COLORADO WATER

Newsletter of the Water Center of Colorado State University

October 2005

Colorado State University President Larry Penley and State Representative Diane Hoppe (foreground) join the Colorado Water Congress tour of the rennovation work at Elkhead Reservoir during the Colorado Water Congress summer convention.

Inside: Research Updates

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WATER ITEMS AND ISSUES . . .

COLORADO WATER
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Published by the Colorado Water Resources Research Institute * Colorado State University, Fort Collins, CO 80523
Phone 970/491-6308 * FAX: 970/491-1636 * E-mail: Gloria.Blumanhourst@colostate.edu

INTERNET SITES
Colorado Water Resources Research Institute: http://cwrri.colostate.edu
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EDITORIAL

Water Research Update

by Robert C. Ward
Director of Colorado Water Resources Research Institute

As humans we are constantly gaining new knowledge and insight. As a society, we are constantly learning new things that, hopefully, will improve our lives and reduce risks of natural and man-made disasters. As hurricanes Katrina and Rita remind us, we still have a lot of learning to do as many of our cities remain highly vulnerable to disaster.

Jared Orsi, an Assistant Professor in CSU's History Department, published a book in 2004 entitled *Hazardous Metropolis: Flooding and Urban Ecology in Los Angeles*. The book describes the strange and often hazardous ways that engineering, politics, and nature interact as humans attempt to reduce the risks of flooding in and around Los Angeles. In the book, Orsi suggests a new paradigm for understanding the city's complex and unpredictable waterways (called 'the urban ecosystem') and offers lessons learned as other cities seek to improve their relationship with the extremes of nature.

On page 21 of this issue, Prof. Orsi shares with *Colorado Water* readers some of the insight he gained in conducting the historical research required to write the book *Hazardous Metropolis.*

The research that Prof. Orsi conducted, and the insight he gained, is an example of the contributions higher education can bring to society as it attempts to reconcile its increasingly complex relationship with water. While flooding is a highly complex issue (as the hurricanes have shown), we in Colorado are struggling with the complex relationships associated with a rapidly growing population in a semi-arid climate. The 2005 Colorado Legislative session established, via HB 1177, water roundtables in each river basin to begin a dialogue about meeting future water demands with limited supplies. Water research in higher education offers many perspectives on the supply and use of water in Colorado – perspectives that may facilitate dialogues at the water roundtables.

For example, in this issue of *Colorado Water* the reader will find results from a study of the leaching of nutrients from irrigated turf as well as updates from the three current CWRRI Water Research Fellows - describing efforts to better understand the 'firm yield' of the Colorado River; the economic impact on rural communities when irrigation water is reduced due to overuse in the past or water is moved to meet growing urban needs; and an assessment of the presence of pharmaceuticals in and around on-site wastewater treatment systems. Future water research priorities of CWRRI's Advisory Committee are listed in the Call for Nominations for CWRRI's FY 2006 Water Fellowship competition.

How does the water information in higher education reach the water dialogues currently taking place across Colorado? Cooperative Extension has organized a team to help the water roundtables gain ready access to higher education's water expertise.

Serving on this team are: Thad Gourd (Adams County) serving the South Platte; Carl Wilson (Denver County) serving the Metro area; Jeff Tranel (Pueblo) serving the Arkansas; Marvin Reynolds (San Luis Valley) serving the Rio Grande; CJ Mucklow (Routt County) serving the Yampa/White; Rod Sharp (Grand Junction) serving the Colorado River; Dan Fernandez (Dolores) serving Dolores/San Miguel and San Juan; Deb Alpe (Jackson County) serving the North Platte; and Wayne Cooley (Tri River Area in Delta) serving the Gunnison. Lyn Kathlene and Reagan Waskom will serve as campus coordinators for this effort. Contact information is on page 31.

I want to personally thank these Extension staff members for offering their time and assistance to Colorado's water roundtables. Their willingness to connect local water information needs with the reservoir of water knowledge in Colorado's higher education system is a valuable service to Colorado.

Colorado State University Agricultural Experiment Station

Leaching of Nitrogen and Phosphorus from Irrigated Turf

by Jennifer E. Morgan, Graduate Research Assistant
Department of Civil Engineering, Colorado State University

Eutrophication of drinking water reservoirs, accelerated by nutrients, is a significant problem in Colorado, and urban landscapes, including irrigated turf, are one of many potential sources of nutrient loading to reservoirs. Previous nutrient transport studies have tended to be site and situation specific and have not often addressed nitrogen and phosphorus transport simultaneously. Conclusions of these studies often disagree, especially with regard to phosphorus transport. Leaching of phosphorus from turf grass is typically considered to be negligible due to the tendency of phosphorus to readily adsorb to soil particles. However, some recent studies have determined that substantial loads of phosphorus can be transported in leachate.

To add some clarity to this issue, particularly with regard to Colorado conditions, the Colorado Agricultural Experiment Station has supported research at CSU to assess the influence of fertilizer treatment on nitrogen and phosphorus leaching from irrigated turf grass in a Colorado landscape. This article provides a snapshot of the study.

Two separate leaching experiments were conducted using 24 sprinkler irrigated lysimeters (Figure 1) located at the Agricultural Engineering Research Center at Colorado State University. Experiment 1 was designed to evaluate the effect of ammonium sulfate on N and P leaching and involved the application of ammonium sulfate fertilizer at rates of zero, 25.7 and 77 kg N ha-1. Experiment 2 was designed to evaluate the effect of both superphosphate and ammonium sulfate fertilizers on N and P leaching and involved three different fertilizer treatments: no fertilizer, superphosphate fertilizer (55 kg P ha-1) , and a combination of superphosphate (55 kg P ha-1) and ammonium sulfate (77 kg N ha-1) fertilizers.

Figure 1. One of twenty-four lysimeters used during the nutrient leaching experiments conducted at the Agricultural Engineering Research Center at Colorado State University.

Irrigation was applied three times per week for both experiments, and leachate was collected following each irrigation event. Water drained from each lysimeter was measured for volume, and samples were analyzed for nitrate and phosphate concentrations. Total phosphorus concentrations, measured on occasion throughout the study, were typically equal to the concentrations measured for phosphate. Thus, it was appropriate to assume that phosphate measurements provided a reliable estimate of total phosphorus leaching.

Nitrate concentrations measured in leachate throughout Experiment 1 and Experiment 2 primarily remained below 1 mg L-1 and were not influenced by fertilizer treatments used in this study. Upon application of ammonium sulfate fertilizer at a rate of 77 kg N ha-1 and 25.7 kg N ha-1 during Experiment 1, a small increase in average nitrate concentration was observed for all three treatments. The trend was similar for both the fertilized and unfertilized lysimeters, suggesting that the increase in concentration may have been due to higher irrigation rates at that point in time. The effect was more dramatic for several individual lysimeters and may have been the result of preferential flow. As illustrated by the range of nitrate concentrations for each fertilizer

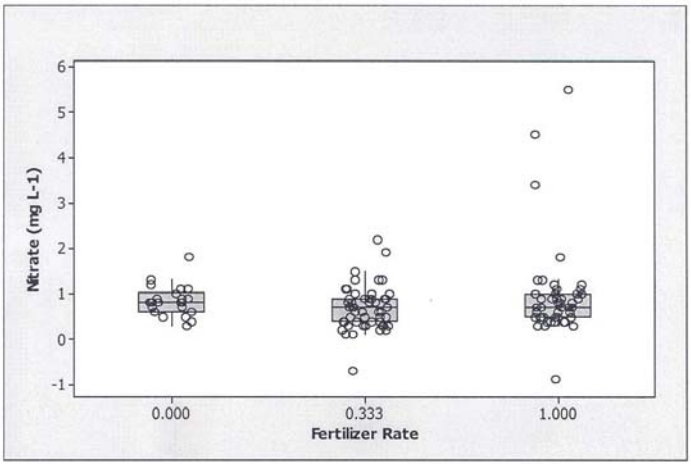


Figure 2. Nitrate concentrations measured in leachate during Lysimeter Experiment 1 for unfertilized lysimeters and lysimeters treated with ammonium sulfate at one and one-third times the recommended application rate of 77 kg N ha-1.

treatment presented in Figure 2, preferential flow was probably occurring in several of the lysimeters, limiting interaction between fertilizer and soil and resulting in high nitrate concentrations in leachate. No increase in nitrate concentration was observed following fertilizer application in Experiment 2. The nitrate concentrations from the P-only treatment and the combination N and P treatment did not differ from the nitrate concentrations produced by the unfertilized treatment.

