



COLORADO WATER

Newsletter of the Water Center at Colorado State University

JUNE 2001

***Spring storm doesn't dampen attendance at Colorado Streamgaging Symposium held May 3, 2001, in Breckenridge, Colorado
See Page 16***



Clockwise from top left: Bill Horak, USGS Colorado District Chief; Hal Simpson, State Engineer, with Scott Tucker, Urban Drainage and Flood Control District; Paul Weiss, Riverside Technology, Inc.; and Chris Rowe, Colorado Watershed Assembly

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Knowledge to Go Places

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Writers: Marian Flanagan and Michael Blackledge

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

INTERNET SITES

Colorado Water Resources Research Institute <http://cwrri.colostate.edu>
 CSU Water Center <http://watercenter.colostate.edu>
 South Platte Forum <http://southplatteforum.colostate.edu>
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THE NEXT COLORADO WATER MANAGERS

Editorial by Robert C. Ward, Director

Operation of Colorado's water management system depends upon the efforts of many well-educated and experienced water managers. The Upper Yampa Water Conservancy District (UYWCD) has recently taken actions to ensure that the cadre of excellent Colorado water managers continues well into the future.

The 2001/02 recipient of the UYWCD Scholarship is announced below. With creation of this new scholarship, the UYWCD is supporting the education of future Colorado water managers in a very direct and meaningful way. John Fetcher, manager of the UYWCD, has been instrumental in establishing the scholarship and working with the CSU Water Center to establish operating policies and procedures.

I want to publicly thank the Board of Directors of the UYWCD for their support of students seeking careers in water. Having worked in the university for many years and watched high school graduates transform themselves, with a college education and work experience, into today's water managers and leaders, I can vouch for the satisfaction that comes from supporting a young person seeking a career in water. I trust the UYWCD Board of Directors gains satisfaction in watching the students it supports develop into tomorrow's Colorado water leaders.

Water organizations, such as the UYWCD, have many pressures on limited financial resources. When money is carved out of their budget to support a scholarship, you know it is a commitment not made lightly. Every effort is made to honor the UYWCD wishes with respect to awarding the scholarship and updates on the recipient's activities and accomplishments will be provided. If other water organizations wish to support a scholarship for a college student planning a career in water, please contact me at (970) 491-6308 or Robert.Ward@Colostate.edu.

UPPER YAMPA WATER CONSERVANCY DISTRICT FUNDS 'WATER' SCHOLARSHIP

The Upper Yampa Water Conservancy District will fund a new, \$2500 scholarship at Colorado State University for the next school year. The one-year scholarship, administered by the CSU Water Center, was established to provide financial assistance to committed and talented juniors who are pursuing a water-related career in any major at CSU. Selection criteria for the scholarship required that the recipient be a full-time student enrolled at CSU; allowed for consideration of financial need, gave preference to students from the Yampa Valley; and required a minimum Grade Point Average of 3.0.

The recipient of the 2001/2002 Upper Yampa Water Conservancy District Scholarship is Joshua Duncan, a junior in Civil Engineering, who is planning a career in hydraulic engineering and water resources. Joshua plans to seek a Masters degree upon completion of his BS degree in May 2002 and then work toward obtaining his professional engineering license.

Joshua is a graduate of Brighton High School with family connections to the Yampa Valley. He maintains a 3.49 GPA and has been active in student professional organizations. For example, he is a student member of the National Society of Professional Engineers, treasurer of the CSU American Society of Civil Engineers Student Chapter, and a member of the CSU Concrete Canoe Team. Joshua enjoys tennis and fishing and plans to be married this summer.

Right: Robert Ward, CSU Water Center Director, congratulates Joshua Duncan, recipient of the 2001/02 UYWCD Scholarship



RESEARCH



INSTITUTIONAL ADJUSTMENTS FOR COPING WITH PROLONGED AND SEVERE DROUGHT IN THE RIO GRANDE BASIN

The following is a summary of an interdisciplinary, interstate research project conducted by the New Mexico Water Resources Research Institute, the Texas Water Resources Institute, and the Colorado Water Resources Research Institute through the U.S. Geological Survey National Grants Program.

Frank A. Ward, New Mexico State University
Robert Young, Colorado State University
Ronald Lacewell, Texas A&M University
J. Philip King, New Mexico State University
Marshall Frasier, Colorado State University
J. Thomas McGuckin, New Mexico State University
Charles DuMars, University of New Mexico
James Booker, University of Colorado
John Ellis, Texas A&M University
Raghavan Srinivasan, Texas A&M University

The Rio Grande originates in the southern Colorado Rocky Mountains, flows through New Mexico, and forms the border between the U.S. and Mexico on its way to the Gulf of Mexico. It serves over one million acres of irrigated and the municipal and industrial needs of cities like Albuquerque and El Paso. In 1938, Congress approved the Rio Grande Compact, which divided the annual water flow among the three states of Colorado, New Mexico, and Texas.

The U.S.-Mexico Treaty of 1906 divides the river flows between the U.S. and Mexico. The Rio Grande Compact acknowledges the Treaty in Articles IV and VI by stating that the Compact shall not diminish the allocation of water to Mexico and shall not degrade its quality.

Since that time, significant growth in the Rio Grande Basin's demand for water due to increasing populations, growing economies, and emerging policies toward fish and wildlife habitat emphasizing endangered species, has stressed

the region's already scarce water supply.

Although the inevitable severe drought would cause significant economic damage to the regional economy, present institutional arrangements have not had to confront such an event since the 1950s. This research project tested the hypothesis that new institutions for interstate coordination of surface water withdrawal and reservoir operations could reduce economic losses resulting from water shortfalls in periods of severe and sustained drought. A three-state research team (New Mexico, Colorado and Texas) of economists, hydrologists and a lawyer was formed to perform the analysis to test this hypothesis. A fully-integrated hydrologic-economic model was developed that extends the basin optimization procedures developed for California (Vaux and Howitt) and the Colorado River Basin (Booker and Young). The geographic scope included the Rio Grande Basin, from Colorado through New

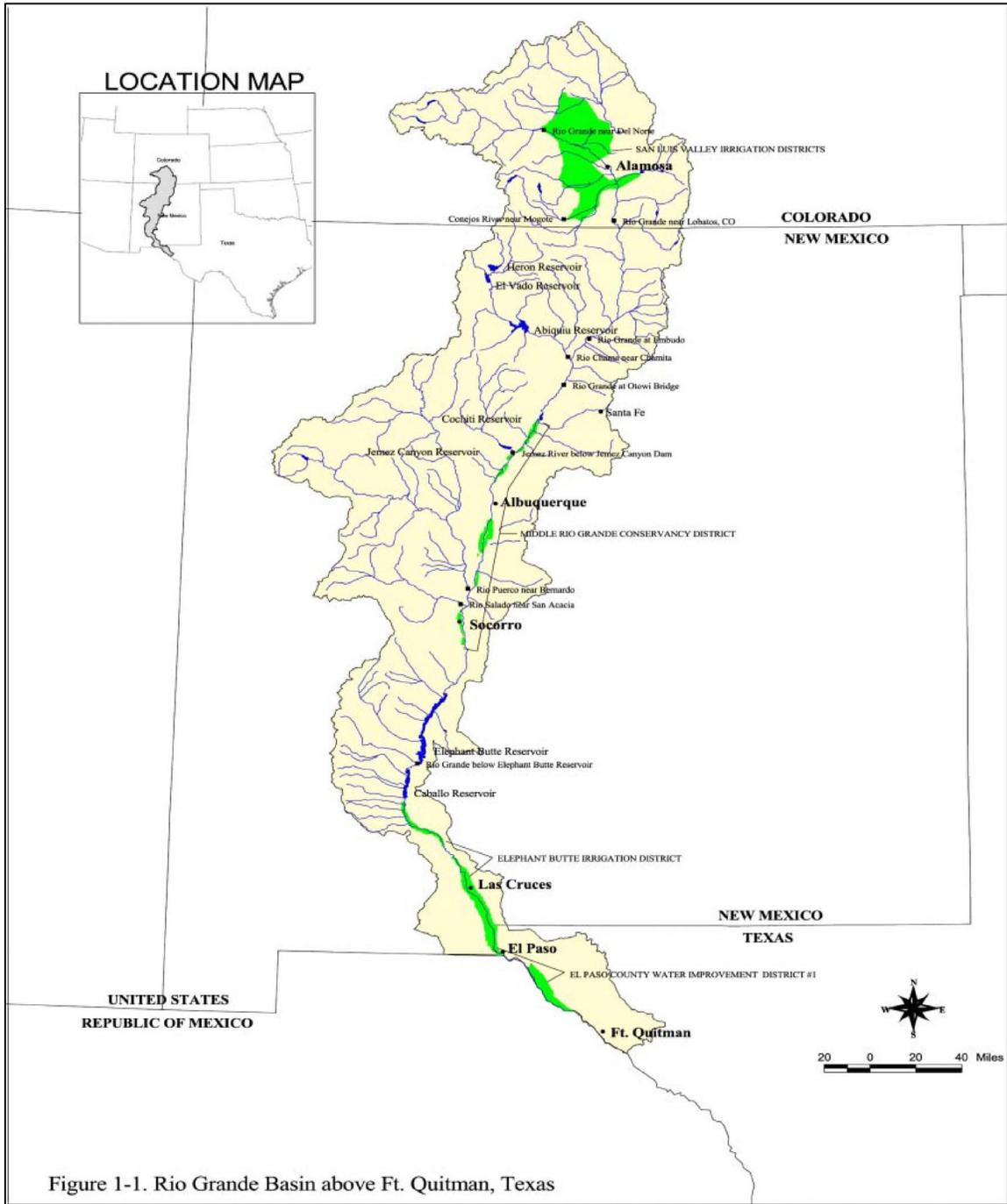
Mexico, to Fort Quitman, Texas downstream of El Paso (See Fig. 1-1).

The general approach used in this study reflected the random supplies and uncertain demands for water, and also reflected river and reservoir management rules resulting from economic growth, and competing demands for water to meet future needs such as endangered species habitats. Water supplies were represented in a yearly time-step over a 40-year planning horizon, including all major tributaries, interbasin transfers, and hydrologically connected groundwater.

Agricultural water uses, the major source of water demands, were split into major crops for four major demand areas. Municipal and Industrial (M&I) and recreational demands were also identified. Separate economic values were identified for each water use at each major location.

Information on the economic value of each water use at each location





provides important facts to decision makers who wish to know impacts of complex proposals whose implementation affects several uses at many locations. A mathematical model was developed that kept track of economic benefits subject to hydrologic and institutional constraints, and was solved with GAMS optimization software. (The technical completion report for this project includes a CD Rom with the GAMS Code for five supportint Models. Each is a stand-alone model that runs with GAMS software).

Each institutional innovation considered was tested against the baseline Law of the River, the current set of rules for storing, allocating, and using water in the basin. Each proposal was tested for its impact on reducing total economic damages under a future, long-run drought scenario defined by inflows produced by the drought of the 1950s. Results are presented as economic and hydrologic impacts of measures for coping with drought by state, economic sector, and institutional alternative.

One baseline and three alternative institutional innovations were selected for evaluation. The baseline Law of the River focused primarily on the Rio Grande Compact and related rules for allocating the total quantity of water entering the Rio Grande Basin and available for use. Total economic benefits were calculated for long-run normal inflows, and a sequence of drought inflows, defined by historical inflows for the period 1942-1985. This period was chosen to represent the severe drought of the 1950s bound by the years leading up to and following that drought. The period was extended to 1942 and 1985 because

spills occurred in these two years, wiping out accrued debits and credits under the Compact. For that period, average inflows summed over six headwater stream gates used for this study were 1.40 million acre-feet per year, about 11 percent below the long-run average of 1.57 million.

Total drought damages were computed as the reduction in future economic benefits if future inflows to the basin averaged 1.40 million acre-feet per year compared to economic benefits if inflows averaged 1.57 million. Future economic activity is based on best available estimates for growth in M&I use based on projected growth of the Albuquerque and El Paso areas.

Long-run annual average future drought damages, defined as the direct economic value of damages caused by the reduced streamflows to water users, were estimated at \$5.8 million for the San Luis Valley (Colorado), \$3.37 million for New Mexico, and \$8.0 million for west Texas, or about \$101 per acre-foot of water supply reduction. Indirect economic impacts, resulting from interactions among drought-damaged water users and the rest of the economy, were not measured.

First Institutional Adjustment

The first institutional adjustment analyzed was increased carryover storage at Elephant Butte Reservoir. This carryover storage was based on reducing the Rio Grande project deliveries downstream of Elephant Butte by 25,000 acre-feet per year in normal years, to be stored for use in drought years. The long-run average annual economic value of drought damages mitigated by this institutional change was zero for Colorado, minus \$200,000 for New Mexico, and minus \$433,000 for

west Texas. This means that the current Law of the River produces less drought damage than the proposed institution of storing the added water at Elephant Butte.

Second Institutional Adjustment

The second institutional adjustment analyzed was a proposal to invest in technical measures to increase irrigation efficiency for the Middle Rio Grande Conservancy District, in which net stream depletions required for application to crops would be reduced by 18 percent. This institutional change produced virtually zero drought damage mitigation to each of the three states. Reduced water diverted from the Rio Grande brought about by greater irrigation efficiency would also considerably reduce irrigation return flows to the river. The result would be virtually zero water saved and essentially zero economic benefit. Zero drought damage mitigation benefits accrued to Colorado, \$7,000 per year to New Mexico, and \$15,000 to West Texas. The cost of technologies needed to implement these increased irrigation efficiencies would have to be virtually zero to justify such investments economically.

Third Institutional Adjustment

The final institutional adjustment analyzed was to build 100,000 acre-feet of new reservoir storage in northern New Mexico above Cochiti Lake. This action produced zero long-run average annual benefit to Colorado, \$134,000 to New Mexico water users, and \$685,000 to West Texas water users. The bulk of these benefits would result from reduced reservoir evaporation and reduced Rio Grande Compact over-deliveries by New Mexico to Texas.



The authors noted that although the model developed for this study was comprehensive and detailed, one special area where further

improvement is needed is to develop a better understanding and modeling of connections among economics, surface water

movement, groundwater hydrology, and behavior of water users.

Acknowledgments

This research project received cooperation among model developers and the Water Resources Research Institutes and Agricultural Experiment Stations of Colorado, New Mexico, and Texas. It also received the assistance of the following people who served on the project Advisory Council.

COLORADO – Dr. Robert Ward, Director, Colorado Water Resources Research Institute, Mr. Ralph Curtis, General Manager, Rio Grande Water Conservancy District, Mr. Allen Davey, Davis Engineering Services, Mr. Leroy Salazar, Agro Engineering Inc., Mr. Steve Vandiver, Colorado State Engineer's Office, and Mr. Hal Simpson, Colorado State Engineer.

