REUSE

Water reuse plant's capacity triples

The City of Aurora has tripled the capacity of its water reuse plant as it adds to its expanse of playing fields and parks. About 150 people gathered at the plant in north Aurora Aug. 8 for the grand opening ceremony of the $11 million project. After solid waste is removed, the water is treated with microscopic bio-organisms that feed on leftover carbon-based organic waste as well as nitrogen and phosphorus-based waste, Wastewater Operations Manager Kevin Wegener said. Then the water spills into further filtration and disinfection systems. The final step of the process uses ultraviolet light for disinfection. Then, the water is pumped through miles of irrigation lines to three city golf courses. The plant is capable of treating 5 million gallons of wastewater daily and is run year-round, but water treated during non-irrigation seasons is discharged into Sand Creek. Some might wonder if it's worth it to treat water then pump it into the creek, but Packer explained that it's more efficient than shutting the plant down, which would require utilities employees to start growing the microbes again, a process that would need to start months in advance.

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Aurora Daily Sentinel, 8/ 15/01

WATER TRANSFERS

Otero County to assess value of major ditches

With a $30,000 GOCO planning grant, Otero County has hired a Denver firm to determine the value of six prominent ditches - Highline, Holbrook, Oxford, Nine Mile, Fort Lyon and Catlin. The county also is using the grant money, matched with $10,000 from the county, to begin developing conservation easements that will protect water rights. The county stands to lose 5,000 acre-feet of water and the agricultural production it supports if the proposed sale of Rocky Ford Ditch water to the city of Aurora is approved by water court. Barry Shioshita, Otero County administrator, said appraisal of the water's value and work toward conservation easements and a local land trust are part of a pro-active approach the county and its Water Works committee have taken. He said

appraisers considered comparable water sales, facts and figures from the State Engineer's office, consumptive use and cropping patterns in determining the ditches' value. "We're trying to see what the municipal or development value would be compared to the historic ag value, Shioshita said." John Rose, Water Works coordinator, said the committee grew out of a forum sponsored by the West Otero/Timpas Soil Conservation District in response to news of the proposed Rocky Ford Ditch sale. "One of the ideas was conservation easements and the establishment of a land trust. We've just about got that finished…The working name is the Arkansas Valley Preservation Land Trust." Rose said several farmers want to donate conservation easements to the trust. The easements would tie the water to the land in perpetuity. "They will be trading the development rights to the land and water for a tax credit from the State of Colorado."

The Water Works committee also is pushing for the Arkansas Valley Conduit because water quality has become so poor in the lower Arkansas Valley, federal drinking water standards have become more stringent, and treating water has become so expensive. Phase one of a feasibility study for the conduit should be complete by the end of the year. If no "fatal flaws" are discovered, phase two would get under way. Cost of the pipeline, which would deliver water from the Lake Pueblo to the lower part of the valley, is estimated at $230 million to $250 million.

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The Pueblo Chieftain, 9/2/01

MISCELLANEOUS

Fluoridation study OK'd

The Colorado Springs City Council, acting as the Colorado Springs Utilities Board, voted to postpone its decision until late November, opting instead to enlist the national Centers for Disease Control and Prevention to study the highly charged issue. Deciding when to vote on adding fluoride to the city's drinking water is becoming just as controversial and complicated as deciding whether fluoride itself poses a health hazard. It is the third time the Utilities Board has agreed to delay a decision on whether fluoride in the form of hydrofluosilicic acid should be added to two-thirds of the city's drinking supply, primarily on the north and east sides. The remaining city water is naturally fluoridated. Many cities across the country, including Fort Collins, are using the acid - an industrial waste byproduct that is extracted from fertilizer scrub stacks - to fluoridate their water. Opponents say the acid contaminates the water with a variety of metals, including lead, and that no studies have been conducted on the long-term health effects. Proponents counter that plenty of studies have been done, and when added to the water, the acid breaks down and becomes harmless. The CDC expressed an interest in carrying out the study. The agency would study three populations along the Front Range: Fort Collins, whose water has been fluoridated with hydrofluosilicic acid since 1993; pockets in Colorado Springs where the water is naturally fluoridated; and pockets where it isn't. Many dentists in Colorado Springs think the acid is safe to use.