Figure 3 shows the average dissolved phosphate concentrations measured before fertilizer application and during Experiment 1 for each fertilizer rate. No phosphorus fertilizer was applied during this portion of the study, yet leachate concentrations were consistently measured over 1.0 mg L-1. During the seventh week, a small increase in average phosphate concentration was observed in leachate from lysimeters treated with ammonium sulfate fertilizer.

Since no phosphorus fertilizer was applied during this portion of the study, P measured in leachate must have originated from residual soil P. Application of ammonium sulfate may have temporarily reduced the pH of the soil solution and increased the availability of calcium phosphate species. The increase in phosphate concentration was short-lived and leachate concentrations returned to previous levels by the next irrigation event. Over the entire duration of the study, ammonium sulfate fertilizer applied at one and one-third the full application rate had very little influence on average phosphate concentrations in leachate.

Average phosphate concentrations in leachate during Experiment 2 are presented in Figure 4. Lysimeters treated with a combination of ammonium sulfate and superphosphate fertilizers produced a three-fold increase in the average phosphate concentration following fertilizer application, illustrated by the spike in concentration occuring on 10/05/04 for the NP treatment. These results further suggest that ammonium sulfate fertilizer was temporarily increasing the availability of phosphorus. In this case, ammo-

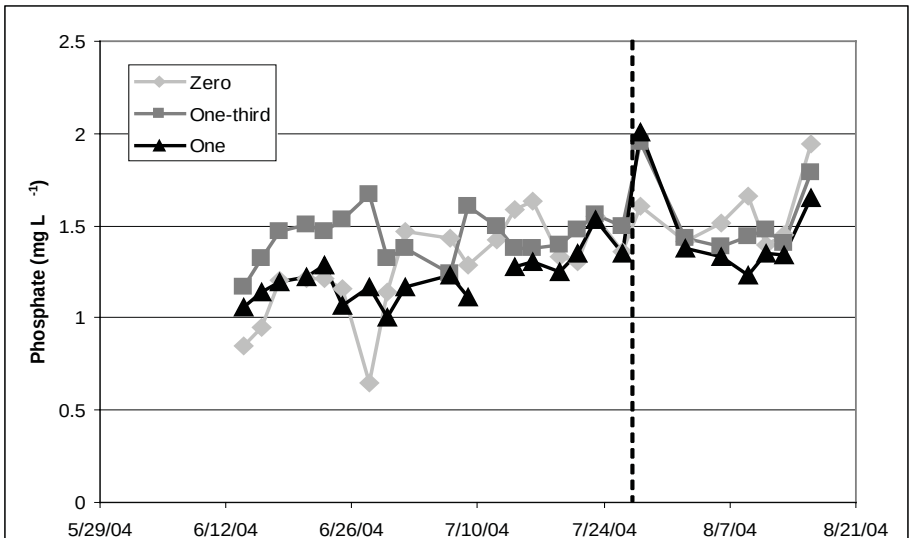


Figure 3. Average phosphate concentrations measured in leachate prior to fertilizer treatment and during Experiment 1. Data points represent average phosphate concentrations for lysimeters of the same treatment following each irrigation event. The dashed line marks the beginning of Experiment 1 when ammonium sulfate fertilizer was applied to a portion of the lysimeters. Fertilized lysimeters were treated with either one or one-third times the recommended fertilizer rate of 77 kg N ha-1.

nium sulfate may have been delaying the adsorption of P applied as fertilizer, prolonging its mobility, and resulting in elevated P concentrations in leachate. Phosphate concentrations quickly returned to previous levels in subsequent irrigation events.

Phosphorus concentrations in leachate were much higher than expected for all treatments including unfertilized controls, while nitrate concentrations remained low throughout the study. Average N and P concentrations were not influenced by fertilizer treatment at the fertilizer application rates used for this study. Although short-term spikes in concentration were observed immediately following fertilizer application, concentrations quickly returned to pre-fertilizer levels after subsequent irrigation events.

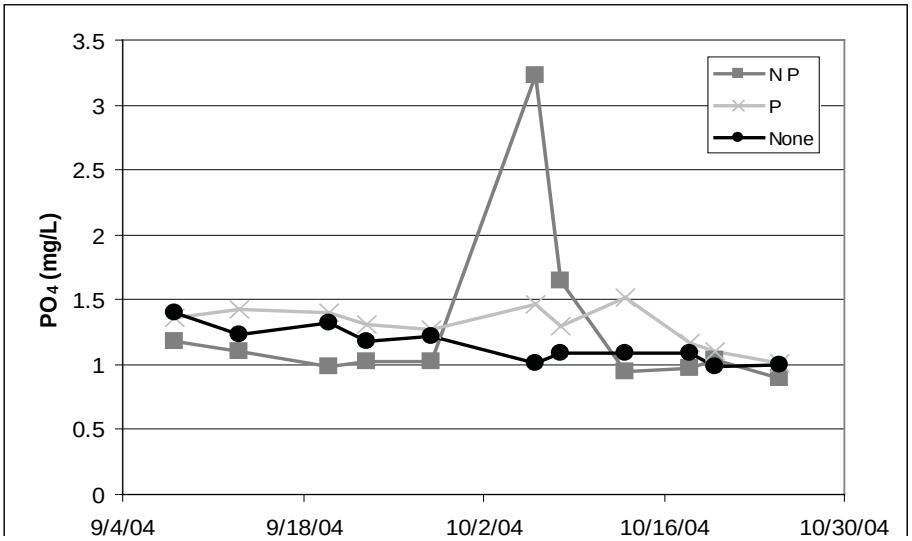


Figure 4: Average phosphate concentrations measured in leachate during Experiment 2. Data points represent average phosphate concentrations for lysimeters of the same treatment following each irrigation event. Treatments labeled by NP, P, and None correspond to ammonium sulfate and superphosphate fertilizer applied simultaneously, superphosphate applied alone, and unfertilized, respectively.

These results suggest that phosphorus leaching under irrigated turf may be more significant than previously thought. From a water quality perspective, phosphorus concentrations of 1.0 mg/L are quite high. As a comparison, desirable phosphorus levels for Front Range drinking water reservoirs are generally less than 0.05 mg/L. In the present study, residual phosphorus in the soil appears to be a significant source of "leachable" P since the leachate concentration was not greatly affected by the amount of phosphorus added in fertilizer.

Another significant finding is that the short-term mobility of phosphorus was increased by the addition of ammonium sulfate fertilizer. This suggests that phosphorus loss from turf grass should be managed not only through controlling the amount of phosphorus fertilizer applied but also through managing nitrogen fertilizer application if ammonium sulfate is being used. Proper use of ammonium sulfate fertilizer may improve the efficiency of phosphorus fertilizers by increasing phosphorus availability and reducing the amount of phosphorus that must be applied. On the other hand increased mobility could result in movement of phosphorus beyond the root zone, increasing the possibility that unwanted phosphorus could enter a surface stream or reservoir. In a parallel study, not reported here, we found that ammonium sulfate fertilizer also increased the mobility of phosphorus in surface runoff from irrigated turf.

As nutrient leaching studies are site and situation specific, so should be the development and application of appropriate and effective best management practices. More complete knowledge of nutrient leaching from a typical Colorado turf grass landscape and further understanding of the impact of ammonium sulfate and pH on phosphorus mobility will assist in developing more effective BMPs.

Acknowlegements: Funding for this study was provided by the Colorado Agricultural Experiment Station Projects COL 00705 "Best Management Practices for Landscape Irrigation" and COL 00726 "Estimating Nutrient Loads for Water Quality Management".

Colorado Water Resources Research Institute Publications Now Available

SR-15 Irrigation, Settlement, and Change on the Cache La Poudre River, by Rose Laflin
For a paper copy, contact Gloria.Blumanhourst@colostate.edu

An examination of the water delivery system of Colorado's Cache La Poudre River including the small ditches, large canals, and reservoirs that divert and store the river's water, originally for agricultural purposes and later for municipal, industrial, and recreational use. The river drains 1,890 square miles of land in the Mummy and Never Summer ranges in Colorado and Wyoming. The first diversions from the river began in the early 1860s, and the water transformed dry grasslands into productive farmland. Increased agricultural demand and drought impelled the Poudre water users to look for more sources and to support the Colorado-Big Thompson Project. Increasing population and economic diversification provided competition for the agricultural use of the water. This study is an attempt to synthesize the history of the Cache La Poudre delivery system.