TEXAS—Dr. Wayne R. Jordan, Director, Texas Water Resources Institute, Mr. Darron Powell, Engineer Advisor to Texas Rio Grande Compact Commissioner, Mr. Herman Settemeyer, Texas Natural Resource Conservation Commission, Mr. Ed Archuleta, General Manager, El Paso Water Utilities, Mr. Mike Fahy, Director, El Paso Water Utilities, Dr. Ari Michelsen, Director, El Paso Agricultural Research and Extension Center, Mr. John M. Bernal, Commissioner, International Boundary & Water Commission, Mr. Edd Fifer, General Manager, El Paso Water Improvement District No. 1, Mr. Wayne Halbert, General Manager, Harlingen Irrigation District, Mr. Mike Personett, Director, Texas Water Development Board, Ms. Cindy Martinez, Rio Grande Watermaster, Mr. John Keiser, South Texas Development Council, Mr. Amando Garza Jr., Executive Director, South Texas Development Council, Dr. Paul Dyke, Director, Blackland Research Center, Mr. Gordon L. Thorn, Texas Water Development Board.

NEW MEXICO – Dr. Tom Bahr, Director, and Dr. Bobby Creel, Associate Director, New Mexico Water Resources Research Institute, Mr. Tom Turney, New Mexico State Engineer, Mr. Gary Daves, City of Albuquerque Public Works, Mr. Gary Esslinger, Elephant Butte Irrigation District, Mr. Subhas K. Shah, Middle Rio Grande Conservancy District, Mr. Steve Hansen, U.S. Bureau of Reclamation, Mr. Dick Kreiner, U.S. Army Corps of Engineers, Mr. Russ Livingston, District Chief, and Dr. Mike Kernodle, U.S. Geological Survey, and Mr. Jeff Whitney, U.S. Fish & Wildlife Service.

The complete report, *Institutional Adjustments for Coping With Prolonged and Severe Drought in the Rio Grande Basin*, can be downloaded at the following website: <http://wrri.nmsu.edu/publish/techrpt/tr317/downl.html>

Virtual Rivers: Lessons from the Mountain Rivers of the Colorado Front Range, by Ellen Wohl, has just been published by Yale University Press. Sparsely settled mountain areas of the world, such as Colorado's Front Range, give the impression of wild, untouched, and unchanging nature. Yet in many cases mountain rivers that appear to be pristine natural systems have actually been impaired as a result of human activities. In this timely and accessible book, Wohl, Professor of Earth Resources at Colorado State University, documents 200 years of land-use patterns on the Front Range and their wide-ranging effects of river ecosystems. If we hope to manage river resources effectively and preserve functioning river ecosystems, the author warns, we must recognize how beaver trapping, placer mining, timber harvesting, flow regulation, road and railroad construction, recreation, cattle grazing, and other human activities have impaired rivers - and continue to do so. Wohl underscores the importance of distinguishing between the form, or physical appearance, of a river and its function, which encompasses physical and chemical processes as well as biological communities associated with the river. Land-use patterns affect both the form and function of the rivers of the Colorado Front Range, as they do other mountain rivers, yet these effects are little-recognized or understood. The book also includes a generous selection of striking historical and contemporary photographs, maps, and diagrams that provide a fresh perspective on the extent to which the rivers of the Colorado Front Range have undergone change during the last two centuries. **Virtual Rivers** can be ordered through book stores or directly from Yale University Press at www.yale.edu/yup. (ISBN 0-300-084849; list price \$35).



A CONTINUOUS FLOW METHOD FOR RAPID MEASUREMENT OF SOIL HYDRAULIC PROPERTIES

by *Dr. Greg L. Butters*
Department of Soil and Crop Sciences

Abstract: Soil hydraulic properties are important in many soil processes but the measurement of these properties is usually tedious and often difficult. A continuous flow method is described which allows very rapid and accurate measurement of hydraulic conductivity ($K(h)$) and moisture retention ($\theta(h)$) functions including hysteresis. The method employs simultaneous tensiometry and water flow measurements which are easily automated. The analysis uses a combination of direct Darcian analysis and numerical inversion of Richards' Equation for estimation of the hydraulic properties. This combination allows for estimation of wetting and/or draining $K(h)$ and $\theta(h)$ over the entire tensiometer range of measurement while retaining the physical significance of the hydraulic parameter estimates.

Introduction

Water flow and retention in soils is of fundamental importance to soil scientist, agronomist, and hydrologists and is a critical element in assessing the environmental implications of soil management. Regardless of your perspective, be it crop production, ecology, or waste management, soil water retention and movement are among the most important properties of the soil resource. Indeed, pardoning the soil physicists bias, in as much as the potential energy-water content relationship ($\theta(h)$) embodies the effects of total porosity, pore-size distribution, and soil texture, its characterization has broad application and is as close as we come to "finger-printing" the soil. However, this finger-print is ever changing. In natural systems, the rate of change may be slow and resulting, for example, from root-growth alterations of the pore-size distribution. In disturbed soil, changes can be dramatic. Tillage, for example, affects an immediate change followed by gradual "recovery" as the soil reconsolidates (though it may take years to reach the pre-disturbance characteristics).

Given their importance, it is not surprising that measurement of the two key hydraulic properties, $\theta(h)$ and the conductivity-potential energy relationship, $K(h)$, has been the subject of a great deal of research. Direct (Klute, 1986) and indirect (van Genuchten et al., 1992) laboratory and field methods abound in the soils, hydrology, and engineering literature. It is generally conceded that measurement of $K(h)$ and $\theta(h)$ is typically time consuming and usually difficult. Recently, advances in numerical techniques have increased the attractiveness of so-called inverse methods. In this approach, the $K(h)$ and $\theta(h)$ are not explicitly measured, but instead are implicitly deduced from a the water flow response observed when a soil is perturbed in a well defined way. For example, if we assume that Richards'

Equation is accurate as the governing flow equation, we could easily predict the water flux from a soil resulting from a defined water pressure change provided $\theta(h)$ and $K(h)$ were known (this is called the direct problem). In the inverse approach, we observe the water flux resulting from a defined pressure change and by a least-squares numerical iteration (a fancy form of trial and error) answer the question, "What $\theta(h)$ and $K(h)$ would give us the observed response?". Kool and Parker (1988) showed the promise of the technique but cautioned potential users that determining unique representations of $K(h)$ and $\theta(h)$ could be a serious limitation. Later, van Dam et al. (1992) and Eching et al. (1994) showed that including both water flux data and soil water pressure data (not just at the soil boundary) as well as conducting the experiment in a series of small steps over a few to several days reduced the uniqueness problems in identifying $\theta(h)$ and $K(h)$. An unresolved limitation was that the method was not reliable near saturation and hence the parameters of the estimated $K(h)$, in particular the saturated hydraulic conductivity (K_s), were fitting values and may not be physically relevant.

The purpose of this research is to develop and apply a measurement technique for $\theta(h)$ and $K(h)$ that is more rapid and more accurate than existing methods. Specifically, the method outlined here can be used to measure both draining and wetting $\theta(h)$ and $K(h)$ over the tensiometer range of soil water potentials (including saturation). Since this continuous flow technique does not employ equilibrium steps, it is uncommonly rapid. Complete characterization of $\theta(h)$ and $K(h)$ over the tensiometer range of soil water potentials, including hysteresis, can be accomplished usually in two days or less.



Experimental Design

The laboratory design for a continuous flow measurement (Fig. 1) consists of three basic elements; a gas phase barrier (ceramic or membrane plate) in contact with a pressure controlled reservoir, tensiometry to monitor soil water pressures at the boundaries of the soil, and a balance to monitor water flow (indicated by changes in weight). The automated data acquisition is not a necessity but it is strongly recommended. The most interesting aspect of the experimental design is the air pressure manipulation of the reservoir head-space. This is the key to initiating flow in the soil sample. Changing the air pressure in the reservoir is analogous to changing the elevation of the free water surface and the rate of air pressure change controls the rate of draining or wetting of the soil. By adjusting the speed of the air-pump to the reservoir, the design allows a great deal of versatility in controlling the rate of draining or wetting and the selection of turning points for reversing the process.

In a typical experiment, we begin by selecting the soil water potential (in the tensiometer range of operation) at which to initiate wetting or draining. For example, suppose the soil sample of length L is saturated and allowed to drain to equilibrium with the free water surface at the elevation of the plate. In this case, the initial soil water potential (in head units) is $-L/2$ at the mid point of the sample and further drainage is initiated by lowering the air pressure in the reservoir. While decreasing the air pressure at a desired rate (e.g. 1 cm/min), the lower and upper boundary soil water pressures are recorded (typically at a 1 min interval) as is the change in weight of the soil sample. The drainage is allowed to proceed to the desired potential ($h > -700$ cm). Wetting the sample may then proceed by reversing the air pump to the reservoir and slowly increasing the air pressure. The process (draining or wetting) may be reversed at any point, allowing recovery of drainage and wetting hydraulic functions, as well as the scanning curves connecting these functions.

Analysis

The data collected as described above may be analyzed by a combination of direct and inverse methods. Provided the soil sample is short ($L < \text{about } 5 \text{ cm}$) and the rate of pressure decrease at the lower soil boundary is modest ($< \text{about } 1 \text{ cm/min}$), the data collected near saturation (draining or wetting) can be used in for a direct calculation of $\theta(h)$ and a direct calculation of $K(h)$ by Darcian analysis. The key elements here are the tensiometry at the boundaries of the sample yielding the average h of the sample and potential gradients, while

simultaneously the weight of the sample yields the average water content and the change in weight indicates the flux across the lower soil boundary. The determination of physically based K and θ data near saturation sets these parameters in the inverse analysis required for the remainder of the data. The inverse analysis is easily accomplished using Hydrus-1D, a computer code available from International Ground Water Modeling Center, Golden, Colorado. For this application, Hydrus-1D performs an inverse numerical analysis of Richards Equation. Inputting the observed tensiometry and flow data (that is, the lower boundary perturbation, $h(0,t)$, and the response pressure $h(L,t)$ and response flow $q(0,t)$) Hydrus1-D returns a minimum sum of squares optimized $K(h)$ and $\theta(h)$ for the soil.

Example Results

Figure 2 illustrates the results of applying the continuous flow method to measuring $\theta(h)$ of a Weld loam. The markers in the figure (circles for drainage data, triangles for wetting) are the results of a traditional pressure plate analysis requiring several weeks of measurement. The continuous flow method results (indicated as solid line for draining, dashed for wetting) are in excellent agreement with the main draining and main wetting branches of $\theta(h)$. In this analysis, the saturated water content (θ_s) was measured independently and provided as an anchoring point for the inverse estimation of $\theta(h)$. This is strongly recommended for retaining a physically realistic θ_s . Since the continuous flow experiment for this example only covered a range $-500 < h < 0$, secondary measurement or approximation of θ at low h is required if one wishes to extend the $\theta(h)$ to the dry soil region. The Hydrus-1D code provides a library residual water content estimates based on texture which might be used in absence of a measurement.

A second example (Figure 3) highlights the accuracy of the characterization of the hydraulic properties using the continuous flow technique. In this case, the hydraulic properties of a Weld loam soil core were measured but followed an independent transient flow experiment wherein the soil was subjected to series of irrigations of irregular duration and timing. The objective was to test if the measured $\theta(h)$ and $K(h)$ would accurately predict soil water pressure and drainage of the second experiment. The prediction was accomplished using Hydrus-1D to solve Richards' Equation as a direct problem. The outstanding predictions of both the soil water pressure and drainage indicated in Figure 3 support a high degree of confidence in the characterization of the hydraulic properties using the continuous flow approach.



Figure 1. Schematic of continuous flow measurement experimental design

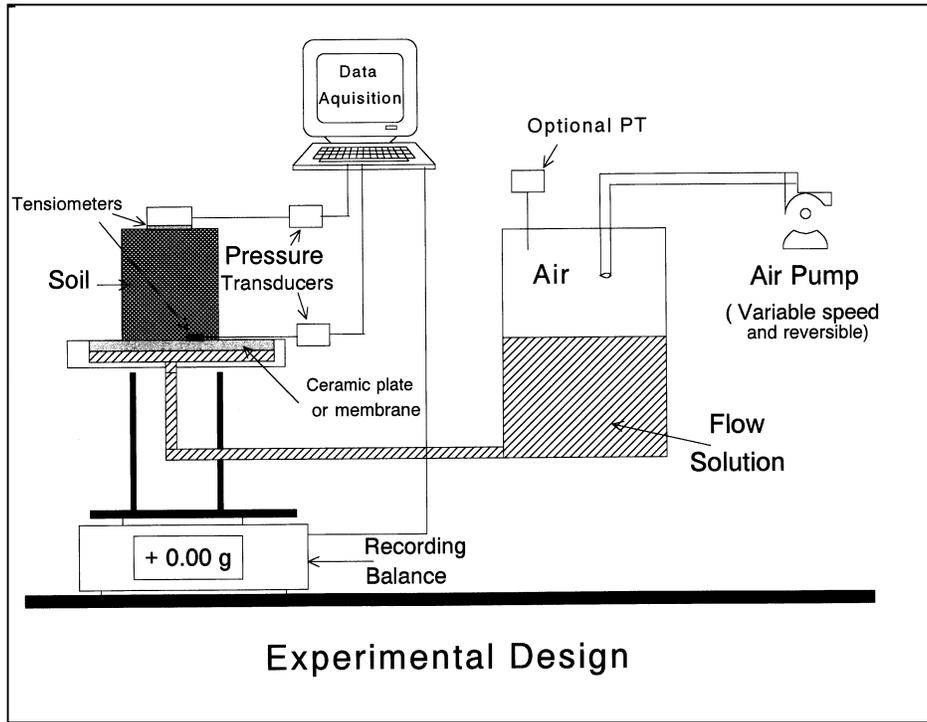


Figure 2. Soil water retention curves for a weld loam comparing results from the traditional pressure-plate technique and the continuous flow approach.