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The Colorado Springs Gazette / September 20, 2001

Water-related film being shot in San Luis Valley

A group from Arkansas is in the San Luis Valley making a low-budget film, "Over Troubled Waters," in hopes of entering it in the Sundance Film Festival in Utah. "Over Troubled Waters," a full-length feature film, is a fictional political drama in which residents of a small Colorado town struggle to protect their underground water from exploitation by a large international water corporation. The citizens embark on a campaign to turn the nearby mountain range into a national park to protect the water permanently. The script supervisor insists the story is pure fiction. The situation in the valley "intensifies when the water corporation hires a team of professional public relations experts, spin doctors and mercenary thugs to silence the local residents and distort the facts about who they are and what they stand for. When the locals recruit a famous water rights activist to help them counter the corporate propaganda, the corporation decides that it is time to play hardball. It invokes the trade barrier rules of the World Trade Organization and North American Free Trade Agreement to overturn the U.S. Congress' decision to create a national park." The film is being made with volunteer actors.

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Pueblo Chieftain, 9/04/01

Water is literally rise and fall of Los Angeles

So much water is pumped in and out of underground aquifers in the Los Angeles area that the entire landscape rises and falls more than 4 inches each year – a finding that is unsettling the calculations of the region's earthquake hazards. The discovery is the product of a new seismic monitoring network of 250 satellite surveying stations and an orbiting imaging radar satellite. From fall to early spring, officials pump water into underground aquifers for storage, causing the land to rise. In summer months, these reservoirs slowly collapse as water is drained for summer use. Overall, the level of the water table sinks lower each year.

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www.coloradoan.com, 8/24/01

MEETINGS

12TH ANNUAL SOUTH PLATTE FORUM
October 24-25, 2001
Raintree Plaza, Longmont, Colorado

WEDNESDAY, OCTOBER 24

7:30-8:00	Registration and Continental Breakfast
8:00-8:15	Robert Ward, Director, Colorado Water Resources Research Institute
8:15-8:45	Ralph Morgenweck, Regional Director, U.S. Fish and Wildlife Service
8:45-10:00	**USE LESS, REUSE MORE** Moderator: Donna Pacetti, Denver Water Panel Jane Fisher, Denver Water Beth Conover, Headaters Consulting – Beneficial Partnerships Brent Mecham, NCWCD Automatic Sprinkler Systems
10:30-12:00	**WHAT'S IN THE WATER? A WATER QUALITY UPDATE** Moderator: Robert Sakata, Water Quality Control Commission Panel Kathryn Hernandez, EPA-Water Quality Nutrient Standard Development Cathy Tate, USGS-Water Quality in the South Platte River Basin: The Second Decade of NAWQA Phil Hegeman, Dept. of Public Health & Environment-Attainment of Water Quality Standards in the South Platte River Basin Deborah Martin, USGS-Forest Fire Sedimentation Issues
12:00-1:00	Colorado State Senator John Evans – "Water Planning Legislation"
l:15-2:45	**WELL AUGMENTATION – BALANCING THE ACCOUNT** Moderator: Tom Cech, Central Colorado Water Conservancy District Panel Hal Simpson, Colorado Division Of Water Resources-Well Augmentation in the South Platte River Basin Ray Bennett, Colorado Division of Water Resources-Colorado's Decision Support System Database and Viewing Tools Luis Garcia, Integrated Decision Support Group-South Platte Mapping and Analysis Project Jon Altenhofen, NCWCD-Managed Groundwater Recharge in the Lower South Platte River
3:15–4:20	**WATER BANKING – MAKING A DEPOSIT FOR THE FUTURE** Moderator: Harold Miskel, Colorado Water Conservation Board Panel Lawrence J. MacDonnell, Attorney-An Overview of Water Banking Representative Diane Hoppe, Colorado State Legislature-Water Banking Legislation John Wilkins-Wells, CSU Department of Sociology-Community Issues and Partnerships
4:30–6:00	Poster Session Networking Hour