CR 201 Determination of Ecosystem Response Thresholds to Nutrient Enrichment of Flowing Waters in Montane Colorado, by William M. Lewis, Jr. Available at: http://cwrri.colostate.edu/pubs/series/completionreport/CR201.pdf

The purpose of this project was to collect field data on streams in the foothills and montane parts of Colorado in support of the State of Colorado's attempt to develop nutrient criteria in preparation for producing nutrient standards for Colorado waters. The state has identified high elevations as the highest priority, which explains the focus on the streams of the mountains and foothills. The study was instituted to provide sufficient data on nutrients and potential ecological indicators of nutrient enrichment. On this basis, thresholds for enrichments relevant to Colorado waters could be established for the state.

CR 202 Effectiveness of Forestry Related Best Management Practices in the Trout Creek Watershed, Colorado, by Nan Bay Teves and John D. Stednick For paper copy, contact Gloria.Blumanhourst@colostate.edu

In multiuse forests, the majority of nonpoint source pollution is typically sediment. Best management practices (BMPs) are implemented to reduce or prevent this pollutant, however little research has been done to quantify the effectiveness of individual types of BMPs. The overall goal of this project was to evaluate the effectiveness of three BMPs implemented to reduce sediment in Trout Creek: cattle fences, off-road vehicle signs, and road culverts.

Robert C. Ward
Director of Colorado Water Resources Research Insitute,
Director of Colorado State University Water Center,
and
Professor of Civil Engineering

Will retire after 35 years service
to Colorado State University

We will honor Dr. Ward and his contributions to the University
at a
Retirement Reception
Tuesday , December 13th, 5 to 6:30
in the Lory Student Center
Colorado State University
Fort Collins Campus

Contact Gloria Blumanhourst at 970-491-6308 or
Gloria.Blumanhourst@colostate.edu for more information.

CWRRI

Editor's note: CWRRI funded three graduate student fellowships for 2005-2006. Each student has provided a summary of their project progress to date.

Hydrologic Analysis and Simulation of the Upper Colorado River System

Julia Keedy, Civil Engineering M.S. Candidate
Colorado State University

As expected, the focus of my research has become more defined as it has progressed. In summary, the sensitivity of the Colorado River system model to different streamflow inputs will be determined.

Streamflow data sets will be compared such as naturalized streamflow data extended backward using stochastic correlation techniques, naturalized streamflows reconstructed from tree ring records spanning from around 1500 to 1999 (the reconstruction has not yet been completed), and generated streamflows based on stochastic techniques. For this purpose, parametric and non-parametric methods will be applied. The sensitivity of the streamflow data scenarios will then be determined by comparing the response of the system. Key parameters will be used to characterize the response of the system. These parameters include critical reservoir levels (such as dead pool, minimum power pool, top of active conservation, and spillway elevation), reservoir releases, and shortage and surplus occurrences for each state. The parameters will be compared by determining their probabilities of occurrence under each different streamflow scenarios.

Another objective of the study is to determine the safe yield of the upper basin. This task will be accomplished by increasing the demands of the upper basin in order to achieve a given, accepted probability of shortage occurrences. While none of the streamflow data sets are quite ready to be used in the model for the final results of this study, currently available streamflows have been used to run the model so analysis techniques can be developed.

I spent last semester focusing on class work and performing a preliminary literature review of river system operations and performance indicators. I took a stochastic modeling class which was an introduction to various different methods of hydrologic modeling focusing mainly on parametric techniques and touching on nonparametric techniques. It helped me to realize the necessity of modeling streamflow and the challenges that are encountered with any method. I also took a water resources systems analysis class. It provided an overview of different approaches to modeling river systems and reservoir operations. The class began with basic methods for modeling simple water systems which provided me with a great appreciation for the capabilities of RiverWare and an understanding of the basis on which it was developed.

This summer, I was in Glenwood Springs working as an intern at the Colorado River Water Conservation District, who is also sponsoring my research. This was an amazing experience, as I was given the opportunity to attend meetings and conferences where I observed first hand many of the issues that face Colorado River users and managers. I was also able to make a

Keedy confers with David Merritt and Dave Kanser at the CRWCD offices.

great deal of progress on my research. I began by familiarizing myself with the RiverWare program and the Colorado River Simulation System (CRSS) model developed by the USBR within it. This, of course, is still an ongoing process.

Once I was fairly familiar with the model, I began to address data formatting and input issues by creating conversion templates and obtaining code that would facilitate importing many slots of data at one time. This is especially critical for changing the streamflow inputs in the model. Finally, I ran the model by simulating the currently accepted streamflow data according to the index-sequential method, a non-parametric technique often used for such purposes. At present, I am analyzing the data output in order to determine how to best compare the response of the river system to the different streamflow simulations.

After performing much of the background research and preparatory work, I look forward to comparing final results in the near future. It will be interesting to see the difference between the two streamflow simulation methods as well as the difference between using 500 years of streamflow data as opposed to 100 years. I hope to obtain finalized streamflow data sets shortly so that I may present some of the final results at the November meeting. For now, I am continuing to learn about the particulars of RiverWare, the CRSS model as I analyze the preliminary output, and SAMS, a software for simulating streamflow sequences based on stochastic techniques.

Colorado's Evolving Irrigated Agriculture: Economic Accounting and Impact Analysis

Jennifer Thorvaldson, Agriculture and Resource Economics M.S. Candidate
Colorado State University

In order to analyze the economic impacts of reducing irrigated agriculture in Colorado, my first objective is to develop a model representing the economy and economic interactions within four water basins in Colorado: Arkansas, Republican, Rio Grande, and South Platte. Working to construct background in the topics important to the discussion, I have spent time on the following tasks:

- Reading the Colorado Water Conservation Board's Statewide Water Supply Initiative report to understand the methods used and assumptions made when predicting the number of acres that will be lost to irrigation by the year 2030.

- Installing and understanding the use of software for the the IMPLAN Input-Output model and 2002 data in preparation for using the model to perform impact analysis. IMPLAN employs two phases of input-output analysis: descriptive and predictive modeling.

The **descriptive model** includes information about local economic interactions known as regional economic accounts, which describe a local economy in terms of the flow of dollars from purchasers to producers within the region. The regional economic accounts are used to construct local-level multipliers. Multipliers describe the response of the economy to an impact (a change in demand or production). The multipliers represent the predictive model. So far, I have built descriptive models for each of the four river basins in my study. The next step is to build the predictive models to estimate the economic impact of the reduction in irrigated acres.

At the Water Study Meeting in Fort Morgan, Colorado, I was motivated to see that real people will use my research for real issues. Convened by the Morgan County Economic Development Corporation, the meeting was attended by representa-

tives from water districts, the county commissioner and assessor, conservationists, retailers, economic developers, a property rights foundation, realtors, NECALG, and farmers. We described our study and how it could help them plan for the economic changes predicted to occur in this and other rural communities. They, in turn, told us what information they were seeking from us. It was very motivating to see that my research indeed matters and will be used by real people for real issues.

My advisor, Dr. James Pritchett, and I co-authored a fact sheet for each river basin in my study which will be published on the Colorado State University – College of Agricultural Sciences – Department of Agriculture and Resource Economics web page. Each fact sheet will contain the economic demographic of the basin, a description of agriculture in the basin, the relative water supply and demand amounts in the basin and the future direction of our study. In addition, we'll be posting a fact sheet about the analysis and the model we are constructing.

Additional funding for this project is provided by the Colorado Agricultural Experiment Station.

Occurence and Fate of Organic Wastewater Contaminants in Onsite Wastewater Systems and Implications for Water Quality Management

Kathleen DeJong, Environmental Science and Engineering Ph.D. Candidate
Colorado School of Mines

Organic wastewater contaminants (OWCs) such as pharmaceuticals and personal care products have received increasing attention in the last decade due to their possible adverse effects on ecosystems and human health. Several studies have identified wastewater as a primary contributing source of OWCs to the environment, but few have quantified their occurrence in onsite wastewater treatment systems (OWS) and associated receiving environments. A substantial portion of the wastewater generated in the U.S. is processed by OWS before discharge to the environment. For example, in Colorado there are over 600,000 OWS in operation serving approximately 25% of the State's population and 7,000 to 10,000 new systems are being installed each year. As a result, over 100 billion liters of wastewater are being processed by OWS and then discharged to the environment every year in Colorado alone. A research project was initiated by the Colorado School of Mines in collaboration with the U.S. Geological Survey to determine the occurrence of OWCs in effluents produced from varying sources and by different types of onsite wastewater systems, to assess the fate and transport of OWCs in soil absorption systems prior to groundwater and surface water recharge, and to assess the potential for OWCs to impact receiving waters.