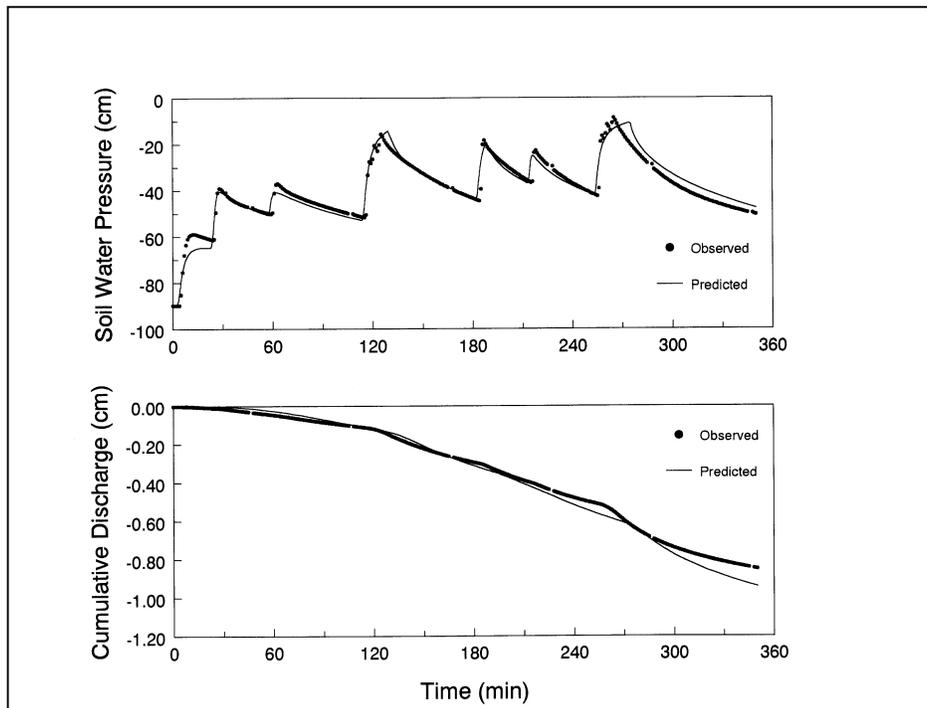
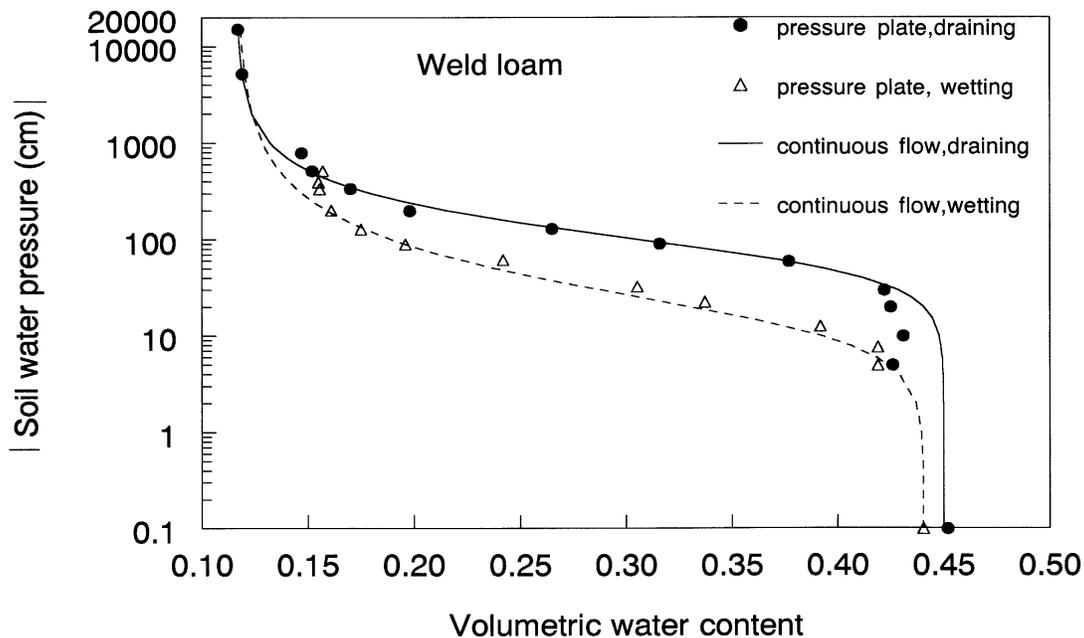


Figure 3. A transient flow experiment in a Weld loam soil core ($L=7.5$ cm) with measurement of soil water pressure at $z=5$ cm (upper figure) and cumulative drainage (lower figure). Irrigation at 0.5 cm/min was applied through needle drippers at the soil surface. The variable timing and duration of the irrigation is suggested by the sudden changes in h in the upper figure. Throughout the experiment, the lower boundary was held at a constant pressure ($h=-90$ cm).



Discussion

The continuous flow method for estimation of soil hydraulic properties is an attractive alternative to traditional methods. This approach combines the benefits of direct analysis, that is, physically based parameter estimates, with the elegance of inverse computation. In essence, the direct analysis anchors the $\theta(h)$ and $K(h)$ at θ_s and K_s while the inverse analysis recovers the shape parameters of the hydraulic functions. In addition to its apparent accuracy, the continuous flow method is fast. The hysteretic $\theta(h)$ in Fig. 2 and the hysteretic $K(h)$ and $\theta(h)$ used for the predictions in Fig. 3

each required less than two days of experimental effort, most of which was automated. The primary limitation of the method as described here is the operational range of the tensiometers. Though the data collected can be supplemented with secondary measurements to extend the range of $K(h)$ and $\theta(h)$ representation, in general the method is not suited to measurements in dry ($h < -700$ cm) soil. However, this limitation is not severe for many applications and, given the promising results of the laboratory investigations, application of the continuous flow method to in-situ field measurements cannot be far behind.

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HIGHLIGHTS OF COLORADO STATE FOREST SERVICE STATE AND REGION-WIDE FOREST PRODUCTS UTILIZATION AND MARKETING PROGRAM

by

*Tim Reader, Utilization & Marketing Forester
Colorado State Forest Service*

We face very challenging times within the Colorado State Forest Service. We are confronting new challenges with a combination of traditional and developing programs that have tremendous potential to positively impact water quality and other natural resources, as well as the quality of life of the communities we serve. One of our newest priorities is to improve the utilization and value of our local and regional timber resource. Where traditional timber harvesting focused on larger-diameter trees of high quality and consistent supply, contemporary forest management priorities now favor removal of trees that are of a lower quality and smaller in size.

Whether through fuels reduction treatments in our urban-wildland interface, forest restoration activities, or conventional timber harvests, today's wood removals present a major utilization and marketing challenge to our state and regional forest products industry. In response, the Colorado State Forest Service has established both a state and region-wide forest products utilization and marketing program. In cooperation with the Four Corners Sustainable Forests Partnership, the Colorado State Forest Service is now able to provide technical assistance and support, and applied research to forest product industries in Colorado, New Mexico, Arizona, and Utah. Highlights of our efforts are presented below.

Utilization of Wood Residues

One approach to improving utilization and value of our forest resource is to develop new markets for the wood residues that are generated during conventional sawmilling operations. Conventional sawmill manufacturing converts only two-thirds of a log into primary wood products such as lumber. The remaining one-third of the log volume is "lost" in the form of sawdust, shavings, slabs, edgings, trim, and bark. Utilization and marketing of these residues is a significant challenge for most of our regional sawmills. In response, several projects are underway in the Four Corners Region. In southwestern Colorado, a small pilot study has demonstrated the potential of composting sawdust with municipal and agricultural wastes (Figure 1). Wood residues from sawmill operations when properly composted can be marketed bagged or in bulk for a number of residential and commercial soil amendment applications. A southwestern Colorado sawmill has recently adopted composting as part of their operation as a direct result of our demonstration pilot project and local marketing study.



Figure 1. Composting wood, municipal, and agricultural residues in Cortez, Colorado.

As an alternative to composting, a northern New Mexico forest products manufacturer has developed a process that combines wood residues and waste plastics into a composite board product used for exterior signing applications. Product and market research through our utilization and marketing program has also demonstrated the suitability of aspen and white-fir wood residues as a bedding material for animal research laboratories. A study by Department of Forest Sciences researchers Dr. Kurt Mackes and Dr. Dennis Lynch has found a potential to realize three to four times the value of traditional animal bedding markets. A small sawmill in northern Arizona has begun to take advantage of this new market opportunity based on this research.

Value-Added Manufacturing

Our forest products utilization and marketing program has also increased the application of value-added wood products manufacturing and marketing. Greater wood-product values are a necessity to offset the increased costs of contemporary forest management treatments. An example is illustrated in Figure 2 that shows a clear (knots have been cut out), finger-jointed and edge-glued panel manufactured from pallet quality ponderosa pine lumber from a southwestern Colorado sawmill. This pallet quality lumber had previously had limited local product and market value and in many cases was shipped (at a loss) to pallet producers in Phoenix, Arizona, and Albuquerque, New Mexico. The adoption of local value-added processing now allows what was once a low value product to compete in higher value local molding and millwork markets, as fascia and soffit stock for roofing applications, and for a local countertop manufacturer.



Figure 2. - Clear (no knots), finger-jointed and edge glued ponderosa pine.

A particular benefit of this project was the performance of a small-scale de-humidification dry kiln (Figure 3). The de-humidification dry kiln removes moisture through condensation rather than venting as in a conventional dry kiln. This can result in lower drying costs. On a larger scale, a western slope sawmill has begun to commercially adopt a similar edge-glu procedure specifically tailored to economically processing small diameter aspen.

Dip-Diffusion Wood Preservation

Our greatest response from industry has been to our research on dip-diffusion wood treatment as an alternative to conventional pressure treatment. Workshops and follow-up on-site treating demonstrations have been held throughout the Four Corners region (figure 4). Findings from our research suggest a potential to treat green (wet) wood through a diffusion process to a level of preservative penetration and retention comparable to conventional pressure treating. Treatment effectiveness, lower start-up costs, and a reduced level of regulatory compliance are the principal advantages of diffusion treatment over traditional non-pressure, and pressure treating methods. Commercial adoption of this innovative treatment process is a high priority for this year's utilization and marketing program.



Above: Figure 3. Ponderosa pine lumber being dried in a small de-humidification dry kiln in Lewis, Colorado.

Right: Figure 4. Ponderosa pine posts being treated using the dip-diffusion wood preservative treatment process in Eager, Arizona.

For further information on both our state and regional forest products utilization and marketing program contact:

Tim Reader
Utilization & Marketing Forester
Colorado State Forest Service
Durango, Colorado
(970)247-5250
treader@fone.net
www.fourcornersforests.org



MEETING BRIEFS



3rd GRADERS GET WET AT CHILDREN'S WATER FESTIVAL

by

Marian Flanagan



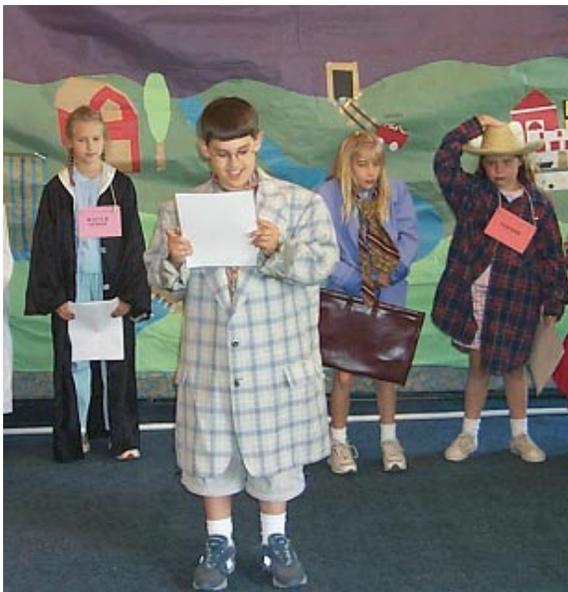
Seventeen hundred 3rd graders from area schools visited CSU on May 22nd for the 10th ANNUAL CHILDREN'S WATER FESTIVAL, co-sponsored by the Fort Collins Utilities, Northern Colorado Water Conservancy District, and Bureau of Reclamation. Volunteers were on hand to participate in the fun of educating the youngsters on a great variety of water related topics. Many exhibits were organized for hands on participation of the bright, and eager boys and girls.

There was plenty of entertainment for everyone with dozens of classroom activities and displays by groups who deal with water. Children learned about the physics of water movement with siphons and tornadoes in a tube, aquatic ecosystems and even recycling. They were excited about getting their hands into some soil and water to capture pond critters, worms and crayfish.

Marian Flanagan and Tyrone Smith represented the CSU Water Center at its exhibit. It was designed to encourage the children to consider job options in the field of water.



Ty Smith, Coordinator, Colorado Alliance for Minority Participation (CO-AMP).



The wit and humor of the children was evident as they dressed up in a role-playing exercise demonstrating future water careers.

The CSU Water Center would like to extend its sincere gratitude to Ty Smith of the Colorado Alliance for Minority Participation (CO-AMP), who offered to fill in when a volunteer had to cancel at the last minute. Ty did a great job taking pictures of the event for this newsletter, as well as Polaroid pictures of the groups for souvenirs. Thanks a bunch, Ty!





SYMPOSIUM PARTICIPANTS LOOK AT COLORADO'S STREAMGAGING EFFORTS



Panel discusses use of streamflow data and the need for system improvements. From left: David Merritt, Colorado River Water Conservation District; Dan Merriman, Colorado Water Conservation Board; Chris Rowe, Colorado Watershed Assembly; and Robert Steger, Denver Water.

On May 3, 2001, eighty people drove through a late spring storm to attend the Colorado Streamgaging Symposium in Breckenridge, Colorado. Given earlier concerns about water supplies for 2001, attendees did not seem to mind driving through the snow and rain to get to the meeting. The meeting brought together, perhaps for the first time in Colorado, the diverse people and organizations that depend upon accurate stream flow data. Learning of the breadth of water interests in Colorado that regularly use stream flow data, as well as the ways the data are used, was judged to be highly valuable to a number of the attendees.



Left: Hal Simpson, Colorado State Engineer, looks for new ideas for maintaining the data collection and distribution system.

Increasing competition for water is driving the need for enhanced flow information. The competition for water is due to rapid population growth and the need for controlling water pollution, protecting threatened native species, and enhancing recreation. Each interest seeks to understand stream flows relative to its particular use of Colorado's limited water supplies. At the same time, more traditional users of water seek accurate flow records to protect their rights to the water.

Bill Horak, USGS Colorado District Chief, noted that the purpose of the meeting was a 'reality check' for the current streamgaging efforts in Colorado. How well are current streamgaging programs meeting the new and diverse information needs? Hal Simpson, Colorado State Engineer, noting the high cost of operating a statewide streamgaging system, hoped the meeting would result in new ideas for maintaining the data collection and distribution system.

Dan Merriman, Colorado Water Conservation Board, noted that the basic question is: "How much water is in the stream?" With over 19,000 miles of live streams in Colorado, this is not an easy question to answer. The USGS operates 280 gages in Colorado, while the State Engineer's Office operates another 240 gages. Other organizations also operate gages. For example, the Urban Drainage and Flood Control District operates 69 gages. In recent years, most of this data has become available over the internet. However, there are still many streams in Colorado that are not gaged.

As speakers throughout the day addressed the use of flow data, each expressed the desire for more data or better data analysis and presentation tools to be more accurate in managing their particular dimension of Colorado's water resources, be it irrigation, public water supply, wildlife, water quality or recreation. Given the funding limitations facing the current streamgaging efforts in Colorado, the issue of adding more gages highlighted funding as a constant undercurrent throughout the meeting. There is not enough money to obtain the large array of

new data desired, develop new data analysis tools, and archive historical data records in a form readily useful for diverse management decisions.

Another theme that ran through the meeting was the huge improvement in data access over that of just five years ago. The placement of flow data online by the USGS, the State Engineer's Office and others, using the latest in information technology, was viewed as a major advance in the management of water resources in Colorado. With the data online, new users are accessing the data and expressing the need for new data analysis and presentation tools to take maximum advantage of its information content.