THURSDAY, OCTOBER 25

7:30–8:00	CONTINENTAL BREAKFAST
8:00–8:45	Who Wants to be a Water Manager? – Bob Steger, Denver Water
8:45–10:15	Chutes, Ramps and Ladders: A Recreation Quantity Issues Panel Moderator: Paul Flack, Colorado, State Park Service Panel Dan Merriman, Colorado Water Conservation Board-Recreational In-Channel Diversions Tim Buchanan, Attorney-Reservoir Lease Negotiations: The Irrigation Perspective Joe Maurier, Colorado State Park Service-Reservoir Lease Negotiations: The Recreation Perspective
10:45-12:15	Fishable, Swimmable and Irrigatable: An Update on Recreation Quality Moderator: Jay Skinner, Colorado, Division of Wildlife Panel Rick Sandquist, Wildland Management. Services-Role of Private Recreation Related to Water and Other Conservation Issues Lori Sprague, USGS-Nutrients in Agricultural and Recreational Reservoirs John Stednick, Watershed Science, CSU-Effects of Off-Channel Water Storage on Water Quality and Recreational Opportunities
12:15–1:15	Keynote Luncheon – Russell George, Director, Colorado Division of Wildlife

Registration fee, $85 after October 1, includes proceedings, meals, refreshments and the networking hour. The forum location is the Raintree Plaza Conference Center in Longmont, Colorado, located on Highway 119 east of Twin Peaks Mall.

FOR MORE INFORMATION:
Contact Jennifer Brown
Email: southplatte@quest.net
Phone 970/213-1618, Web Address: http://southplatteforum.colostate.edu

Sponsored by: Colorado Division of Wildlife, Colorado State University Cooperative Extension, Colorado Water Resources Research Institute, Denver Water, Northern Colorado Water Conservancy District, U.S. Bureau of Reclamation, U.S. Environmental Protection Agency, U.S. Fish and Wildlife Service, and U.S. Geological Survey.

CALLS FOR PAPERS

Hardrock Mining 2002 – Issues Shaping the Industry
May 7-9, 2002 — Westminster, Colorado

Abstracts for both oral and poster presentations must be submitted by Friday, Nov. 9, 2001. Submit abstracts either by E-mail or regular mail to: Alina Martin, SAIC R-4-3, 11251 Roger Bacon Drive, Reston, VA 20190. E-mail martinali@saic.com, Phone 703/318-4678, ext. 1. Visit the EPA's website for more information at: **http://www.epa.gov/ttbnrmrl**.

2002 USSD Annual Meeting and Conference – Dams: Innovations for Sustainable Water Resources
June 24-28, 2002 — San Diego, California

The United States Society on Dams (USSD) invites abstracts related to conference theme. **Deadline: Nov. 1, 2001**. For additional information and/or abstract form contact Larry Stephens at Phone 303/628-5430, FAX 303/628-5431, E-mail stephens@ussdams.org, or visit the web site at **http://www.ussdams.org**.

Second Federal Interagency Hydrologic Modeling Conference
Theme: " Hydrologic Modeling for the 21st Century"
July 28 – August 1, 2002 — Riviera Hotel, Las Vegas, Nevada
Abstracts due November 30, 2001

BACKGROUND: The Subcommittee on Hydrology (SOH), Interagency Advisory Committee on Water Data, held the Federal Interagency Workshop on Hydrologic Modeling Demands for the 90's in Fort Collins, Colorado in 1993. That highly successful workshop was limited to Federal participants. Subsequent to that Workshop, the SOH decided to hold a broader conference and to open it to all interested parties. The conference covered models addressing surface water quality and quantity issues and was held in 1998 in Las Vegas, Nevada. That conference, the First Federal Interagency Hydrologic Modeling Conference, was also very successful. One of the needs identified in that conference was for better coordination among similar model development/support activities in the profession. To address those needs and plan for the future, the SOH decided to hold the Second Federal Interagency Hydrologic Modeling Conference, in 2002. Key issues and topics for the 2002 conference are identified below.

New observations and data for Hydrologic Modeling	Uncertainty estimates for data, parameters and results
Instrumentation to support Hydrologic Modeling in the 21st Century	Model Sensitivity Analysis and Error Estimates
Evaluation of Hydrologic Models by Regime and Climate	Advances in Model Calibration Techniques
Standards for Hydrologic Data	Remote Sensing/GIS Applications
Agency Specific Hydrologic Modeling Practices	Data Sharing Information Management Automation
Research versus Operations Needs in Hydrologic Modeling	Environmental River Management
Documenting Quality of Hydrologic Data	Flood Hydrology
Establishing Standards for the Evaluation of Hydrologic Models	Case Studies of Interagency Cooperation in Hydrologic Modeling
Error Propagation for Hydrologic Models	Modeling of Major River Systems
Identifying Model Parameters	Landscape Erosion, Sediment Transport
Sustaining River Environments	Modeling Water Quality Transport Processes
Using Models in Developing TMDL's	Modeling Dam Decommissioning

MODEL DEMONSTRATION: An evening session for up to 40 demonstrations will be offered. Individuals wishing to take part in these demonstrations will be required to furnish their own computers and software.