Thirty OWS, 10 groundwater wells, and 9 surface waters in a Front Range region and Rocky Mountain region of Colorado were selected and sampled for conventional water and wastewater parameters and for a suite of OWCs. The OWS sites represented a range of sources: residential (single-family and multi-family homes), commercial (restaurants, convenience stores, and retail centers), and institutional (veterinary hospitals, schools, and churches). Ten groundwater wells and 9 surface water sites were selected to be representative of the sampling region and samples were collected in conjunction with the OWS sites.

Fellow CSM Ph.D. graduate student Jim McKinley and DeJong sampling septic tank effluent

Table 1. Eight compounds of interest, their uses and sources

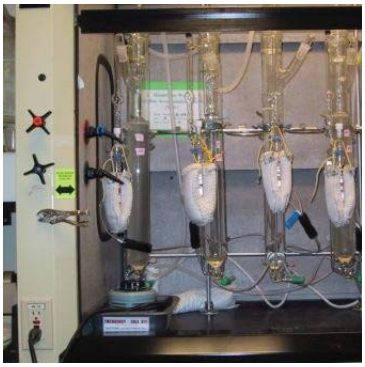
Compound	Use	Source
4-Methylphenol	Disinfectant	Cleaners
3-β-Coprostanol	Animal fecal steroid	Animal
Cholesterol	Animal steroid	Animal
Caffeine	Stimulant	Beverages, drugs
EDTA	Metal-complexing agent	Shampoos, cleaners
Triclosan	Antimicrobial	Soaps, disinfectants, toothpaste
4-Nonylphenol	Surfactant metabolite	Industrial and domestic cleaners
NPEC	Surfactant metabolite	Industrial and domestic cleaners

The matrix of each OWS effluent, groundwater, and surface water sample collected has been characterized by general water and wastewater parameters. A wide range in concentrations has been measured for on-site system wastewater effluents, as would be expected from the diversity of wastewater sources sampled (e.g. ranging from single-family homes to large commercial and institutional establishments). The median values, though, are comparable to typical values reported for constituents in OWS effluents. For example, a typical effluent from an onsite system serving a residential source would be characterized by a carbonaceous biochemical oxygen demand (cBOD5) around 450 mg/L, total nitrogen of 100 mg/L, ammonia of 65 mg/L, and total phosphorus of 47 mg/L.

Each OWS effluent, groundwater, and surface water sample collected has also been analyzed for a suite of 25 organic wastewater contaminants. OWCs were identified frequently and at high concentrations in the wastewater effluents. Twenty three of the 25 compounds were identified in one or more of the wastewater effluents in concentrations ranging from less than the reporting level to greater than 1 mg/L. The number of compounds in each wastewater effluent sample ranged from 8 to 19, with the veterinary hospitals and convenience stores having the highest average number of compounds and the residential sources having the lowest average number of compounds. Eight of the most frequently detected compounds are listed in Table 1 with their uses and some common sources.

The occurrence and concentrations of OWCs in OWS effluents can be related to the water use distribution at the wastewater source. For example, significantly higher concentrations of cholesterol, 3-β-coprostanol, caffeine, and triclosan were found in both convenience stores as compared to any other wastewater source included in the study. At convenience stores, approximately 90% of the water discharged to the onsite system originates from the public restrooms, i.e. from toilet and urinal flushing and sink faucets, therefore, higher concentrations of human-derived compounds (e.g. cholesterol, 3-β-coprostanol, and caffeine) and ingredients found in hand soaps such as triclosan are be expected in the wastewater effluent. Restaurants and veterinary hospitals that have a higher percentage of wastewater originating from clothes and dish washing reported elevated concentrations of EDTA, 4-methylphenol, and the surfactant metabolite and endocrine disruptor NPEC.

The occurrence of endocrine disruptors such as surfactant metabolites in wastewater raises concerns about their adverse impacts on the environment following recharge of groundwater and potential recharge of surface waters. Concentrations of nonylphenol as low as 10 ug/L have been reported to induce production of the egg yolk precursor vitellogenin, an indicator of endocrine disruption, and significantly decrease the rate of growth of the testes in rainbow trout. In 2003 the U.S. Environmental Protection Agency proposed that the 4-day average concentration of nonylphenol in freshwater should not exceed 5.9 ug/L to ensure aquatic life water quality. Twenty five of the 30 sites included in the study had detectable concentrations of nonylphenol and



Liquid-liquid extractors for identification of trace organic chemicals

approximately half of those exceeded the proposed value of 5.9 ug/L, some by greater than ten times. The effect from multiple endocrine disruptors, such as the suite of alkylphenolic compounds studied here, is unknown but studies have indicated an additive effect. Significant treatment occurs during infiltration and percolation through the soil absorption system of OWS, though the removal rates and mechanisms of OWCs prior to recharge to the environment are currently unknown. Additionally, there is the potential for treatment failure, by preferential flow through the soil, or from hydraulic failure, such as a storm event, that would send untreated wastewater with pollutant concentrations seen here directly to ground or surface water. Currently, there are no established regulations for these compounds because little is still understood about the long-term reproductive effects of chronic exposure to pharmaceutically-active compounds at low concentrations such as those seen here.

Of the nine surface waters sampled in the study, very few OWCs were identified, and, if present, were in low concentrations. Cholesterol and 4-methylphenol were the only compounds identified in surface waters above the reporting level. The surface water sites are located in regions which rely heavily on OWS for wastewater treatment, but are not directly impacted by wastewater from municipal wastewater treatment plant discharge. Instead, treated OWS effluent percolates through the soil until it reaches the water table and recharges the groundwater which may, in turn, recharge the local surface water. Surface water may also be impacted by runoff from agriculture and development.

Surface water site sampled in the study

In the ten groundwater wells, there were more OWCs identified at higher concentrations than in the surface waters. Every groundwater well was contaminated with at least one and at most seven of the 25 OWCs included in this study. Nine of the sites are drinking water wells located up gradient on the same property as an OWS included in the study. In the OWS-reliant developments, contamination of these wells could indicate regional impacts to the groundwater from treated effluent recharge.

Due to the widespread and growing use of OWS as an appropriate method of wastewater treatment, understanding the potential impacts on the receiving environments to which they discharge is critical. Results of this study indicate OWCs are present in OWS effluent frequently and in variable concentrations. Treatment occurs in the septic tank, in additional pre-treatment units such as filters and wetlands, and during percolation through the soil absorption field prior to groundwater recharge. Controlled laboratory- and field-scale transport studies are underway to investigate the key mechanisms of removal during soil treatment. OWCs have been identified in groundwater wells and, to a much lesser extent, in surface waters located in OWS-reliant regions. The results from the transport experiments in conjunction with the occurrence findings will aid in defining potential adverse effects to ecosystem and human health due to organic wastewater contaminants discharge from onsite wastewater treatment systems.

Additional funding for this project is provided by Colorado School of Mines.

Colorado Water Resources Research Institute

2006 Water Fellowship Program Announcement

The Colorado Water Resources Research Institute (CWRRI) announces its 2006 Graduate Research Water Fellowship competition. Graduate students conducting or planning research in water resources areas may apply for a stipend-only fellowship which must be paid out between March 2006 and February 2007.

Fellowship support will be awarded based on research priorities identified by the CWRRI Advisory Committee on Water Research Policy (ACWRP). Regional, state, or local collaborations; external co-funding; and/or specific plans to prepare proposals to seek additional external funding for water research will strengthen an application.

2006 Water Research Priorities

- Using tree-ring and stochastic hydrology approaches, what are the basin-wide long-term 'firm yields' water managers can expect from Colorado river basins?
- What possibilities exist for more efficient use of ground and surface waters in Colorado's irrigated valleys, given the current compact compliance requirements and water market conditions?
- Are there pharmaceuticals in Colorado's rivers and streams? If so, are the levels threatening to aquatic and human health and are the trends increasing or decreasing?
- With treated wastewater return flows constituting a large percentage of river flows at certain times of the year, what are appropriate nutrient criteria for Colorado rivers and lakes?
- What are the 'best' ways to mitigate the impact of excess salinity on irrigated agriculture in the Lower Arkansas Valley while avoiding negative impacts on other water users along the river?
- Development of decision support tools for determining augmentation flows for well pumping in the South Platte Basin.