Another aspect of flow data being online was the speed with which traditional users of the data are now able to conduct business. 'Fast data' speeds up traditional water resource management tasks associated with water rights deliberations. Some users are finding that while flow data are on the internet, they are not necessarily 'analysis ready'. In other words, data on the internet are not always in a form ready for all types of analyses.

With data handling and analysis greatly enhanced via new information technology, there is a corresponding need to develop new technology to acquire data in the first place. Are there technologies that could increase the efficiency of data collection while protecting the accuracy of the measurement? Are there new technologies that could accurately measure flows in winter when a stream may be covered with ice?

Additional points made during the day are summarized below:

- The basic question: How much water is in the stream?
- Need consistent flow records over time.
- Need flow data at sites important to aquatic habitat health.
- Need to understand flows at the time of allocation, even if it was 100 years ago.
- Public access to flow data, via the internet, has generated a number of new users (and thus supporters of streamgaging).
- Members of the public, with access to flow data on the internet, are now able to 'double check' water rights administration performed by the State Engineer's Office.
- The internet is creating a 'data commons' with no one organization responsible for its maintenance. Thus, quality of 'data commons', over the long haul, is not assured.
- Accuracy of data – 'a number is better than nothing!'
- Need to better match measuring technology to information required by management decisions.

In his concluding remarks, Robert Ward, Director of the Colorado



Panel members Jon Altenhofen, Northern Colorado Water Conservation District (above) and David Graf, Colorado Division of Wildlife (below), present perspectives on use of streamflow data and needs for improvement.



Water Resources Research Institute, noted that expanding uses of flow data and information, combined with advancements in sharing data via the internet, are transforming streamgaging into a much broader-based activity than at any time in Colorado history. In light of this transformation, there is a need to examine how society supports streamgaging if we are to have the critical data needed to effectively and efficiently manage our limited water resources. Hopefully, the dialogue that began on May 3, 2001 will assist in developing options for placing Colorado streamgaging on a firm financial foundation. Symposium sponsors hope to schedule additional meetings every two years.



COLORADO STATE HOSTS 21ST ANNUAL HYDROLOGY DAYS

The 21st Annual HYDROLOGY DAYS, held April 2-5, 2001 at Colorado State University, was dedicated to Professor Stanley A. Schumm, Professor of Earth Resources at CSU.



Above from left: *Vijay Gupta, Department Of Civil Engineering, CU-Boulder, and Jose Salas, Department of Civil Engineering, CSU*



Above from left: *Stanley Schumm and Lee MacDonald, Department of Earth Resources, CSU*



Above from left: *Bill Sanford, Professor of Earth Resources, and Dana Orrick, Earth Resources Graduate Student*



Professor Stanley A. Schumm (above left) was honored during the 2001 Annual Hydrology Days meeting. Professor Jorge A. Ramirez, Department of Civil Engineering, CSU (above right), organized and coordinated the meeting.

Dr. Schumm began his career as a Research Geologist with the U.S. Geological Survey in 1954. He came to Colorado State as an Associate Professor of Geology in 1967. Dr. Schumm has received numerous awards during his career, including the 1997 Distinguished Career Award from the Geological Society of America, the 1986 G.K. Warren Prize from the National Academy of Science, the 1982 David Linton Award from the British Geomorphological Research Group, the 1979 Kirk Bryan Award from the Geological Society of America, and the 1957 Horton Award from the American Geophysical Union. In 1974 Dr. Schumm was named an Outstanding Educator of America. From Colorado State University he has received the 1980 L.W. Durrell Award, the 1986 University Distinguished Professor award, and was named Honor Scientist of the CSU Chapter of Sigma Xi during the same year.

The annual Hydrology Days meeting presents the latest findings in water research and education, not only in Colorado, but from around the world. This year's program included presentations by representatives of local, state and federal agencies and the private



sector. Updates on hydrology concerns and research were presented by international representatives as well, including:

- the University of Nottingham, U.K.;
- the Universidad de Carabobo, Valencia, Venezuela;
- the Departamento de Engenharia Hidraulica E Ambiental, Centro de Tecnologia – UFC, Fortaleza, Ceara, Brazil;
- the Albanian Academy of Sciences, Hydrometeorological Institute, Tirana, Albania and the Institute of Informatics and Applied Mathematics, Tirana, Albania;
- the Department of Land Management, Feng Chia University;
- the Civil and Environmental Engineering Dep., Los Andes University, Bogota, Colombia;
- the National Observatory of Athens, Athens, Greece;
- the Environmental Sciences, Griffith University, Nathan, Queensland;
- the Mohammadia School of Engineers, Rabat, Morocco; DIIAR, Politecnico di Milano, Milan, Italy;
- the Tashkent Irrigation Institute, Tashkent, Uzbekistan;
- the Power and Water Institute of Technology, Tehran, Iran;
- the Laboratory for Meteorology and Environmental Modeling, Campi Bisenzio (FI) Italy; and
- the Department of Hydraulic, Environmental and Surveying Engineering Hydraulics, Politecnico di Milano Piazza Leonardo da Vinci, Milan, Italy.



Dr. Stanley A. Schumm was Keynote speaker at the Hydrology Days luncheon on April 3.

The 21st Annual Hydrology Days, organized and coordinated by Professor Jorge A. Ramirez of CSU's Civil Engineering Department, gave students preparing for careers in water an abundance of opportunities to interact with water professionals from all sectors at both the national and international levels.

Water Rights Terminology

Absolute water right – A water right that has been placed to a beneficial use.

Conditional water right – A right obtained through the water court which fixes the priority of the water right with a date certain, even though the appropriation has yet to be completed. It gives the holder of that right time to complete the appropriation as long as they diligently pursue completion of the project. Every five years the court reviews what progress has been made toward completion of the project. Once the right has been perfected by use, the holder of the conditional right must then ask the court to make it an absolute water right.

See the website <http://water.state.co.us/terms.htm>

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 March 26-May 22, 2001

Title	PI	Dept	Sponsor
Visitor Response to National Wildlife Refuge Recreation Fee Demonstration Projects	Vaske, Jerry J.	NRRT	USGS
Recreationists' Acceptability Norms toward Fire Management	Bright, Alan	NRRT	USDA
Center for Earth Atmosphere Studies Tropical Rainfall Measurement Mission & AMSR-E Algorithm Improvement Efforts	Kummerow, Christian D.	Atmospheric Sci.	NASA
Testing a High-Sensitivity ATR-FTIR Water Monitor for Ionic CWA Breakdown Products	Strauss, Steven H.	Chemistry	DOD-ARMY
Herbivory in Streams - Context-Dependent Species Interactions & Functional Redundancy	Poff, N. LeRoy	Biology	NSF
Integrated Electrochemical Degradation & Biodegradation for Treatment of Contaminated ...	Reardon, Kenneth F.	CBE	NSF
Advanced Hydrometeor Identification of Severe Storms During STEPS	Bringi, Viswanathan N.	Elec. & Computer Engr.	NSF
Air-Sea Interaction Remote Sensing Processes	Vonderhaar, Thomas H.	CIRA	NOAA
CIRA Activities & Participation in the GOES I-M Product Assurance Plan	Vonderhaar, Thomas H.	CIRA	NOAA
Sensitivity of Cloud Resolving Simulations of Convective Precipitation & Cloudiness...	Cotton, William R.	CIRA	NOAA-
Strategic Planning for Federal Interagency Fire Programs	Rideout, Douglas B.	Forest Sciences	NPS
Analysis of Pre- & Post-Restoration Hydrology of a Pine Savanna Wetland at Moores Creek National Battlefield, NC	Cooper, David Jonathan	Earth Resources	NPS
Status of Flannelmouth & Bluehead Suckers & Roundtail Chub	Bestgen, Kevin R.	FWB	USBR

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 Astrodynamical Research, AOS-Atmospheric & Oceanic Sciences, CADSWES-Center for Advanced Decision Support for Water and Environmental Systems, CEAE-Civil, Environmental, and Architectural Engineering, CIRES-Cooperative Institute for Research in Environmental Sciences, 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
Clouds & Ocean-Atmosphere Interactions in the Pacific Basin	Randall, David A.	Atmospheric Sci.	DOE
IID/SDCWA Water Transfer EIR/EIS - Conservation Modeling	Labadie, John W.	Civil Engr.	CH2M Hill
Monitoring Fire Effects & Vegetation Recovery on the Jasper Fire	Smith, Frederick W.	Forest Sciences	USDA-USFS-RMRS
Long-Term Ecological Research - Luquillo Experimental Forest	Covich, Alan P.	FWB	University of Puerto Rico
Willow Persistence in Yellowstone National Park: Interactive Effects of Climate, Hydrology & Herbivory	Hobbs, N. Thompson	NREL	USGS
Hydrologic Investigations at Bent's Old Fort National Historic Site	Macdonald, Lee H.	Earth Resources	NPS
Technology Transfer/Information Dissemination	Ward, Robert C.	CWRRI	USGS
Managed Groundwater Recharge for Habitat Restoration	Garcia, Luis	CWRRI	USGS
Description & Interpretation of Salinization in the Lower Arkansas River Valley	Gates, Timothy K.	CWRRI	USGS
Eutrophication of Reservoirs on the Colorado Front Range	Loftis, Jim C.	CWRRI	USGS
Distribution, Habitat, Life History of Brassy Minnow in E. Colorado	Fausch, Kurt	CWRRI	USGS
Applicability of Trophic Status Indicators to Colorado Plains Reservoirs	Stednick, John	CWRRI	USGS
Enhancements to South Platte Mapping and Analysis Program (SPMAP)	Garcia, Luis	CWRRI	USGS
Development & Implementation of GOES Rainfall & Fire Detection Products for Guatemala	Connell, Bernadette H.	CIRA	USAID
Eutrophication of Reservoirs on the Colorado Front Range	Loftis, Jim C.	Civil Engr.	Various "Non-Profit" Sponsors
Implementing Best Management Practices in Colorado's Irrigated Agriculture	Loftis, Jim C.	CWRRI	CDPHE
Yampa River Native Sucker Hybridization Assessment	Douglas, Marlis R.	FWB	CDOW
Rio Grande Chub Limiting Factors Research and Genetic Assessment (segment II, ecology)	Bestgen, Kevin R.	FWB	CDOW
Rio Grande Chub Genetic Assessment/Limiting Factors Research	Douglas, Marlis R.	FWB	CDOW
Investigation of Environmental Factors Limiting Suckermouth Minnow Populations	Beyers, Daniel W.	FWB	CDOW
Suckermouth Minnow Genetic Assessment	Douglas, Marlis R.	FWB	CDOW
Inventorying & Monitoring Natural Resources Status & Trends in the National Park System	Loftis, Jim C.	Civil Engr.	NPS
Ecosystem Structure & Function in Watersheds	Binkley, Daniel E.	Forest Sci.	USDA-USFS-RMRS
Dynamical, Microphysical & Electrical Studies of Convection in STEPS	Rutledge, Steven A.	Atmospheric Sci.	NSF

Title	PI	Dept	Sponsor
Research Experiences for Undergraduates Program in Water Research at Colorado State University: SITE	Ramirez, Jorge A.	Civil Engr.	NSF
Boater Recreation at Falls, & Jordan Lake & North Central Portion of the Nutbush Arm of Lake Kerr	Haas, Glenn E.	NRRT	DOD
Retrieval of Properties of High Clouds from LITE Data	Stephens, Graeme L.	Atmospheric Sci.	NASA
Analysis of Data from Tropical Rainfall Measuring Mission to validate Tropical Rainfall Measuring Mission...	Rutledge, Steven A.	Atmospheric Sci.	NASA
CloudSat	Stephens, Graeme L.	Atmospheric Sci.	NASA
Eutrophication of Reservoirs on the Colorado Front Range	Loftis, Jim C.	Civil Engr.	Various "Non-Profit" Sponsors
Investigation of Groundwater Age in the Northern San Juan Basin, Colorado	Sanford, William E.	Earth Resources	BP Amoco
Tamarisk Removal & Riparian Restoration Along Reaches of the Green River, Colorado	Cooper, David Jonathan	Earth Resources	DOI
Herbivory in Streams - Context-Dependent Species Interactions & Functional Redundancy	Poff, N. LeRoy	Biology	NSF
Restore Snake River Gravel Pit, John D. Rockefeller, Jr. Memorial Parkway, to a Self-Sustaining Riparian ...	Cooper, David Jonathan	Earth Resources	NPS
2001 Basinwide Field Verification Proposal, FY01, Project Phase: Upper Yampa, Upper White, & Little Snake Rivers	Stevens, Joseph E.	FWB	CDOW
Planning Visit to Bangladesh: Arsenic Removal from Drinking Water	Karim, M. Nazmul	CBE	NSF
Framework for Decision Support System for Rocky Flats	Garcia, Luis	Civil Engr.	DOE
Evaluation of Seepage Losses from the Fort Lyon Canal	Gates, Timothy K.	Civil Engr.	Fort Lyon Canal Comapny
Developing Agronomic Parameter Estimations from Remote Sensing Data	Broner, Israel	Civil Engr.	Astrium

UNIVERSITY OF COLORADO, BOULDER, COLORADO 80309
Awards for February-April, 2001

Title	PI	Dept	Sponsor
The Effects of Rainfall Exclusion on an Amazon Forest	Asner, Gregory	Geological Sciences	Woods Hole Oceanographic Institute
Sea Ice Surface Characteristics from High Resolution Reconnaissance Imagery	Fetterer, Florence	CIRES	NSF
Collaborative Research: An Integrated High-Resolution Study of the Effects of Shifting Climate on Late Paleocene - Early Eocene Continental Ecosystems	Kraus, Mary	Geological Sciences	NSF
Land and Land-Use Change in the Climate Sensitive High Plains: An Automated Approach with Landsat	Goetz Alexander	Geological Sciences	CIRES