WORKSHOPS: Several major topics will be chosen from the subjects listed above for the development of mini-workshops. Papers will be given on these subjects; a discussion and recommendation period will follow.

SUBMISSIION OF ABSTRACTS: Federal agency authors should submit an abstract of not more than 500 words to their hydrology Subcommittee Representative (see **http://water.usgs.gov/wicp/acwi/hydrology/hydrol_members.html**). All other authors should submit their abstracts to Don Frevert or George Leavesley at the addresses below. Abstracts are due by November 30, 2001. Indicate which topic area the paper is to be considered for and whether it is to be an oral presentation or a computer demonstration or both. Authors are encouraged to submit their abstract via email. Authors will be notified of paper selection and provided with formal instructions by December 30, 2001. Final papers are due by March 30, 2002. Senior authors are responsible for obtaining approval of their papers by their organizations prior to final submission.

ORGANIZING COMMITTEE
Arlen Feldman, Conference Chair; COE, Hydrologic Engineering Center, 609 Second Street, Davis, CA 95616, 530-756-1104, Fax 530-756-8250, arlen.d.feldman@usace.army.mil; Doug Glysson, Operations Chair; USGS, 412 National Center Reston, VA, 20192, 703/648-5019, Fax 703/648-5722, gglysson@usgs.gov; Don Frevert, Co-Technical Program Chair; USBR, P.O. Box 25007 M/C D-8510, Lakewood, CO 80225, 303/445-2473, Fax 303/445-6351, dfrevert@do.usbr.gov; George Leavesley, Co-Technical Program Chair, USGS, Box 25046, MS 412, Lakewood, CO 80225, 303-236-5026, Fax 303/236-5034, george@usgs.gov

FOR ADDITIONAL INFORMATION SEE: **http://water.usgs.gov/wicp/acwi/hydrology**

STUDENT WATER SYMPOSIUM
Planning for the Inevitable
November 7-9, 2001

All CSU graduate and undergraduate students are invited to present ongoing or completed water-related coursework and research projects. The format will consist of a 10-15 minute oral presentation and/or a poster display (a full paper is not required). Awards will be given for the best presentations and posters. **The deadline for abstract submittal is 22 October 2001.** Information and abstract submittal forms can be found on the website at: **http://watersym.colostate.edu/**

The Student Water Symposium is happy to announce that Dr. Peter Gleick will be the symposium's keynote speaker. His talk, scheduled for 7:00 p.m. on Wednesday, November 7, 2001, is titled, "The Changing World of Water: New Ideas for Old Problems." Dr. Gleick is co-founder and President of the Pacific Institute for Studies in Development, Environment, and Security in Oakland, California. The Institute is one of the world's leading non-partisan policy research groups addressing global environment and development problems. Dr. Gleick is a leading expert on global freshwater resources, including the hydrologic impacts of climate change, sustainable water use, planning and policy, and international conflicts over water resources.