Reporting requirements

CWRRI Fellows will be asked to provide three reports/products during the course of their Fellowship:

1. November 2006 – oral summary of progress before the CWRRI ACWRP annual meeting in Denver;
2. February 28, 2007 – written *summary* of progress/results for the CWRRI newsletter; and
3. February 28, 2007 - final 'deliverable' of Fellowship, per application description.

Proposal criteria

- Fellowships will be awarded to graduate students performing M.S. or Ph.D. level water resources research at a Colorado research university.
- Fellowships may be requested for three summer months, for a semester plus the summer (7.5 mo or 8.0 mo), or a full year.
- CWRRI Fellows are expected, as the final 'deliverable' of their fellowship, to produce a CWRRI report and one other document. See the full proposal for details.
- The award committee may offer a lesser award than requested.
- Multiple applications from a research group are permitted.
- The applicant's thesis project should be defined and be approved by their graduate advisory committee prior to submittal of the proposal.
- The advisor / institution will provide research support costs such as supplies and travel.
- The fellowship must be matched by twice the amount awarded from non-federal sources which will vary by institution.
- Students who received CWRRI support in past may apply for a CWRRI Fellowship.
- Fellowship funding is available from March 1, 2006, through February 28, 2007 (or as soon thereafter as the USGS authorizes CWRRI funding).

Applications should be prepared using the guidelines on the following page. The complete Request for Proposals may be accessed from our web page www.cwrri.colostate.edu or by calling 970-491-6308.

Colorado Water Resources Research Institute
2006 CWRRI Water Fellowship Program
Guidelines For Preparation Of 2006 Applications

Applications should be prepared by the graduate student, under the direction of his/her research advisor. The application should contain the following:

1. Cover Page with scholar's name, name of degree, program, institution, contact information for scholar, contact information for advisor.
2. Title of the thesis project.
3. Introduction of the applicant: major, research specialization, research advisor, post-secondary education, progress in degree program (courses completed, candidacy or comprehensive exams, anticipated completion date), progress in thesis research, previous professional and scholastic accomplishments (presentations, publications, awards).
4. Description of the critical state or regional water problem being (or to be) investigated and relationship to CWRRI ACWRP priorities.
5. Key literature and prior work in your research group (if applicable).
6. Scope and objectives of the proposed research.
7. Methods, procedures, and facilities.
8. Anticipated results and benefits from the proposed study ("deliverables" including proposals to seek additional support for the research).
9. If research is underway, progress to date.
10. Completed Budget/Justification form (available on line or from Gloria at (970-491-6308) which details how the 2 to 1 non-Federal to Federal match will be covered. The form suggests various categories of expenses which are justifiable as matching funds.

The application, prepared in a single spaced, 11-12 point format, should not exceed seven pages (not including the cover page and budget/justification page). Append graduate transcripts (or undergraduate transcripts for a new graduate student). Graduate transcripts should be complete through spring or (if applicable) summer of 2005 (the original grade report sent to the student is acceptable).

The ***deadline*** for receipt of fellowship applications is 5:00 p.m., November 1, 2005.

Submit the application to:

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

or as an e-mail attachment in Word for Windows format to:

Gloria.Blumanhourst@Colostate.edu

Portions of the successful fellowship applications will be included as part of the Institute's FY2005 proposal to the USGS. Suggestions for improvement or clarification of points in the text may be forthcoming from the CWRRI Advisory Committee on Water Research Policy and/or CWRRI director.

For links to recent articles about water in Colorado newspapers
go to the Colorado Nonpoint Source webpage at
http://www.npscolorado.com/news.html.

Carpenter Papers Open for Research

By Patricia J. Rettig
Head Archivist, Water Resources Archive
Colorado State University Libraries

In *Silver Fox of the Rockies: Delphus E. Carpenter and Western Water Compacts* (2003), Daniel Tyler wrote: "Much work remains to be done to make the Carpenter Papers fully accessible to future scholars" (p. xviii). The Water Resources Archive at Colorado State University is pleased to announce that "much work" has been done and in mid-October the Carpenter Papers will be fully accessible to present and future scholars and any interested parties.

Work on the Collection

Over a year of work has gone into the Papers of Delph E. Carpenter and Family since its donation to the CSU Libraries in spring 2004. This was partly due to the size of the collection—135 linear feet and more than 100 oversized items—and partly because of its condition. The collection, spanning the years 1827 to 1992, arrived with some materials being very fragile, dusty, and, more significantly, moldy.

Delph Carpenter's briefcase

The mold, which was dormant, required thorough cleaning before the collection could be made publicly accessible. With Dan Tyler's assistance, the Libraries was able to raise sufficient funding to pay for equipment, supplies and staff time to facilitate cleaning and related activities. A fleet of students, hired with the donated funds, was trained to painstakingly brush both sides of each piece of paper in the boxes identified for cleaning. The oversized items, including maps and certificates, were cleaned and flattened by a contracted conservator. Environmental testing has shown the process to be effective in removing the mold spores.

Funding also enabled hiring students to assist the archivist with sorting, photocopying, listing and labeling activities, helping ensure long-term preservation of the materials as well as efficient access for researchers. The archivist sorted everything into archival series, putting like items together, such as professional correspondence, family correspondence, publications, photographs, etc. She also rehoused everything in archival boxes and folders upon the final sort, and described it all in a finding aid, the typical "end product" when working on an archival collection.

Contents of the Collection

The focus of the collection is Delph E. Carpenter and his work on interstate river compacts. One of Colorado's most important water lawyers, Carpenter (1877-1951) conceived, negotiated and promoted the Colorado River Compact as well as compacts on other interstate rivers.

Much of Carpenter's work on the compacts, done primarily between 1921 and 1933, was carried out in correspondence, including frequent telegrams. These materials, part of the collection's first series, measure four linear feet, with most of them relating to the Colorado River as well as the Rio Grande, the North Platte, the Arkansas, the La Plata and the South Platte rivers.

Many people from many states and levels of government were involved in these issues, so correspondence from prominent people can be found here. These include the water commissioners from other states, governors, state engineers, government officials (including Herbert Hoover and Elwood Mead), university professors and presidents, and other water and law experts. Negotiations away from the meeting table can

be traced through this correspondence, giving a good idea of what ideas were mentioned, by whom, and how they were received.
Much material supporting the compact negotiations can be found in the second series of the collection, Professional papers (5 linear feet). These include meeting minutes, reports, data, maps, legislation, briefs, and more relating to rivers in general as well as compact issues. Perhaps most significant to a modern understanding of what the compact commissioners actually intended to convey in the compacts are the drafts that exist. Though not always dated or numbered to be able to trace their evolution, the drafts show how the text of compacts varied over the course of negotiations. Occasionally Carpenter's notes on the draft pages give some insight into his thoughts on the matter. The collection contains drafts of the Arkansas, Colorado, La Plata, Little Snake, North Platte, Rio Grande, and South Platte compacts.

While the majority of the compact-related materials are of a business nature, an exception is Carpenter's diaries. They are not detailed with thoughts and feelings about a day's activities, though there are exceptions; mostly they give Carpenter's whereabouts during his frequent travels, or whom he was meeting with on what topics. For example, the entire entry on November 18, 1922, during the Colorado River Compact negotiations in Santa Fe reads: "Sessions of Commission. Phrasing and drafting of compact. Blow-up by Arizona." Carpenter kept diaries for nearly every year between 1914 and 1928, the most important years of his working life. They are contained in one box in series three (0.5 linear feet).

The three series mentioned so far contain more than compact-related materials. There are also documents from Carpenter's other activities: his law practice (including the *Wyoming vs. Colorado* suit), his time as a Colorado state senator, his cattle breeding endeavors, as well as personal materials. Personal items include papers from his college days at the University of Denver; writings (poems, articles, and short stories); medical assessments; financial and real estate documents; and memorials written in his memory after he died in 1951.