Title	PI	Dept	Sponsor
A Hydro-Economic Approach to Representing Water Resources Impacts in Integrated Assessment Models	Strzepek, Kenneth	CEAE	Tufts University
Decision Support for Design-Build Delivery of Water/Wastewater Treatment Facilities Phase One: Industry Case Studies	Molenar, Kenneth	CEAE	CH2M Hill
Width Adjustment in Mixed-Load Rivers	Pitlick, John	Geography	NSF
Collaborative Research: The Direct and Indirect Photolytic Fate of Persistent Organic Pollutants in Arctic Surface Waters	McKnight, Diane	CEAE	NSF
The Dynamics of Water in the Tropics	Mapes, Brian	CIRES	NSF
Application of Sheba Data to Understanding and Simulating the Cloud-Radiation Feedback: Climate Model Perspective	Lynch, Amanda	CIRES	NSF
Intuit Knowledge of Climate Change in the Eastern Canadian Arctic	Barry, Roger	CIRES	NSF
Climatology of Arctic Canada	Steffen, Konrad	CIRES	NSF
Use of Satellite Gravimetry to Develop and Test a Land-Water and Energy-Balance Model	Wahr, John	CIRES	NSF
Assessment of Greenland Outlet Glacier Albedo Variability	Stroeve, Julienne	CADSWES	NASA
Upper Colorado Research, Development, and Support for Riverware	Zagona, Edith	CADSWES	DOI
Yakima Maintenance Agreement	Zagona, Edith	CADSWES	USBR
Photochemical Processes Controlling Manganese Chemistry in Pristine and Contaminated Mountain Streams	McKnight, Diane	IAAR	EPA
Investigation of the Assimilation of Ice Motion Data in Sea Models	Arbetter, Todd	Aerospace Engineering	NASA
Reservoir Stratigraphy and Its Controls on Reservoir Architecture and Performance: and Investigation of Key Surfaces and Fabrics in Marginal Marine Environments	Weimer, Paul	Geological Sciences	Various Oil Companies - Foreign
Source Water and Flowpath Identification, Mary Murphy Mine, Chalk Creek, Colorado	Williams, Mark	IAAR	State of Colorado
Reconstructing Arctic - Atlantic Interactions on a Sub-Millennial Time Scale: Holocene Sediment Records from the Southeastern Barents Sea	Lubinski, David	IAAR	Ohio State University Research Foundation
Deep-Water Polynyas: Formation, Maintenance and Relationship to Antarctic Climate	Bailey, David	CIRES	Jet Propulsion Laboratory
Water Resources Issues Within the Integrated Assessment of the Human Dimensions of the Global Change	Strzepek, Kenneth	CEAE	Carnegie Mellon University
Collaborative Research: Reconstructing the Past 20,000 Years of Glacial and Sea-Level History for Severnaya Zemla, Russia, 80 North	Lubinski, David	IAAR	NSF

Title	PI	Dept	Sponsor
Environmental Changes and Human Responses in the North Atlantic (Iceland and Greenland Sectors) During the Last 2,000 Years	Ogilvie, Astrid	IAAR	NSF
Doctoral Dissertation Research: Rainfall Characteristics and the Influence of Urban Land Use on Shallow Landslide Initiation Seattle, Washington	Caine, T. Nelson	Geography	NSF
The Niwot Ridge Long Term Ecological Research Program and Interactions of Alpine and Subalpine Ecosystems of the Colorado Front Range	McKnight, Diane	IAAR	NSF
An Integrated Assessment of the Impacts of Climate Variability on the Alaskan North Slope Coastal Region	Lynch, Amanda	CIRES	NSF
Investigation of Photochemical Transformations Within Snow and Their Effects on Snow and Atmospheric Composition	Steffen, Konrad	CIRES	NSF
Climate Modeling and Societal Impacts: Scientific, Political, and Philosophic Themes	Frodeman, Robert	Center of the American West	NSF
Characterizing the Siple Coast Ice Stream Using Satellite Images, Improved Topography, and Integrated Aerogeophysical Measurements	Scambos, Theodore	CIRES	NASA
Optimization of Urban Sewer Systems During Wet Weather Periods	Heaney, James	CEAE	EPA
Theoretical Studies of Stratospheric Clouds and Aerosols in Support of Solve	Toon, Owen B.	CIRES	NASA



WATER SUPPLY

Conditions varied across the state during April, with snowpack dropping in the northern mountains, maintaining in the central mountains, and increasing in the south central and southwest portions of the state. Statewide the snowpack averaged 84% of normal as of May 1. The Rio Grande basin was the only basin with above average snowpack, having 120% of average. Some irrigation demand began in April. Those reservoirs that could continue to fill during the month. 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 snowpack, reservoir storage, and precipitation for the winter period (Nov. through April). During the winter period, snowpack is the primary component in all basins except the South Platte Basin, where reservoir storage is given the most weight. The following SWSI values were computed for each of the seven major basins for May 1, 2001, and reflect conditions during the month of April.

Basin	5/1/01 SWSI Value	Change from the Previous Month	Change from the Previous Year
South Platte	0.1	+0.3	-1.4
Arkansas	-1.6	+0.4	-0.7
Rio Grande	0.9	+2.4	+3.3
Gunnison	-1.5	+0.1	+0.6
Colorado	-1.7	+0.1	-1.2
Yampa/White	-2.8	+0.2	-0.6
San Juan/Dolores	-0.2	-0-	+1.9

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





GS 592
WATER RESOURCES SEMINAR
COLORADO STATE UNIVERSITY
History, Current Use and Future of the Prior Appropriation Doctrine

Fall 2001
4:10pm, Tuesday
Room C-142 Clark Building

The Fall 2001 offering of the Water Resources Seminar (GS 592) will define, and examine issues surrounding, use of the Prior Appropriation Doctrine to allocate water in Colorado during rapidly changing times. In an arid climate, some formal and legal means of allocating water to competing uses has to be developed. Humans, around the world, have developed a number of ‘doctrines’ for allocating water to competing uses. Do the citizens of Colorado understand use of the Prior Appropriation Doctrine today? Is the Prior Appropriation Doctrine able to adapt to the new demands placed upon it? The Prior Appropriation Doctrine has been criticized as being outdated; however, what doctrine would be selected to replace it?

The Colorado Legislature has modified the Prior Appropriation Doctrine over the years to adapt it to new knowledge of hydrology and ecosystem needs. As the needs continue to change, what future changes may be necessary to keep the Prior Appropriation Doctrine viable in meeting Colorado’s need to fairly allocate its limited water resources?

The Fall 2001 offering of the Water Resources Seminar (GS 592) will examine the Prior Appropriation Doctrine from the standpoint of:

- What is the Prior Appropriation Doctrine and why does Colorado use it to allocate water?
- How, administratively, is water in Colorado streams put to beneficial use?
- What changes have been made to the doctrine over the years?
- What does the future hold for the Prior Appropriation Doctrine?

Students interested in taking the one-credit seminar should sign up for GS 592, Water Resources Seminar, Section ID Number: 270582. In addition to attending all seminars, students taking the seminar for credit are expected to work with a group of students from other water-related disciplines to prepare an interdisciplinary analysis of a Prior Appropriation topic in which they are interested and the instructors approve. (Students who have enrolled in GS 592 in the past can also enroll for this offering)



<i>Date</i>	<i>Topic/Speaker</i>
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Water Doctrines

August 28	“Water allocation doctrines employed around the world including the Public Trust Doctrine” - Jim Schmehl , Schmehl, Yowell & Mackler, P.C., Fort Collins
September 4	“Creation of the Prior Appropriation Doctrine in the Western U.S.” – Brian Werner , Northern Colorado Water Conservancy District, Loveland
September 11	<i>Student Synthesis of the various options humans have developed for allocating water to competing uses. (by student team)</i>



Implementation of the Prior Appropriation Doctrine in Colorado

- September 18 “The Prior Appropriation Doctrine as Implemented in Colorado Water Law Today” – **Bill Fischer**, Fischer, Brown and Gunn, Fort Collins
- September 25 “Administration of the Prior Appropriation Doctrine in Colorado” - **Dick Stenzel**, Division 1 Engineer, Water Resources Division, Greeley, Colorado.
- October 2 *Student Synthesis of current implementation of the prior appropriation doctrine in Colorado (by student team)*

Ability of the Prior Appropriation Doctrine to Adapt to Changing Needs

- October 9 “Ability of Prior Appropriation Doctrine to Address Social, Economic and Environmental Needs of Colorado Citizens” - **Doug Kenney**, Natural Resources Law Center, University of Colorado School of Law, Boulder
- October 16 “Instream Flow Program to Protect Critical Habitat” - **Dan Merriman**, Colorado Water Conservation Board, Denver
- October 23 *Student Synthesis of ability of Prior Appropriation Doctrine to Adapt to Changing Social, Economic and Environmental Needs (by student team)*

Growth and Colorado’s Future under the Prior Appropriation Doctrine

- October 30 “What Role does Water Supply Play in Managing Growth in Colorado? – **Dan Luecke**, Senior Scientist and Regional Director, Environmental Defense Fund, Boulder
- November 6 “Legislative Efforts to Provide Water to Support Colorado’s Rapid Population Growth” - **Chris Paulson**, Friedlob, Sanderson, Paulson and Tourtillott, Denver
- November 13 “Does the Past Tell Us How the Prior Appropriation Doctrine will Adapt to New Needs in Allocating Colorado’s Water Resources?” – **Justice Greg Hobbs**, Colorado Supreme Court
- November 20 Thanksgiving Holiday
- November 27 *Student Synthesis of the ability of the Prior Appropriation Doctrine to meet future water and water-related needs of Colorado citizens (by all students in the seminar)*
- December 4 Student Evaluations and Planning for Fall 2002 Water Resources Seminar

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

Managing water is both a technical and a diplomatic challenge. New technologies and analytical tools can help us reduce waste, mitigate pollution, and allocate water more efficiently. But to be effective, management must be done on a basin-wide or watershed basis.

Madeline Albright
CIVILIZATION, The Magazine of the Library of Congress
Oct/Nov 2000

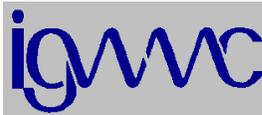
CWRRI



HAPPENINGS AT CSM

MODFLOW 2001 and Other Modeling Odysseys Golden, Colorado -- September 11-14, 2001

This conference brings together users and developers of MODFLOW, related, and alternative modeling programs to present innovations capabilities, limitations, and explore future developments in groundwater modeling. For information contact the IGWMC at address below or access the IGWMC website.



Short Course Schedule

MODFLOW: Introduction to Numerical Modeling	SEP 8-11	\$895	\$1095 w/o Modflow 2001*
Subsurface Multiphase Fluid Flow and Remediation Modeling	SEP 9-11	\$895	\$1095 w/o Modflow 2001
UCODE – Universal Inversion Code Automated Calibration of “Any” Code	SEP 10-11	\$795	\$995 w/o Modflow 2001
Practical Simulation/Optimization Modeling for Optimal Groundwater Management	SEP 10-11	\$845	\$1045 w/o Modflow 2001
Model Calibration Using PEST	SEP 14-16	\$795	\$995 w/o Modflow 2001
MT3DMS Workshop	SEP 15	\$395	\$495 w/o Modflow 2001
Advanced Modeling of Water Flow and Solute Transport in the Vadose Zone	SEP 15-16	\$495	\$595 w/o Modflow 2001

*MODFLOW 2001 Conference will be held on the Colorado School of Mines Campus in Golden, Colorado September 11-14, 2001.

FOR INFORMATION CALL (303) 273-3103 -- FOR REGISTRATION CALL (303) 273-3321

VISIT <http://www.mines.edu/igwmc/> FOR MORE INFORMATION



HAPPENINGS AT CU



Dr. Charles W. Howe has been honored by the Universities Council on Water Resources (UCOWR) with the “Friend of UCOWR” award with the following statement:

“UCOWR and the entire water community have benefited from your guidance and encouragement. Your steadfast support has always made a difference. We are honored to add your name to our distinguished list of “Friends.”

Dr. Howe is Professor of Economics and a member of the professional staff of the Environment and Behavior Program, Institute of Behavioral Science, at the University of Colorado at Boulder.

Dr. Hannah Gosnell has received an award for her Ph.D. dissertation from the Universities Council on Water Resources. The award was in the category of socio-economics. Hannah recently completed her dissertation in Geography, “Water, Fish, Tribes and Choice: A Geographic Evaluation of Endangered Species Act Implementation in the San Juan River Basin.” Her adviser was Dr. Jim Wescoat, Department of Geography, University of Colorado-Boulder. The award competition is conducted annually by UCOWR, and award winners are honored at the UCOWR annual meetings. This year’s meeting will be held in Snowbird, Utah June 27-30.



WATER NEWS DIGEST



by Marian Flanagan

DAMS

Work on Horsetooth ahead of schedule, under budget

Modernization of Horsetooth Reservoir west of Fort Collins is ahead of schedule and under budget, according to the Bureau of Reclamation. The initial contract for work on the reservoir's four dams came in about \$4 million under budget and the contractor said that part of the work may be completed as much as six months early. Bids for the next phase will be sought this summer and that work should start early next year. That work involves renovating part of the three earthen dams on the east side of the reservoir and will have more impact because it is in a more residential area. Some public meetings will be scheduled to explain the work and hear concerns; however, the four, 50 year old dams are in no danger of failing. The anticipated cost of the project is \$105 million, and is expected to take until 2003 to complete. The federal government funds 85 percent of the project, the other 15 percent is funded by water users and others who benefit from the water in the reservoir. While the first phase of the contract was under budget, the next phase requires specialized work that will limit the number of bids.

Greeley Tribune, 4/12/01

Horsetooth to get monitoring buoy

A 350-pound, solar-powered, computerized buoy installed in Horsetooth Reservoir will measure water quality at various depths 24 hours a day and automatically send data to the Fort Collins Utilities' water treatment facility. The \$63,383 buoy, funded by a grant from the U.S. Bureau of Reclamation, is a critical tool for the city to monitor water quality in the reservoir while repairs are made on four earthen dams. Water quality is expected to be an issue, since the water level in the reservoir will vary as the repairs occur. The real-time data will give notice of any changes to raw water quality so adjustments can be made in the treatment process to maintain superior drinking water quality for health and safety. The buoy is being placed near Soldier Canyon Dam because it's also near the Fort Collins Water Treatment Facility. The water-quality information collected will be shared online with the Fort Collins-Loveland Water District, the city of Greeley and the Northern Colorado Water Conservancy District. Water-quality concerns that will be tracked include turbidity, or cloudiness, pH levels, temperature, dissolved oxygen, and levels of chlorophyll A. The project is expected to last three to five years.

Fort Collins Coloradoan, 4/24/01

Cracks found in Rifle dam

Bureau of Reclamation officials are investigating cracks recently discovered at the top of Rifle Gap Dam. USBR staff and engineers from Grand Junction, Denver and Salt Lake City have been at the site, a parking lot area on the west end of the 350-acre reservoir, since the beginning of April. USBR's Western Colorado Area Office in Grand Junction has hired a contractor to do a ground penetration radar layout of the area so they can try to figure out the extent of the cracks. Other steps under way, or scheduled to begin soon, include digging shallow holes in the area, reviewing original construction reports and collecting field data and other information. The USBR said there is no immediate danger, as no major concerns were found with the structure or safety of the dam. Rifle Gap Dam was built in 1967.

Grand Junction Daily Sentinel, 4/4/01

Manitou levels beaver dam

With a few swipes of a backhoe, Manitou's public works director destroyed a six-foot dam in Fountain Creek - the busy work of at least five beavers whose tireless frenzy has cost Manitou Springs more than \$1,000. It was the second dam the city has demolished in the creek in an attempt to head off potential flooding problems. With spring runoff and the rainy season both dams were starting to plug up nearby culverts that allow floodwater to flow into the creek. The beavers - each as much as 40 pounds and about two feet long - built the dams at night. To build the dams, the critters felled about 50 trees along the creek, some as thick as a foot in diameter and as tall as 15 feet. The city hired a private trapper to capture them.