Oct. 24-25	WASSUP IN THE SOUTH PLATTE BASIN, Longmont, CO. Contact: Jennifer Brown, Email southplatte@qwest.net, Phone 970/213-1618. Web address: **http://southplatteforum.colostate.edu**.
Oct. 29-30	COLORADO NPS FORUM 2001. Contact the Colorado Department of Public Health and Environment at 303/692-3571 for further details.
Nov. 2	A YEAR OF CHANGE -- OPPORTUNITIES FOR THE FUTURE, Annual Cherry Creek Stewardship Partners Conference, Lone Tree, CO. Contact: E-mail partners@cherry-creek.org or see web site **http://www.cherry-creek.org**.
Nov. 7-9	STUDENT WATER SYMPOSIUM -- Planning for the Inevitable, Fort Collins, CO. Website: **http://watersym.colostate.edu/**.
Nov. 7-9	A LAKE ODYSSEY, Madison, WI. For information see the web site **http://www.nalms.org** or Email Yvonne Feabel, Chair, Host Committee at jyfeavel@execpc.com, or Phone 715/258-8034.
Nov. 11-13	NASULGC 2001, 114th Annual Meetiing, Washington, DC. Call national office at 202/478-6050, or see NASULGC website at **http://www.nasulgc.org/am2001**.
Nov. 12-13	COLORADO WETLANDS & MITIGATION BANKING, Denver, CO. Register online at **http://www.cle.com** or call 800/873-7130.
Nov. 12-15	AWRA ANNUAL WATER CONFERENCE, Albuquerque, NM. Contact: Michael Campana, AWRA, at Phone 540/687-8390 or access web site at **http://www.awra.org**.
Nov. 13-16	CONSERVATION IN A WORLD ECONOMY, 57th Annual Meeting, Colorado Association of Soil Conservation Districts, Fort Collins, CO. Contact: CASCD at Phone 303/232-6242, FAX 303/232-1624.
Nov. 16	THE ENDANGERED SPECIES WORKSHOP. Held in the Colorado Water Congress Conference Room, 1580 Logan Street, Suite 400, Denver, Colorado. Phone: (303) 837-0812, Fax: (303) 837-1607, E-mail macravey@cowatercongress.org, website **http://www.cowatercongress.org**.
Nov. 28	TROUBLED WATERS: THE DENVER BASIN RISK, Denver, CO. Contact: Phone 303/399-3173 or E-mail Jana Miller at janajane1@aol.com.
Nov. 28	USCID ENERGY WORKSHOP -- IRRIGATION WATER MANAGEMENT IN A CHANGING ENERGY ENVIRONMENT, Rapid City, SD. Contact: USCID at Phone 303/628-5430, FAX 303/628-5431, E-mail stephens@uscid, Internet **http://www.uscid.org/~uscid**.
Dec. 12	USCID ENERGY WORKSHOP -- IRRIGATION WATER MANAGEMENT IN A CHANGING ENERGY ENVIRONMENT, Rapid City, SD. Contact: USCID at Phone 303/628-5430, FAX 303/628-5431, E-mail stephens@uscid, Internet **http://www.uscid.org/~uscid**.

	2002
Jan. 27-30	CONFERENCE ON TAILINGS AND MINE WASTE '02, CSU, Fort Collins, CO. Contact: Linda Hinshaw at Phone 970/491-6081, FAX 970/491-3584, E-mail lhinshaw@engr.colostate.edu, or see website at **http://www.tailings.org**.
Feb. 22-23	8TH XERISCAPE CONFERENCE, Albuquerque, NM. Contact: Scott Varner, Xeriscape Council of New Mexico, at Phone 505/294-7791. Website **http://www.xeeriscapenm.com**.
May 7-9	HARDROCK MINING 2002 -- Issues Shaping the Industry, Westminster, CO. Contact: Lary Stephens at Phone 303/628-5430, FAX 303/628-5431, website **http://www.ussdams.org**.
June 24-28	22ND ANNUAL MEETING AND CONFERENCE, U.S. Society on Dams, San Diego, CA. Contact: Contact: Larry Stephens at Phone 303/628-5430, FAX 303/628-5431, or E-mail stephens@ussdams.org.
July 10-13	ENERGY, CLIMATE, ENVIRONMENT AND WATER -- ISSUES AND OPPORTUNITIES FOR IRRIGATION AND DRAINAGE, San Luis Obispo, CA. Contact: Larry Stephens at Phone 303/628-5430, FAX 303/628-5431, Email stephens@uscid.org. Internet: **http://www.uscid.org/~uscid**.
July 23-26	INTEGRATED TRANSBOUNDARY WATER MANAGEMENT, Traverse City, MI. For further details, access the web site at **http://www.uwin.siu.edu/ucowr/**. To receive futhre announcements, Email ewri@asce.org or ucowr2002@siu.edu, or call UCOWR headquarters at 618/536-7571.

The **AGU Hydrology Days 2002** will be held at Colorado State University during April 1-4, 2002. Hydrology Days is a unique celebration of multi-disciplinary hydrologic science and its closely related disciplines. The Hydrology Days vision is to provide an annual forum for outstanding scientists, professionals and students involved in basic and applied research on all aspects of water to share ideas, problems, analyses and solutions. The focus includes the water cycle and its interactions with land surface, atmospheric, ecosystem, economic and political processes, and all aspects of water resources engineering, management and policy.

For detailed information about the Year 2002 edition of Hydrology Days please point your web browser to our web page at the following URL address: http://hydrologydays.colostate.edu/

The web page also provides information about on-line registration, and on-line submission of abstracts and papers. Please share this invitation with your students and colleagues and encourage them to participate.