Other series in the Carpenter papers with compact-related materials include series 7, Publications and reports (3.5 linear feet); series 8, Clippings (0.5 linear feet); and series 9, Photographs (0.25 linear feet). Though largely published items, the publications and reports also contain "grey literature" such as printed speeches and legislation. The clippings contain hundreds of articles clipped from newspapers and organized by subject, greatly facilitating research access to daily news coverage of compact negotiations, especially for the Colorado River. Few of the more than 700 photographs in the collection relate directly to water issues, but there are some gems, such as a snapshot of Carpenter on a raft in the Grand Canyon portion of the Colorado River.

So much more can be said about the collection, but any description of it would

be incomplete without mentioning the family papers included. Beyond Delph Carpenter, the collection extends to ancestors, who were Union Colony pioneers, and offspring, primarily the late Weld County Judge Donald A. Carpenter. In-laws and other branches of the family are also documented through correspondence, diaries, photographs and personal items such as graduation announcements and teaching certificates. The final series in the collection contains the family's artifacts, including Delph Carpenter's briefcase. It is well-worn black leather, giving signs of a hard-working owner.

The finding aid describing the complete contents of the Carpenter Papers, available for public use in mid-October, will be on the Water Resources Archive website at http://lib.colostate.edu/archives/water/. For a printed copy or other information, contact the author at 970-491-1939 or Patricia.Rettig@ColoState.edu.

Next for the Collection

"Much work" has been done, but that is not to say it is finished. The collection will be used to create exhibits, both physical and virtual. Additionally, portions of the collection will be digitized as time and money allow. Any virtual exhibits or searchable digitized documents created will be available on the Water Resources Archive's website.

Next up though is an event! To celebrate the opening of the Carpenter Papers, the Water Resources Archive is hosting a reception at Morgan Library on Friday, November 18, 2005, at 4:30 p.m. Featuring exhibits and brief talks by archivist Patty Rettig and author Dan Tyler, it will be the perfect opportunity to find out more about the collection and Delph Carpenter. See the box on the previous page for more information.

Drought 2002 Topic of Article by Colorado Researchers

An article entitled "Drought 2002 in Colorado: An Unprecedented Drought or a Routine Drought?" is available from http://springerlink.com . The 2002 drought in Colorado was reported by the media and by public figures, and even by a national drought-monitoring agency, as an exceptionally severe drought. In this paper we examine evidence for this claim. Our study shows that, while the impacts of water shortages were exceptional everywhere, the observed precipitation deficit was less than extreme over a good fraction of the state. A likely explanation of this discrepancy is the imbalance between water supply and water demand over time. For a given level of water supply, water shortages become intensified as water demands increase over time. The sobering conclusion is that Colorado is more vulnerable to drought today than under similar precipitation deficits in the past. The article was written by Roger Pielke, Nolan Doesken, Odilia Bliss, Tara Green, and Jose Salas of Colorado State University along with Clara Chaffin at University of Idaho, Connie Woodhouse and Klaus Wolter of NOAA, and Jeffrey Lukas of University of Colorado.

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0033 – 4553/05/091455–25
DOI 10.1007/s00024-005-2679-6
Pure and Applied Geophysics

Squillace Director of Natural Resources Law Center at CU Law School

Professor Mark Squillace is the newly-named Director of the Natural Resources Law Center at the University of Colorado School of Law. Before coming to Colorado, Professor Squillace taught at the University of Toledo College of Law where he was the Charles Fornoff Professor of Law and Values. Prior to Toledo, Professor Squillace taught at the University of Wyoming College of Law where he served a three-year term as the Winston S. Howard Professor of Law. He is a former Fulbright scholar, and the author or co-author of numerous articles and books on natural resources and environmental law. In 2000, Professor Squillace took a leave from law teaching to serve as Special Assistant to the Solicitor at the U.S. Department of the Interior. In that capacity he worked directly with the Secretary of the Interior Bruce Babbitt, on variety of legal and policy issues. Squillaces' publications address issues in the arena of natural resources policy and law including decision-making, water law, wetland regulations, and mining.

Water Information Center Available at U.S. National Acadamies Website

The U.S. National Academies is pleased to announce the launch of its Water Information Center, a portal of more than 100 peer-reviewed reports from the National Academies on water-related issues. The website (http://water.nationalacademies.org) aims to assist the work of water scientists, engineers, managers, policy-makers, and students throughout the world. These reports represent independent and objective consensus among experts from academia, industry, and other entities.

The website features the following major topics:

a. Water Supply and Sanitation
b. Water and Soil Remediation
c. Hydrologic Hazards
d. Water Quality in the Natural Environment
e. River Basin Systems Management
f. Environmental Assessment, Management, and Restoration
g. Water Science and Research

All of the reports can be read for free on-line, and summaries are freely downloadable as PDFs. If you have questions or comments, contact Ellen de Guzman at Email: water@nas.edu

The U.S. National Academies of Sciences is a non-profit organization that brings together committees of experts in all areas of scientific and technological endeavor. These experts serve pro bono to address critical national issues and give advice to the federal government and the public. The organization is composed of the National Academy of Sciences, the National Academy of Engineering, the Institute of Medicine, and the National Research Council.

Is Marginal Cost Pricing of Municipal Water to Encourage Conservation Really Practical for Front Range Utilities?

by Carol Malesky,
Integrated Utilities Group, Denver

Oct 26th, noon to 1 p.m.
Animal Science Building, Room 110
Colorado State University, Fort Collins, CO

Sponsored by
MAC Foundation
CSU Department of Agricultural and Resource Economics,
CSU Department of Economics, and
USDA Forest Service Rocky Mountain Research Station

Building at Engineering Research Center Named for Daryl Simons

Colorado State University's College of Engineering and the Department of Civil Engineering celebrated the naming of the main building at the Engineering Research Center the Daryl B. Simons Building on Saturday, Aug. 27, as part of a host of activities honoring the former civil engineering professor's life.

The building dedication began with comments by Provost and Senior Vice President Anthony Frank; Ray Chamberlain, former president of Colorado State; and Sandra Woods, interim dean of the College of Engineering. A celebration of Simons' life followed in the North Ballroom of the Lory Student Center, and the events concluded with a reception and dinner.
Simons, who died in March, was the first associate dean for research at the College of Engineering. In his 18 years there, annual research funding for the college jumped from $100,000 to more than $20 million. He had an international reputation in watershed management and river mechanics and sedimentology, working on every major river system in the world.
"Daryl B. Simons was an extraordinary engineer and college professor who solved problems of river degradation and pollution around the world for more than 50 years," said Neil Grigg, a civil engineering professor at Colorado State who was one of Simons' graduate students. "In addition to his practical work, which helped reduce flooding and open rivers to navigation and other uses, he was a mentor to a new generation of engineers from about 50 countries, and his guidance will be felt in better water systems around the world."

The Daryl B. Simons Building at the Engineering Research Center, which is based at Colorado State's Foothills Research Campus, features research on hydrology, hydraulics, lasers, optics, materials, plasmas, groundwater, wind engineering, structural engineering and environmental issues, among others.

From a press release by Emily Narvaes Wilmsen

Would you rather receive your Colorado Water electronically?

Send an email to Gloria.Blumanhourst@colostate.edu with "e-Colorado Water" in the subject line. Include your name as it now appears on your hard copy of the newsletter and your current email address in the body of the email.

We'll remove your name from the hard copy mailing list, and instead send you an email when the electronic version is posted on-line.

Jahnke Director of Colorado State Forest Service

Jeff Jahnke has been named as the Colorado state forester which includes the role of director of the Colorado State Forest Service (CSFS). Jahnke's office and the CSFS headquarters are located on the Colorado State University campus in Fort Collins.

Jahnke

Jahnke has a bachelor's degree in forestry from Michigan Technological University and a master's in forest and range management from Washington State University, and has built a 35-year career in state forestry organizations. Jahnke, who previously served as state forester in Alaska, currently chairs the National Association of State Foresters' Forest Fire Protection Committee and holds a leadership position with the Western Forestry Leadership Coalition. He has more than three decades of wildland firefighting experience, which includes managing firefighting operations at all levels and functioning as a Type I Incident Commander.

"Jeff Jahnke knows Western forestry through experience in the West including Montana, Alaska and regional leadership positions. He has the experience, knowledge and personality to lead the Colorado State Forest Service and to provide its vital services to Colorado citizens," said Marc Johnson, the Colorado State University vice provost who oversees the agency.

The CSFS helps landowners reduce wildfire hazards, assists communities with forest insect and disease problems such as the major mountain pine beetle outbreak currently killing thousands of acres of trees in Colorado's high country, and aids farmers and ranchers in establishing windbreaks on Colorado's Eastern Plains.