Colorado Springs Gazette, 4/4/01

ENDANGERED SPECIES

Taxes and the boreal toad

Taxpayers who checked Box 44 on their state income tax returns have helped the John W. Mumma Native Aquatic Species Restoration Facility in Alamosa obtain endangered and threatened species, among them the boreal toad, believed to live in Cucumber Gulch in Peak 8. The facility is the first in the nation designed to raise threatened and endangered fish, amphibians and mollusk species. It opened last spring with a dozen toads and hundreds of their eggs collected from sites throughout the state. The goal is to establish a captive brood stock at the facility for future breeding purposes. Researchers hope to use the captive breeding program as insurance against the extinction of Colorado's only alpine toad and to prevent the need for federal listing (as a threatened or endangered species). Without



taxpayer donations, the establishment of the facility's brood stock wouldn't have been possible, as well as the scientific research that confirmed the presence of a deadly chytrid fungus in a boreal toad population west of Denver. The fungus has previously been linked to the decline of amphibians in Australia and Central America and is now known to infect three populations of Colorado toads. Today, toads from 11 imperiled populations are housed at the facility. Colorado listed the toad as endangered in 1993. Two years later, the U.S. Fish and Wildlife Service concurred, designating the boreal toad as "warranted but precluded" from listing as an endangered species, meaning the toad deserves federal protection but won't get it immediately due to more pressing needs. Boreal toads (*Bufo boreas boreas*) have been reported in montane habitats throughout the state at elevations between 7,000 and 12,000 feet. Continued efforts to save the toad were made possible last year with approval of more than \$540,000 for programs to manage wildlife species for which people don't hunt or fish. The DOW receives no general tax fund revenue. Instead, by purchasing hunting and fishing licenses, hunters and anglers support programs to benefit game animals and fish. Other money is spent on managing non-game, threatened and endangered species. The bulk of the money — about \$3.5 million per year — comes from Great Outdoors Colorado.

Summit Daily News, 4/10/01

Population decline of toads linked to warming trend

Warmer weather over the South Pacific during the past three decades has caused an environmental chain reaction that is killing most of the eggs of a type of toad in Oregon, according to a study. It is believed to be the first study to directly link global climate change with declining amphibian populations. Other studies have linked large-scale climate changes to population fluctuations in American songbirds and European butterflies. The warmer weather is causing less rain and snow in Oregon's Cascade Range where western toads are found, resulting in shallower lakes and ponds. In more shallow water, when toads lay their eggs in early spring, their eggs are exposed to more ultraviolet light, which makes them susceptible to a water mold that kills the embryos by the hundreds of thousands. Amphibian populations have been declining worldwide since the 1980s, alarming scientists. Amphibians are considered a barometer of the Earth's health because they are so sensitive to environmental changes. In the past decade, 20 amphibian species have become extinct, and many more are in severe decline. Scientists point to a variety of factors, including habitat destruction, use of fertilizers and pesticides, and increased ultraviolet light from an ozone layer thinned by pollutants. Researchers say average sea-surface temperatures in the South Pacific have been elevated since the mid-1970s, causing drier winters in Oregon.

Grand Junction Daily Sentinel, 4/4/01

FLOODS

County to hear flood concerns

The Boulder County Commissioners have held a public hearing to discuss whether to buy and remove about 90 households in the path of a 100-year flood south of Boulder. Displacing about 90 residents of Sans Souci Mobile Home Park and the Marshall Road area is just one of several possibilities officials considered in an attempt to protect people near South Boulder Creek from flood dangers. The commissioners represent one of four governing bodies that will ultimately decide the fate of a flood plain recently found to be more dangerous than previously thought. Boulder County, the city of Boulder, CU and the Urban Drainage and Flood Control District funded a study that projected a 100-year flood could cause about \$321 million in property damage, possibly cost lives, and paralyze south Boulder with closed streets. It found that 4 inches of rain falling in the upper reaches of the creek's watershed in 24 hours could create flooding serious enough to place Sans Souci under 4 feet of water, flood U.S. 36 and flood southeast Boulder neighborhoods and encompass 1,400 homes. The commissioners will ultimately need to make a recommendation on the county's preferred alternative. The city is also forming a citizen advisory board to help guide the selection of a flood control plan.

Boulder Daily Camera, 4/2/01

Below normal snowpack signals little chance of spring flooding

There shouldn't be any flooding problems along the South Platte and Poudre rivers this spring. Snow surveys, conducted by officials with the U.S. Department of Agriculture, show water content of the mountain snow pack as of April 1 is below average in most areas. In the South Platte River Basin, which includes the Poudre, it is 19 percent below average. The April 1 readings are the most important of the season for projecting the state's spring and summer water supplies. Data from monthly surveys allows hydrologists to predict the amount of runoff when the snowmelt occurs in the spring. Water users, including those involved in agriculture, industry and municipalities, use that information for planning. As much as 80 percent of the state's surface water supplies originate from the mountain snow pack. The readings mean that near average to just below average runoff can be expected this year across most of the state. The best prospects for average runoff are in the southwestern part of the state. Only two basins saw decreases in the snow pack during March — the North Platte and the combined San Juan, Animas, Dolores and San Miguel basins. The only basin to show an increase for two consecutive months was the Rio Grande in southern Colorado. Reservoir storage statewide is near average with the state's 74 major reservoirs storing 108 percent of the 30-year average. The lowest storage, however, is in the South Platte basin, 11 percent below average and 17 percent below last year's storage. Much of that, however, can be attributed to the lowering of the largest reservoir in northern Colorado, Horsetooth Reservoir, for repairs. Those repairs are expected to take three to four years.

Greeley Tribune, 4/7/01



GROWTH**County gives nod to more groundwater studies**

La Plata County commissioners have unanimously voted to continue funding a study on the effects that growth and development have on groundwater levels. The study collects data from the Florida Mesa area. The USGS is funding 50 percent of the study with La Plata County and the Southwestern Water Conservation District sharing the remaining half. Commissioners recommended expanding the study to include more areas within the county and suggested getting frequent updates and analyses on the study's progress. Both ideas, however, would probably cost the county more money and would not begin until next year. The data show that groundwater levels are decreasing as more development occurs on the Florida Mesa.

Durango Herald, 4/10/01

Denver Water helps preserve 97 acres in Summit County

A rural 97-acre parcel of streamside meadows, wetlands and forests in Summit County will remain largely undeveloped thanks to an agreement between Denver Water and the Summit County commission. Denver Water bought the land, known as Blight Placer, about two decades ago during construction of the Roberts Tunnel. The property abuts the Snake River Road about 2 miles east of Keystone Resort's River Run base area. A shaft on the property continues to provide access for tunnel maintenance, but Denver Water has agreed to sell most of the development rights associated with the parcel, placing them in transferable water banks. The development rights can later be purchased and moved to areas where zoning encourages growth. As open space this will also help create a buffer between the dense resort developments at Keystone and the rural, historic character of the Montezuma area, just a few miles up the valley.

Denver Post, 4/27/01

PEOPLE**Norton picks water agency attorney for assistant**

Interior Secretary Gale Norton has announced the nomination of Colorado water lawyer Bennett Raley as assistant secretary for water and science. Raley has been the attorney for the Northern Colorado Water Conservation District. If he gets Senate approval, he will oversee the US Geological Survey and the US Bureau of Reclamation. Colorado water experts see his position as beneficial for Colorado water rights, the most important issue in the state. As a top aide to former senator Hank Brown, Raley worked with democrats to reach a compromise on the Colorado Wilderness Bill, designating new wilderness areas on Forest Service land in Colorado.

Fort Collins Coloradoan (AP), 4/18/01

RECREATION**DOW Commission approves new fish stocking regulations**

The Colorado Wildlife Commission has revised regulations that require ponds, lakes and reservoirs in the Colorado River Drainage to have dikes or screens. All waters less than 6,500 feet elevation in the Colorado River basin are covered by the new regulations, effective May 1. The action is an attempt to prevent exotic fish such as bass, bluegills, crappie and grass carp from escaping into the river where they could prey on endangered native Colorado River species such as the humpback chub, razorback sucker, bonytail chub and pike minnow. Colorado is working with the U.S. Fish and Wildlife Service to protect remaining populations of these native fish, to restore and enhance existing habitat, to raise more fish in federal and state hatcheries, and to restock the species into their native waters. The regulations require that dikes on ponds, lakes and reservoirs within the 50-year flood plain be at least five feet above the ordinary high water line and engineered to withstand a 50-year flood. If a screen is required to keep fish from escaping from a pond or reservoir, the gap size on the screen must not exceed one-quarter inch.

Rifle Citizens Telegram, 4/11/01

City eyes recreational uses of Barker Reservoir

Boulder has closed on its \$12.5 million purchase of the reservoir, its dam and downstream pipelines and hydroelectric station, giving the city control of Boulder Creek from its source until it leaves the city. Colorado's Public Service Co. was the owner for nearly a century before the sale. The city now can revamp its water management plan for the creek and create its own plan for use of the reservoir. The planning process is expected to take 18 months. Boulder also has the ability to improve the stream habitat on Boulder Creek between the Barker Reservoir dam and Boulder Falls, a stretch known as Middle Boulder Creek. While the city wants to accommodate many uses and as many public interests as possible, its goal is to keep the reservoir and creek as pure as possible. Presently, the only recreational use allowed at Barker Reservoir under a license from the Federal Energy Regulatory Commission is fishing. Under the new plan, sailing and swimming may be permitted, with trails and picnic areas added around its banks, but motorized boating is ruled out as detrimental to water quality.

Boulder Daily Camera, 4/16/01



SB216 would require state review of recreational water rights

Cities want water rights for “invaluable” recreational purposes, but some state lawmakers view this as a threat to water for homes, industry and farms. Under Colorado Senate bill SB216, the Colorado Water Conservation Board would be required to approve or deny a city’s request for more than 50 cubic feet per second of water flows for boat courses before the city could file a case in state court. The board’s decisions under the bill, SB216, would be based in part on whether recreational use would harm the ability to use water in traditional ways. Golden is one of the cities that has filed for in-stream water rights for its nationally known kayak course and has a case pending in court. Although the bill exempts Golden, it would still affect efforts of Vail and Breckenridge to obtain similar rights, and by other cities that may want in-stream flows for boating in the future. City officials and recreational groups oppose the bill as unconstitutional, saying it would harm property rights of individual citizens. Small towns and the CWCB worry that the increasing popularity of recreational rights for boating will prevent other towns from getting water rights in the future for their growth needs.

Denver Post, 4/26/01

Fish kill cleans lake

State officials have poisoned Confluence Lake with rotenone to remove carp and other unwanted species. Recreationalists can look forward to an improved fishery when state officials begin stocking warm-water sportfish this summer. Confluence Lake is off-limits to fishing until toxins dilute out of the water. If the water temperature is OK this spring, the Colorado Division of Wildlife will stock 25,000 rainbow trout. Fishing can resume after the trout are stocked. The lake, nestled at the confluence of the Gunnison and Uncompahgre rivers in Delta, was originally intended as a warm-water fishery, but that never materialized due to federal government concerns about endangered fish species downstream. State and federal officials have formulated procedures since then to prevent non-native fish from escaping stocked lakes and harming endangered river species. The Uncompahgre River supplied water and several harmful fish species, such as carp to the lake through an inlet pipe, along with tons of sediment, raising the lake bottom about 6 feet and hindering the plant life essential to warm-water environments. The CDOW plugged the river inlet this year and overhauled a discharge structure to prevent fish from entering the rivers and harming endangered species. A well drilled nearby will feed clear water to the Confluence Lake, making the aquatic environment more habitable to warm-water sport fish. In August, the state plans to put 15,000 bluegills in the lake and will eventually stock 15,000 largemouth bass in 2002.

Grand Junction Daily Sentinel, 4/4/01

Kayakers brave cold water to test Breck’s new park

Breckenridge’s new whitewater park officially opened in May, and kayakers braved the freezing temperatures of the Blue River to take advantage of its Class II waters. Boaters said the park needs a little tweaking, but it’s great fun. The town’s newest amenity — and one of the least expensive, had a \$165,000 price tag and involved relocating boulders, digging channels and making bank and access improvements. The new course has 8 features, including splash rocks, pools, falls and eddies. Kayakers appreciate how it enhanced the banks and the fish habitat, but they are more excited about the features, the proximity and the water flow, estimated to be at 250 cubic feet per second (cfs). The intent of the construction was not only to provide a place for boaters to play, but to build a structurally and hydraulically sound, aesthetic and natural course. Water levels will rise with the spring runoff, but for now, it means not having to travel long distances to other favorite river spots. The course is also designed to withstand major flooding. For more information, contact the Breckenridge Recreation Center at 453-1734.

Summit Daily News, 5/17/01

WATER BANKING**Water bank bill sails**

The Colorado Legislature has passed three water bills, including one authorizing a pilot project for water banking in the Lower Arkansas Valley. Sen. Lewis Entz, R-Hooper, teamed up with Rep. Diane Hoppe, R-Sterling, on the water banking proposal and another bill setting up an interim committee on water issues statewide. Entz joined with House Majority Leader Lola Spradley, R-Beulah, on a third bill to require the Colorado Water Conservation Board to review recreational water rights claims before they go to water court. The bill grandfathers in already decreed rights for kayak and recreational watercourses in Fort Collins and Littleton, as well as pending applications for Golden, Vail and Breckenridge. Future applications, however, must go through a CWCB review on whether the recreational diversion would harm other users’ water rights upstream. The Entz-Hoppe water banking bill, HB1354, will have the most immediate effect on the Pueblo region, because the pilot project will be conducted in the Arkansas River Basin. Gov. Bill Owens is expected to sign the bill because the Governor’s Commission on Saving Open Spaces, Farms and Ranches drafted it last fall.

Pueblo Chieftain, 5/10/01

WATER CONSERVATION**City commission fears conservation evaporating water rights**

Use it or lose it is the rule in Colorado water law. Members of the Durango Water Commission are concerned that if Durango conserves water, the city could lose some of its water rights to downstream users. This is an uncomfortable prospect for the Commission, which is

working on a water conservation plan, because it means every drop saved by a low-flow showerhead or toilet has the potential to be legally claimed downstream. A Durango-based engineer who monitors water usage in Southwest Colorado, said he had not heard of any municipality losing water under such a scenario. The city's long-range plan calls for increasing awareness of water use, reducing costs in the public works department, and reducing demand. Durango takes water from the Florida and Animas rivers, treats it, delivers it to residents, and then treats it again before releasing it back to Animas River. The Animas flows into the San Juan River, which is part of the Colorado River basin. The Southwestern Water Conservation District and the Animas-La Plata Water Conservancy District are two entities whose charge is to push A-LP through. There are practical reasons, however, for the city to conserve water. Less water used per capita is cost efficient, enabling a treatment plant to serve more people, thereby extending the life of the facility. And, municipalities must also have a water plan if they want to compete for low-interest loans from the state for water improvement projects.