As state forester, Jahnke will oversee 135 full-time employees and 17 field offices across the state. He will manage forest fire prevention and wildland fire programs that are coordinated among federal, state and county agencies and train and equip about 450 volunteer fire departments. Jahnke also will administer programs to protect forests from and treat forests damaged by insect and disease, provide technical assistance to owners of 8 million acres of private and state forest land and assist with monitoring forest conditions on 14 million acres of federal land. In addition, Jahnke will oversee tree nurseries and forest stewardship, and environmental education efforts administered across the state through the state office.

"Following former state foresters Jim Hubbard and Tom Borden is going to be an awesome task," Jahnke said. "They have established a 40-year legacy of success for the Colorado State Forest Service that will be important to maintain and grow."

Jahnke will work to improve Colorado's forest resources through partnerships, interagency collaboration and securing grants to assist fire departments and landowners across the state.

"Managing Colorado's natural resources takes dedication and cooperation from all agencies," said Russell George, executive director of the Colorado Department of Natural Resources. "I know that Jeff is up to the challenge of managing our forests and participating in this cooperative effort. I look forward to working with him."

The Colorado State Forest Service is currently celebrating its 50th anniversary in service to the people of Colorado.

Reflections on Hurricanes and Other Unnatural Disasters

by Jared Orsi, Professor of History, Colorado Sate University

During the 1998 hurricane season I was in Chicago writing a book about the history of natural disasters. I could not help but notice that what was obvious to me—that natural disasters have a good deal of human history behind them—was anything but obvious to the wider public. As the *Chicago Tribune* editorialized, in the face of "nature's most violent displays of brute force," humans "can do little but watch in awe the 'great mischief' of Mother Nature." Two years later, I was living in the tinderbox known as the American West (the book was still not done), when the forests around Los Alamos, New Mexico, burst into flame after a controlled burn by the National Park Service didn't stay controlled. Instead of blaming nature this time, the papers wanted a hanging. "The Park Service should hold its personnel accountable," the *Denver Post* opined. "I find it hard to believe," fumed the Los Alamos congressional representative, "that no one is held accountable. Didn't someone make a mistake?"

As I write today, September 23, 2005, one of the worst hurricanes in history has just devastated the coastal regions of Louisiana and Mississippi, and another severe one is apparently bearing down on Texas's Gulf Coast. Yet again we seek answers: Nature's fury? God's wrath? Malfeasance or at least incompetence on the part of responders—from emergency crews to the President of the United States? Although fingers point in many different directions, these explanations and the responses to the 1998 hurricanes and the Los Alamos fire share one thing: the assumption that something must go extremely wrong in order to produce an extreme tragedy. Nature must do something extraordinarily powerful, or human beings must make extraordinary mistakes. Although seemingly logical and very understandable given the scale of tragedy that results from natural disasters, this assumption is not borne out by historical evidence. It does not take a big and bad cause to produce a big and bad effect.

In the case of Los Alamos, the fire was caused by a complex of unfortunate but unremarkable mistakes and coincidences: the accumulation of ground fuel in the 1990s, the pending retirement of a park superintendent who favored use of fire as a tool in forest management, a drought that portended a bad fire season. All of these ordinary things conspired to add urgency in officials' mind for the need for a burn in the spring of 2000. But there was more: an out of date protocol for prescribed burning that had been mistakenly posted on the internet, small mistakes in the admittedly imprecise science—no, guess work—that goes into estimating fire safety conditions. And then there was the big mistake that came from the invisible problem of combining the wrong protocol with the small errors in the fire safety rating. Add to this a National Weather Service report that never got to park service officials. All of these conspired to lead officials to pick a very bad day for the fire. Finally there was the chaotic patterns of blowing wind and burning flames. Neither predictable, neither controllable. From all these small, ordinary system failures—failures that can happen on any given day without any severe consequences—came a billion-dollar tragedy. The Secretary of the Interior Bruce Babbitt likened it to a series of stones loosened from a mountainside. "Sometimes," he said, "a rock is dislodged and nothing happens, but other times a rock is dislodged and it starts a cascading series of events…[until] you have a landslide at the bottom."

Hurricanes work similarly, though on a much larger scale. First, human beings with short memories and big plans for the future put a lot of stuff in harm's way in the twentieth century. South Florida, for example, enjoyed three decades between Hurricane Betsy in 1965 and Hurricane Andrew in 1992, and during that time, population and property values skyrocketed. This pattern has repeated across the country and around the globe, with the consequence that the severity and frequency of natural disasters has increased steadily since the 1970s. The worldwide price tag

for weather-related catastrophes in 1998 alone topped that of the entire decade of the 1980s. Humans may not cause the wind to blow or the ground to shake or the rain to fall (though even that is increasingly being called into question), but they do unquestionably shape the results that follow whenever the wind blows or the ground shakes or the rain falls.

Next the question is how does all of that stuff get into vulnerable places? The answer is: through countless ordinary decisions and actions undertaken entirely innocently of their impact on hurricane vulnerability. When couples from the frigid upper Midwest dream of retirement on the Gulf Coast, the hurricane risk goes up a little. When the federal government makes home loans or finances highway construction in South Florida to promote economic growth or reward political support or whatever, the hurricane risk goes up. When coastal boosters advertise sunshine, boating, and golf but neglect to mention the periodic evacuations, the hurricane risk goes up. The truth is there is a system in place, a system that has no designer or controller but plenty of participants. It is a system that rewards people for putting themselves and their property (and other people and their property) in dangerous places. These rewards are short-term but significant—return on investment, a nice vacation, insurance policies, a monthly paycheck, a government contract, a home loan, re-election. Most of the time it works safely, as people seeking these rewards retire, build, buy, and advertise. Each action is rational and carries no negative consequences for the actor. In combination, however, they are deadly. Like the rocks cascading down Babbitt's mountainside, they are individually benign, but in combination they put people in severe danger.

The last step in making a hurricane or any other natural disaster is the distribution of its effects. Women and children die in greater numbers than adult men in Third World earthquakes because they are disproportionately likely to be in homes and other poorly constructed buildings; adult men are more likely to find themselves in workplaces, government buildings, and other more solid structures when the ground shakes. Poor people have a harder time evacuating in the cases of floods and hurricanes because they lack good access to transportation and the extended social networks that allow them somewhere else to go. Even in something as simple as a heat wave, elderly people living alone invisibly roast to death in unairconditioned apartments and public housing units, cut off from family, friends, and neighbors, sometimes having locked the doors and windows for fear of danger from their crime-infested surroundings. None of this is to deny the real and widespread suffering of middle- and upper-class people in the aftermath of disasters. Nor is it to suggest that anyone deliberately discriminates against these least among us such dire times. But it is inescapable that disasters are

Books on topics related to this article:

John Barry, *Rising Tide: The Great Mississippi Flood of 1927 and How It Changed America* (Simon and Schuster, 1997).

Kenneth Hewitt, ed., *Interpretations of Calamity from the Viewpoint of Human Ecology* (Allen & Unwin, 1983).

Ari Kelman, *A River and Its City: The Nature of Landscape in New Orleans* (University of California Press, 2003).

Jared Orsi, *Hazardous Metropolis: Flooding and Urban Ecology in Los Angeles* (University of California, 2004).

John McPhee, *Control of Nature* (Farrar, Straus, Giroux, 1989).

Charles Perrow, *Normal Accidents: Living with High-Risk Technologies* (Basic Books, 1984).

Ted Steinberg, *Acts of God: The Unnatural History of Natural Disaster in America* (Oxford University Press, 2000).

Diane Vaughan, *The Challenger Launch Decision: Risky Technology, Culture, and Deviance at NASA* (University of Chicago Press, 1996).

not equal opportunity killers. The people who are the most vulnerable every day of the year are also the most vulnerable in times of catastrophe. In that sense, we humans may not cause the wind to blow, but we do determine who gets hurt the most when it does.

And when it's all over? First, we care. Federal money and charitable generosity flow freely. The American heart opens graciously and embraces those in need. Here is often when we are at our best as a society. Then, we repeat. So many people are so dependent on the ordinary system that it is inconceivable not to repair it. The ordinary has broken down, but in the face of the extraordinary, we can think of little else than restoring the comfortable, the familiar, the deadly. And so federal money and private generosity rebuild homes and other structures in dangerous places. We return to marginalizing poor neighborhoods and isolating the elderly. In the process of nobly rebuilding the best of what has been damaged, we also rebuild its dark sides as well. Finally, we forget. Years or decades elapse between cat-5 storms, 7-point earthquakes, and hundred-year floods. We advertise dangerous places. We weaken or evade building codes, hazard zoning ordinances, and other nuisances of doing businesses. We demand lower insurance rates. And then….