Durango Herald, 4/22/01

WATER DEVELOPMENT/SUPPLY

Animas-La Plata funding hike expected

The Bush administration is expected to propose more funding for the Animas-La Plata water project for the budget that begins Oct. 1, according to the US Bureau of Reclamation. Additional money is needed if excavation work is to start in 2003 as planned, according to the USBR project manager. With additional funding, the reservoir, a pumping plant and a pipeline between the two should be completed in seven years. The project would provide water for more than 3,000 members of the Ute Mountain Ute and Southern Ute Indian tribes, as well as businesses and farms on and off reservations in southwestern Colorado and northwestern New Mexico. Cost estimates vary from about \$250 million to more than \$340 million. USBR was given \$2 million this year to plan for minimizing the impacts of construction on the environment; however, much of the money will be spent on preparing for possible lawsuits, which will soon be filed by opponents of the project. A study released by American Rivers ranked the Animas River as the nation's ninth most endangered river, pointing to the water storage project as its biggest threat. The group claims that the project, which would divert a quarter of the river's flow, would threaten two endangered fish species, the Colorado pikeminnow and the razorback sucker - as well as the recreational rafting industry, riverbank lands and a trout fishery. Other concerns include the inundation of 2,000 acres of elk and deer habitat under the resulting lake and the creation of air and water pollution from the coal-fired power plant needed to run water uphill. Proponents of the project stress that the plan that passed Congress last year is an environmentally sound, watered-down version of the original and that the scaled-down version of the Animas-La Plata project is the most environmentally sensitive and most cost-effective means of (addressing) the tribe's water rights. Despite the backing of the former Democratic administration and two Colorado Republicans, American Rivers said it plans to encourage Congress to not appropriate federal funds for the project in the future.

Fort Collins Coloradoan (AP), 4/8/01, *Pueblo Chieftain*, 4/12/01

WATER QUALITY

Arsenic levels low in Pueblo's drinking water

Pueblo's Board of Water Works and Pueblo West officials say drinking water in the area has less than 1 micron of arsenic per liter - well below the current federal standard of 50 microns and even below the 10-micron standard that public health and consumer groups are demanding. The latest tests results on Arkansas River water intake showed only 9 microns per liter of arsenic in the river. After the treatment process removes some of that arsenic, drinking water showed an average arsenic level of .3 microns per liter. The Director of the Pueblo West treatment system said the water provided to Pueblo West residents was virtually clear of arsenic where water showed much less than .1 micron of arsenic per liter. While arsenic is not a concern in Pueblo, that isn't the case everywhere in Colorado. According to the Colorado Health Department, there are three small water districts in the Alamosa area - East Alamosa Water and Sand District, Price East Alamosa Water Co., and the Cottonwood Mobile Home Park - that cannot meet the current 50-micron standard. The 1,700 people served in those districts have been aware of the problem for a long time. State officials did not think it practical to force these little districts to install the technology to clean the water to 50 microns if the 10-micron standard was going to be imposed. Those districts depend on well water, and don't have large resources for upgrading their systems. If the 10-micron standard were ultimately enforced, about 20 systems around the state - none in major urban areas - would have to improve their treatment programs, to comply. In Albuquerque, N.M., which has more arsenic to deal with in the city's water system, officials have led the campaign in Congress to hold the federal standard at 50 microns.

The Pueblo Chieftain, 4/13/01

Health of Yampa River studied

The Colorado Department of Public Health and the Environment has been studying health of the Yampa River by sampling mud for aquatic insects and small slimy prehistoric bottom-feeding fish called sculpin. The Department is examining the river basins of northern Colorado, starting with the Yampa, to see how aquatic life is holding up as rivers absorb the impacts of growth and various user groups. The sculpin is a good sign, because the fish is especially susceptible to environmental contaminants, and its presence can be an indicator of a healthy river. Smaller sculpin are also an important food source for trout. While the state has done these sorts of studies before, the comprehensive nature of this examination is unprecedented. Most studies of the river in the past have included chemical tests that have



examined the potential health of the living organisms in the river but have not looked at the organisms themselves. In addition, studies have traditionally focused on potential point sources of pollution, looking at discharge from places like wastewater treatment plants and factories. The new approach will take into account non-point source pollution, which can include everything from parking lot and construction site runoff to agricultural runoff. The Yampa is seen as a healthy river, but with growth and potential new pollutants, it could be in danger. The studies are done in an attempt to check data in reference to the federal Clean Water Act. The department measures levels of nutrients such as nitrates and phosphates in the river to see if pollutants are causing high levels of nutrients. The baseline data collected will be compared to data taken in September to determine how much they have changed. The amount of algae growth, for instance, can be an indicator of the amount of various pollutants in the river.

Steamboat Pilot, 4/15/01

WATER RIGHTS

NPS claim for water rights in Black Canyon sets record for oppositions filed

Backlash from a National Park Service claim for water rights in the Black Canyon of the Gunnison National Park may have sparked a state record for oppositions filed in water court. Colorado Water Court Division 4, located in the Montrose County Justice Center, has received 383 statements of opposition to a claim the U.S. Department of Justice filed Jan. 18 on behalf of the National Parks Service. Charged with a mandate to preserve the Black Canyon's historic, natural character as much as possible, the NPS wants Gunnison River flows to resemble conditions that existed before the construction of three upstream dams in the 1960s and '70s. The NPS's 1933 water rights date back to a claim created the year the narrow, remote canyon on the Gunnison River near Montrose was declared a national monument. Roughly 12 miles of the Gunnison River flow through the Black Canyon of the Gunnison National Park. The NPS claim could impact water users from the Uncompahgre Valley to the Upper Gunnison River Basin. The water rights holders who have priority over the NPS will not be affected, however, water users with junior water rights that fall secondary, may be. Park Service officials did not estimate how many water users the proposal might affect or to what extent, and the NPS filing has left water users, including irrigators and local governments, scrambling to determine whether they might lose water rights under the proposal. A coalition of five environmental groups has sided with the NPS to ensure the Park's aquatic ecosystem is restored and preserved. The five groups include the Wilderness Society, High Country Citizen's Alliance, Western Colorado Congress, Western Slope Environmental Resource Council and Environmental Defense. Based in Montrose, Division 4 is responsible for the administration of water rights. How much water the 1933 claim gives the federal government remains unresolved. NPS officials have said they hope to negotiate a settlement out of court.

Montrose Daily Press, 4/29/01, The Denver Post, 3/31/01

Forest Service to refashion water bypass flow rules

A controversial Forest Service policy regarding bypass flows may change under the Bush administration. The agency's policy has required some owners, since 1993, to leave a portion of their water in the river to benefit fish and wildlife downstream. In exchange, the water user can cross federal land to gain access to the water. The water rights are renegotiated only when existing claims expire. Opponents claim that policy has cost some Colorado residents part of their historic water rights. The president of Trout Unlimited says that it makes sense in some cases to use the access to federal land as leverage to make sure enough water stays in the rivers to sustain wildlife and habitat. Agricultural Secretary Ann Veneman has been asked to return to a 1992 standard for renegotiating water rights. The policy is still being revised.

Fort Collins Coloradoan (AP), 5/23/01

WATER TRANSFERS

Aurora wants to avoid legal battle over water

Aurora wants to avoid a legal fight over its purchase of water from southeastern Colorado farmers, and its mayor says the city will pay to lessen the impact of diverting water from the area. Some Rocky Ford shareholders and area leaders oppose the sale to Aurora of shares in the Rocky Ford Ditch Co. They say the Arkansas River provides water to area farmers for irrigation and the impact of about 2,800 acres of farmland drying up will be huge. Aurora requires developers and homeowners to conserve water and has growth-management plans, but still needs more water. The Southeastern Colorado Water Conservancy District is fighting Aurora's plan to store some of its Rocky Ford water in Pueblo Dam. Aurora said if the district prevails, the city could lose water it already stores there, and threatens to lobby against federal approval of the district's plan to enlarge the dam. The district, made up of various water users, owns the dam. Aurora officials said the city invested a lot of money revegetating former farmland after it bought some of the rights to Rocky Ford water in the 1980s. The state Water Court will consider the city's latest water purchase, which would be about 5,000 acre-feet, or enough for 20,000 people for one year.

Aurora Sentinel, 3/29/01

WETLANDS

EPA keeps wetlands rule

The EPA says it will leave in place a Clinton Administration rule that will expand protection for tens of thousands of acres of wetlands across the United States. "Wetlands" is a collective term that refers to marshes, swamps, bogs and similar areas, all of which filter and cleanse water, help to contain floodwaters and provide natural habitat for many species of fish, birds and wildlife. The decision is a big defeat for developers, who have contended for years that the action would impose restrictions far beyond those authorized by Congress. The EPA has said that the action would close a loophole that in the last two years permitted the destruction of 20,000 acres of 150 miles of streams without environmental review. The new rules require developers to obtain permits under the Clean Water Act before carrying out earth-moving activities to limit the presence of wetlands and their environmental restrictions. These practices include the digging of artificial lakes and gouging streams with man-made channels. A challenge to the rule by the National Association of Home Builders is pending in the US District Court in Washington.

Denver Post/ New York Times 4/17/01

MISCELLANEOUS

World Affairs panel speakers ponder water supply

The most precious resource on Earth only catches attention of Americans when it's scarce, according to a panel at the Conference of World Affairs. But for people living in other parts of the world, water already is in short supply, and it promises only to become more limited in the future. Worldwide consumption of water is doubling every 20 years. By 2025, the panel estimates two-thirds of the world's population will live in a condition of water shortage, and one in three people will live in a situation of absolute water scarcity. We have the same amount of fresh water on Earth that we had during biblical times. Panelists agreed that Americans do not have a sense of the imminent global water problem. Even with severe drought seasons and restrictions on water use, Americans don't really know what it's like to have a scarcity of water.

Boulder Daily Camera, 4/11/01

Global thirst for water might be cause for future wars

At the end of last year, U.S. intelligence agencies, in unusual collaborations with universities, and think tanks, published a 68-page study called "Global Trends 2015." One of the most interesting conclusions of the analysts and scholars is that there will be energy and food enough to go around, but there will be famine because of poor distribution complicated by politics and war. Water will be the problem. Demands for water might be the cause of future wars and more than a third of the world's people will be in areas described as "water-stressed". Also, aqueducts and irrigation systems in one country may threaten the existence of others, particularly in the Middle East.

Denver Post, 4/1/01

Judge: Feds must pay for Calif. water

A federal judge has ruled that the government must pay farmers in California's arid Central Valley for water diverted to protect endangered fish. Growers argued that by taking water away to protect Chinook salmon and the delta smelt, the U.S. Fish and Wildlife Service and the National Marine Fisheries Service effectively took fields out of production and took money from farmers' pockets. The judge ruled that the farmers are entitled to protection under the Fifth Amendment, which prohibits the government from taking property without paying for it. The ruling could have broad implications for farmers and urban water users in the 17 Western states where federal rules protecting wildlife are increasingly in conflict with water allocations. Some water contracts held by the federal government might be outside the scope of the suit because they pay only for what they receive. It was not clear what impact it would have on farmers who get their water from the federal government or districts that supply households.

Fort Collins Coloradoan (AP), 5/5/01

CU drones are busy as bees over Arctic

For 10 days in April, 3 small, unmanned University of Colorado planes equipped with digital cameras snapped pictures of shifting sea ice and coastal erosion in the Arctic Ocean. Temperature, humidity and wind-speed data were collected over the ocean near Point Barrow, Alaska as part of a National Science Foundation-funded research project. In the last decade there has been a shrinking of the sea ice in this region. James Maslanik, a CU aerospace engineer, directed the flights from Point Barrow to map the changes. The planes, built by an Australian company, and leased to CU researchers, are called aerosondes and can fly 1,500 miles on a single gallon of fuel. Though researchers keep in touch with them by radio and satellite, the aerosondes are autonomous and can fly up to 40 hours without human intervention. The latest models have a 9-foot wingspan and feature the world's smallest fuel-injected engine. As the Arctic ice shrinks, coastal erosion has increased, and the types and numbers of fish and sea mammals in the region have changed, which is a concern to Inuit fishermen who hunt whales and other marine mammals, as well as fish. The CU researchers will monitor the Arctic coastal changes with aerosondes through 2006. (*Denver Rocky Mountain News, 4/18/01*)





Call for Posters

You are invited to submit a one-page abstract to the organizing committee by Aug. 1, 2001. Selected posters will be displayed throughout the forum with a staffed session during the networking hour, 4-7 p.m., Oct. 24. Authors whose posters are selected for presentation will be notified by Sept. 1, 2001. All accepted abstracts will be published in the conference proceedings.

To submit abstracts or request additional information, please contact:

Jennifer Brown
South Platte Forum
513 N. Harding Ave.
Johnstown, CO 80534
Phone: 970/213-1618

E-mail: southplatte@west.net

Website: <http://southplatteforum.colostate.edu>

Sponsored by:
 Colo. Division of Wildlife
 Colorado State University Cooperative Extension
 Colorado Water Resources Research Institute
 Denver Water
 Northern Colorado Water Conservancy District
 US Environmental Protection Agency
 US Fish and Wildlife
 US Geological Survey

KEYNOTE SPEAKERS

Russell George, Director, Colorado Division of Wildlife
Senator John Evans, Colorado State Legislature

SESSIONS

Water Banking: Making a deposit for the future
Well Augmentation: Balancing the account
What's in the Water? A water quality update
Chutes, Ramps and Ladders: A recreation quantity discussion
Fishable, Swimmable, Irrigatable: A recreation quality update
Reduce, Reuse, Recycle: Saving water for tomorrow

MEETINGS

**COLORADO LAKE AND RESERVOIR MANAGEMENT ASSOCIATION FALL CONFERENCE
WEDNESDAY, OCTOBER 3, 2001, FROM 9:30 AM – 3:30 PM
WESTMINSTER RECREATION CENTER, 10455 SHERIDAN BLVD.**

The theme for the fall conference is “Challenges of Managing Limited Water Resources in Colorado Lakes and Reservoirs.” We will have an exciting and dynamic program with topics including water quality criteria, water quality in Front Range Reservoirs, the monitoring program in Barker Reservoir, an evaluation of stormwater best management practices to reduce bioavailable phosphorus, information on the Three Lakes project, and impacts of the Summitville Mine on the Alamosa River fishery below Terrace Reservoir. We also plan to have a discussion panel on conflicting use restrictions for recreation in drinking water reservoirs with representatives from several Colorado communities such as Boulder, Aurora, Westminster, Denver, Fort Morgan, and Steamboat Springs. Please plan to join us! Registration cost is \$75 per person and includes a continental breakfast, hot lunch, and afternoon cookies! Contact Sharon Campbell at 970-226-9331 for further information or a registration form.



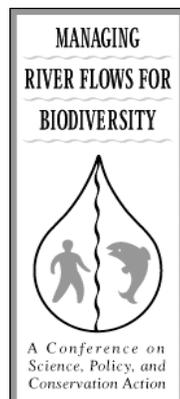
**2001 AWRA/UCOWR SUMMER SPECIALTY CONFERENCE
DECISION SUPPORT SYSTEMS FOR WATER RESOURCES MANAGEMENT
SNOWBIRD, UTAH
JUNE 27-30, 2001**

For registration information, access the AWRA website at: <http://www.awra.org>

This conference will provide a forum for addressing the latest advancements in data collection, information processing, decision support systems, and remote data collection for water resources management, and for discussing the educational and institutional infrastructure needed to make the use of these tools more effective in the water sector. Remote data collection has become rapid and inexpensive. Water resources managers now have access to high quality data that is available more rapidly and in greater quantities than ever before. The challenge now is to process and understand the data as rapidly as it is generated. Decision support systems, often employing technology such as Geographic Information Systems (GIS) and the World Wide Web (WWW), offer decision-makers the opportunities to utilize information to evaluate a variety of potential system operations by providing them with data in form that facilitate immediate and accurate decisions. During the conference, the National Science Foundation is sponsoring four sessions addressing the relevance of university-based science to society. The Corp of Engineers is sponsoring three sessions addressing curricula development for water resources planning and management graduate studies, primarily for continuing education purposes.



**MANAGING RIVER FLOWS FOR BIODIVERSITY
JULY 30 - AUGUST 2, 2001
COLORADO STATE UNIVERSITY, FORT COLLINS, COLORADO**



The **Managing River Flows for Biodiversity Conference** is designed for water managers, staff from non-governmental organizations that work to influence water management decisions, and the attorneys, scientists, and other consultants that advise these groups. Attendees will have an opportunity to examine the real and perceived conflicts between meeting ecosystem needs and human demands for water; discuss the state of science with respect to flow requirements for biodiversity conservation; hear case studies where practitioners are working to meet human demands for water while also providing for ecological needs; and attend a field trip to nearby Rocky Mountain rivers.

To register for the conference, please download the printable registration form (105kb pdf file) located at <http://cwrr.colostate.edu>. Click on Upcoming Events



**THE 26TH ANNUAL
COLORADO WATER WORKSHOP
JULY 25 - 27, 2001
PRESENTED BY WESTERN STATE COLLEGE, GUNNISON, COLORADO**

WHO'S IN CHARGE?

How are changes in the federal and state governments affecting water use in Colorado? How are recent court decisions and new legislation shaping the future? Are collaborative efforts working for water users? Join us at the Colorado Water Workshop for a mix of policy debates and Case studies on the latest issues in water management.

DAY ONE – Wednesday, July 25

All sessions take place in the College Union unless otherwise noted.

- 12:00 **BBQ on the Union Lawn**
- 1:00 **Welcome** (Union Ballroom)
- 1:00 **What to expect from the Bush Administration**
Secretary of Interior Gale Norton (*invited*)
- Maintaining Control of Colorado's Water Resources**
Ken Salazar, Attorney General, State of Colorado
- Meeting the Water Needs of Colorado's Future Generations – The State's Role**
Harold Miskel, Chair, Colorado Water Conservation Board
- 3:00 **Break**
- 3:15 **Water Quality Management: Is There Still a State Role?**
Paul Frohart, Administrator, Colorado Water Quality Control Commission
- Protecting Public Values – The Importance of Regulations, Government Programs, and Voluntary Action**
Pam Eaton, Four Corner States Regional Director, Wilderness Society
- You Can Lead the Horse to Water, BUT... Will There Be Anything to Drink? – Private Users, Programs, Regulations, Requirements, and Uncertainty...**
Ken Spann, Spann Ranches, Gunnison, Colorado

5:00 **Adjourn**

5:15 – 6:30 Reception & Special Video Presentation

(Aspinall-Wilson Conference Center)

Relax with a glass of wine or beer and catch up with old friends. Enjoy a special short video presentation with W.D. Farr as he reflects on his experience with the Colorado-Big Thompson Project. The 10 minute video will be shown at 5:30 and 6:00. Mr. Farr will be on hand to add commentary and answer questions.

DAY TWO – Wednesday, July 25

- 7:30 **Continental Breakfast** (Union Lobby)
- 8:00 **Introduction**
- 8:10 **How are Colorado's state legislators looking out for our water future?**
- Meeting the Needs of Colorado's Growing Population**
Senator John Evans
- Water Banking, Recreational Flows, and Other Issues**
Senator Lewis Entz
- 9:15 **The Growing Demand for Recreational Water- "What is Reasonable and Efficient?"**
Doug Whittaker, PhD, Resource Social Scientist, Confluence Research and Consulting, Anchorage, Alaska
- 10:00 **Break**
- 10:15 **The Right to Float? – Implications for Recreational Water Use**
John R. Hill, Bratton & McClow, LLC
- 10:45 **Bypass Flows – Debate**
Kate Zimmerman, Environmental Attorney (*invited*)
Jim Witwer, Attorney, Trout & Raley
- 11:30 **Lunch**
- 12:45 **Keynote Presentation**
Congressman Dennis Hastert, Speaker of the House, US Congress (*invited*)
- 1:30 **Break**
- 1:45 **Basin of Origin Protection – A proposal Ballot Initiative**
Bob Jackson, Former State Legislator, Former Member Colo. Water Conservation Board
Ron Aschermann, Farmer, Rocky Ford
- 2:30 **Recent Court Decisions Influencing Future Water Use**
Sandy White, White & Jankowski

3:10	Renewable Water for the Front Range-Cooperative Efforts Jim Sullivan, President, Douglas County Water Resources Authority; Board Member, Colorado Water Congress	9:45	Break
3:45	Break	10:00	Providing Stream Flows in the Gunnison Basin – Reserved Rights, Bypass Flows, and Other Issues Tara Thomas, Director, West Slope Environmental Resource Council
4:00	Concurrent Sessions		Impacts for Water Users in the Lower Gunnison Basin Marc Catlin, Uncompahgre Valley Water Users (invited)
	1) Recreational Flows: The Clear Creek Case Bo Shelby, PhD, Sociologist, Department of Forestry, Oregon State University	11:00	Break
	2) Transbasin Diversion: A View from the Basin of Origin Kathleen E. Curry, Manager, Upper Gunnison Water Conservancy District John McCLOW, Bratton & McCLOW LLC	11:15	Concurrent Sessions
	3) Water for the West: A Humorous History Katherine Scott Sturdevant, Social Historian, Pikes Peak Community College		1) Elections of Conservancy District Boards Ed Quillen, Columnist, <i>Denver Post</i> Kathleen Curry, Manager, Upper Gunnison River Water Conservancy District Terry Scanga, Upper Arkansas Water Conservancy District
	4) Easy Living Through Cooperation – Examples from the Rio Grande Water Conservancy District Ray Wright, President, Rio Grande Water Conservancy District		2) A Success Story – The Colorado River Programmatic Biological Opinion Larry Clever, Manager, Ute Water Conservancy District
5:00	Adjourn – Dinner on your own		3) Consent – Building Secrets of “Implementation Geniuses” Hans Bleiker, Institute of Participatory Management & Planning
			4) Solving Problems at the Local Level: Watershed Efforts Larry McDonald, Colorado Watershed Network Calvin Campbell, President, North Fork River Improvement Association Carol Ekarius, Coordinator, Upper South Platte Watershed Protection Association
DAY THREE – Friday, July 27			
7:30	Continental Breakfast (Union Lobby)		
8:00	Introduction		
8:10	Black Canyon Reserved Rights Chuck Pettee, Chief of Water Rights Branch, National Park Service	12:15	Lunch and Closing Speaker
	Impacts of Black Canyon Rights for Water Users Greg Peterson, Board Member, Upper Gunnison River Water Conservancy District		The Art of Accomplishing a Difficult Mission in a Democratic Society Hans Bleiker, Institute of Participatory Management and Planning
	Gunnison River Endangered Fish Recovery Programmatic Biological Opinion Gerry Roehme, Instream Flow Coordinator, Upper Colorado River Endangered Fish Recovery Program	1:45	Adjourn

Contact

Lucy High, Director
 Colorado Water Workshop
 Western Water Workshop
 Gunnison, CO 81231
 Phone 970/641-8766,
 FAX 970/641-6280
 E-mail water@western.edu





2001 REVEGETATION SUMMER FIELD TOUR
 Sponsored by the
HIGH ALTITUDE REVEGETATION COMMITTEE AND THE
COLORADO SECTION – SOCIETY FOR RANGE MANAGEMENT
 August 16-17, 2001

The High Altitude Revegetation Committee (HARC), through Colorado State University and the Colorado Section of the Society for Range Management (SRM) invite you to the annual Revegetation Summer Field Tour. The tour will take place in **Rocky Mountain National Park** just a couple of hours from Denver. This is the first time the High Altitude Revegetation Committee has had a joint sponsor, and we look forward to having members from both organizations on this exciting and educational field trip. During the two-day tour, we will visit some very interesting areas of restoration in the largest national park in Colorado. Revegetation sites we will visit range from ponderosa pine/upland shrub at 7,800 feet to alpine tundra at 12,000 feet.

Since Rocky Mountain National Park is very busy during the summer and parking at the various places is limited, travel will be by busses. We will meet in Estes Park, the gateway community on the east side of Rocky Mountain National Park, between 8:30 and 9:30 a.m., at the local high school parking lot and leave our personal vehicles there. Please come as early as you can to give time for the check-in process. That morning we will collect a nominal fee of \$10 to help cover the cost of the busses. If you decide to drive your personal vehicle into the park for the tour, **which we do not recommend**, there will be an entry fee of \$15 payable at the entrance station, and there is no guarantee you will find a parking space for your vehicle where the busses stop. As always, family and friends are welcome and encouraged to join the tour. Bring your own sack lunch for both days, and we will provide free soft drinks for our lunchtime picnics. We will have a free social hour, free catered barbecue and a local history speaker on Thursday evening in Estes Park. **Since we will be using busses, preregistration is required this year.** Register early to guarantee a seat. Register online at <http://www.highaltitudereveg.com>, or contact one of the following: Jeff Connor at 970/586-1296, Gary Thor at 970/484-4999, Wendell Hassell at 303/422-2440, or Don Hajar at 970/356-7002. Registrations are due by August 6th.



CALENDAR



June 27-29	THE ENDANGERED SPECIES ACT AND WATER LAW IN THE SOUTHWEST, Albuquerque, NM. Contact: Western States Water Council, Creekview Plaza, Suite A-201, 942 East 7145 So., Midvale, UT 84047, Phone 801/561-5300, FAX 801/255-9642.
June 27-30	TRANSBASIN WATER TRANSFERS, Denver, CO. USCID, Phone 303/628-5430, FAX 303/628-5431, Email stephens@uscid.org , Website http://www.uscid.org/-uscid .
June 27-30	JOINT AWRA/UCOWR SUMMER SPECIALTY CONFERENCE, DECISION SUPPORT SYSTEMS FOR WATER RESOURCES MANAGEMENT. Snowbird, UT. Contact: Technical Program Chairperson Donald F. Hayes, Civil and Environmental Engr., Univ. of Utah, 122 So. Central Campus Dr., Ste 104, Salt Lake City, UT 84112, Phone 801/581-7110, FAX 801/585-5477, E-mail: hayes@civil.utah.edu . Conference General Co-Chairperson Mac McKee, Utah Water Research Lab, Utah State Univ., UMC8200, Logan, UT 84322-8200, Phone 435/797-3188, FAX 435/797-3663, Email: mmckee@cc.usu.edu , Website http://www.awra.org .
July 19-20	WATER LAW & POLICY, San Diego, CA. See Water Education Foundation website at: http://www.watereducation.org .
July 25-27	26TH ANNUAL COLORADO WATER WORKSHOP - WHO'S IN CHARGE?, Gunnison, CO. Contact: Lucy High, Western State College, Gunnison, CO, 81231, Phone 970/641-8766, FAX 970/641-6280, E-mail water@western.edu .
July 30-Aug. 3	21 ST ANNUAL MEETING OF U.S. SOCIETY ON DAMS (USSD), Denver, CO. Contact: Larry Stephens, Phone 303/628-5430, FAX 303/628-5431, E-mail stephens@ussdams.org , or see website at http://www.ussd.org .
Aug. 19-24	LINKING STORMWATER BMP DESIGNS AND PERFORMANCE TO RECEIVING WATER IMPACTS MITIGATION, Snowmass, CO. Contact: Ben Urbanas at 303/455-6277; 303/455-7880, Email burbonas@udfed.org .
Aug. 19-Sept 13	17th International Seminar on FOREST AND NATURAL RESOURCES ADMINISTRATION AND MANAGEMENT, Fort Collins, CO. Contact Ann Keith, Coordinator, Phone 970/482-8098, FAX 970/490-2449, E-mail IFS@cnr.colostate.edu , Website http://www.fs.fed.us/global/isfam .



Aug. 23-24	COLORADO WATER CONGRESS - SUMMER CONVENTION, Steamboat Springs, CO. Phone: (303) 837-0812, fax: (303) 837-1607, E-mail macravev@cowatercongress.org , website http://www.cowatercongress.org .
Sept. 7-8	2 ND ANNUAL CONFERENCE, COLORADO WATERSHED ASSEMBLY, Frisco, CO. Contact: Chris Rowe at Phone 303/291-7437 or E-mail cwn@coloradowatershed.org .
Sept. 9-12	DAM SAFETY 2001, Assoc. of State Dam Safety Officials Annual Conference, Snowbird, UT. Contact: ASDSO, 450 Old Vine Street 2nd Floor, Lexington, KY, 40507. Phone 859/257-5140, FAX 859/323-1958, E-mail info@damsafetv.org , Website http://www.damsafetv.org (go to conferences and training).
Sept. 10-11	WATER LAW SEMINAR sponsored by Colorado Water Congress. 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 macravev@cowatercongress.org , website http://www.cowatercongress.org .
Sept. 22-26	GROUND WATER PROTECTION COUNCIL ANNUAL MEETING, Reno, NV.
Oct. 10-12	SYMPOSIUM ON THE SETTLEMENT OF INDIAN RESERVED WATER RIGHTS CLAIMS, St. George, UT. Contact: Western States Water Council, Website http://www.westgov.org/wswc/ .
Oct. 17-19	THE NATIONAL URBAN WATERSHED CONFERENCE, Costa Mesa, CA. Contact: National Water Research Institute, PO Box 20865, Fountain Valley, CA 92728-0865. Phone 714/378-3278, FAX 714/378-3375, Email NWRI-2@worldnet.att.net .
Nov. 11-13	NASULGC 2001, 114th Annual Meeting, Washington, DC. Call national office at 202/478-6050, or see NASULGC website at http://www.nasulgc.org/am2001 .
Nov. 12-15	AWRA ANNUAL WATER CONFERENCE, Albuquerque, NM. Contact: Michael Campana, AWRA, at Phone 540/687-8390 or access website at http://www.awra.org .
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 macravev@cowatercongress.org , website http://www.cowatercongress.org .
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 .

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

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