The *Trib* was wrong: there is plenty we can do in the face of the brute force of Mother Nature. Still, it is hard to write that on this day. Hard to write about the ordinary in the face of the extraordinary. Hard to write about innocent decisions of the past while people are hungry, homeless, and grieving. Hard to write about the lessons we should learn from one hurricane while another is already threatening. I do pray that we learn those lessons—that natural disasters are very much of our own making and that we make them through the ordinary decisions and actions of our lives, decisions that we have much control over. But I pray that it does not take a second hurricane in one month to teach us.

Louisiana WRRI Studied New Orleans Inundation

The web pages of the Louisiana Water Resources Research Institute provide a glimpse into the scholarship surrounding hurricanes and the impacts of landfall. Of particular interest are projections of the impacts of flood inundation of New Orleans during hurricane. These and a variety of other resources which were developed for LWRRI under the directorship of Joseph Suhayda (retired) are available from the web page at www.lwrri.lsu.edu and www.lwrri.lsu.edu/1998_2002WEB.htm.

EPA Website Now Offers Water Quality Data

In Feburary, the Environmental Protection Agency - Office of Water, released the first ever interactive database of state water quality assessment data, which provides the public with easy Web access to water quality information at the state and local levels. The 2002 reporting cycle was a transition period between traditional 305(b) water quality reporting and integration of 305(b) with reporting of impaired waters under section 303(d) of the Clean Water Act, as outlined in EPA guidance to the states in November 2001. EPA is continuing to call for integrated reporting of 305(b) and 303(d) information.

States are participating in an extensive review and approval of the 2002 data. This initial Web release of the 2002 National Water Quality Database summarizes electronic data for 32 states. The remaining states should be added to the database by late summer 2005. National summary water quality statistics will be available at that time. The database may be viewed at www.epa.gov/305b/2002report and if you have any questions, please contact Cary McElhinney at mcelhinny.cary@epa.gov .

RESEARCH

COLORADO STATE UNIVERSITY, FORT COLLINS, COLORADO
Awards for August 2005 to September 2005

Principal Investigator – Department –Sponsor – Project Title – Amount

Fausch,Kurt D—1474 Fish Wldlfe Bio --NSF - National Science Foundation--*Collaborative Research-Terrestrial Effects of an Aquatic Invader: Does Regional Context Change the Impact of Fish ...*--$304,998.00

Garcia,Luis--1372 Civil Engineering--DOI-Bureau of Reclamation--*Subsurface Drainage Research* --$30,000.00

Stednick,John D--1472 For Range Water Steward--USDA-USFS-Rocky Mtn. Rsrch Station - CO--*Biogeochemical Fluxes at Glacier Lakes Ecosystem Experiments Site (GLEES) (Phase II)*--$22,000.00

Galvin,Kathleen--1499 Nat Res Eco Lab--NSF - National Science Foundation--*DRU. Decision-Making in Rangeland Systems: An Integrated Ecosystem-Agent-Based Modeling Approach to Resilience an...*--$220,414.00

Thornton,Christopher I--1371 Civ Eng--USDA-USFS-Rocky Mtn. Rsrch Station - CO--*Hydraulic, Hydrologic, Geomorphic, Sediment & Investigations of the Rio Grande*--$76,544.00

Galvin,Kathleen--1499 Nat Res Eco Lab--NSF - National Science Foundation--*DRU. Decision-Making in Rangeland Systems: An Integrated Ecosystem-Agent-Based Modeling Approach to Resilience an...*--$409,586.00

Loftis,Jim C--1371 Civ Eng--DOI-NPS-National Park Service--*IT Support for the NRPC of the National Park Service*--$130,730.00

Wohl,Ellen E--1482 Geosci--NSF - National Science Foundation--*Testing the Existence of a Threshold Discharge in Bedrock Channels*--$70,124.00

Loftis,Jim C--1371 Civ Eng--DOI-NPS-National Park Service--*Bibliographic Design Expertise & Technical Support to the NRPC of the NPS*--$26,091.00

Loftis,Jim C--1371 Civ Eng--DOI-NPS-National Park Service--*Development & Research of IT Policies, Procedures & Training Methodologies*--$73,830.00

Loftis,Jim C--1371 Civ Eng--DOI-NPS-National Park Service--*Software Engineering Research and Support for the National Park Service, ONRIS*--$301,600.00

Culver,Denise R--1474 Fish Wldlfe Bio--Colorado Division of Wildlife--*Complete Survey of Critical Wetlands & Riparian Areas in Grand County*--$15,000.00

Pielke,Roger A--1371 Atmos Sci--DOC-NOAA-Natl Oceanic & Atmospheric Admn--*Field Surveys for Selection of United States Historical Climatology Network Sites*--$9,570.00

Ramirez,Jorge A--1371 Civ Eng--USDA-USFS-Rocky Mtn. Rsrch Station - CO--*Development of Methodologies to Upscale/Downscale Cold Land Processes & Properties*--$19,62.00

Sovell,John R--1474 Fish Wldlfe Bio--Denver Board of Water Commissioners--*Post Fire Effects on Pawnee Montane Skipper Habitat*--$6,000.00

Newman,Peter--1480 Nat Res Rec Tour--DOI-NPS-National Park Service--*Research to Support Development of Visitor-based Soundscape Indicators and Standards*--$48,737.00

Deo,Shripad D--1375 CIRA--DOC-NOAA-Natl Oceanic & Atmospheric Admn--*Advanced Hydrologic Prediction Service* --$9,000.00

Clements,William H--1474 Fish Wldlfe Bio--DOI-USGS-Geological Survey--*Effects of heavy metals in Rocky Mountain streams* --$10,000.00

Sovell,John R--1474 Fish Wldlfe Bio--USDA-USFS-Forest Research--*Post Fire Effects on Pawnee Montane Skipper Habitat: 2005 Monitoring*--$23,825.00

Norton,Andrew P--1177 Bioag Sci and Pst Mgmt--DOI-NPS-National Park Service--*Monitoring Saltcedar (Tamarix) Biological Control (Diorhabda elongata) Insectary Establishment in Echo Park, Dinosaur...*--$24,000.00

Cooper,David Jonathan--1472 For Range Water Steward--DOI-NPS-National Park Service--*Prepare Final Reclamation Design for the Pond 5 Area at the Snake River Gravel Mine, John D. Rockefelller, Jr. Memoria*--$24,981.00

Labadie,John W--1371 Civ Eng--KOWACO-Korean Water Resources Corp.--*Advanced Application of K-MODSIM Model for Basin-Wide Optimal Water Allocation and System Evaluation*--$82,628.00

Poff,N LeRoy--1878 Bio--USDA-USFS-Forest Research--*Aquatic Ecosystem Responses to Streamflow Diversions*--$10,000.00

Barbarick,Kenneth A--1170 Soil Crop Sci--City of Littleton--*Land Application of Sewage Biosolids* --$79,929.00

Manfredo,Michael J--1472 For Range Water Steward--Western Assoc. of Fish & Wildlife Agency--*Wildlife Values in the West* --$7,500.00

Siemers,Jeremy--1474 Fish Wldlfe Bio--Colorado Division of Wildlife--*Preble's Meadow Jumping Mouse Northeast Range Survey*--$11,999.00

Vukicevic,Tomislava--1375 CIRA--DOC-NOAA-Natl Oceanic & Atmospheric Admn--*Efficient All-Weather (Cloudy & Clear) Observational Operator for Satellite Radiance Data Assimilation*--$53,000.00

Pielke,Roger A--1375 CIRA--DOC-NOAA-Natl Oceanic & Atmospheric Admn--*The Response of North American Monsoon to Boundary & Regional Forcing*--$105,369.00

Kummerow,Christian D--1371 Atmos Sci--NASA - Natl Aeronautics & Space Admin.--*A Cooperative Climate Rainfall Data Center* --$235,450.00

Child,R Dennis--1472 For Range Water Steward--USDA-USFS-Rocky Mtn. Rsrch Station - CO--*Monitoring Rangeland Sustainable Management* --$24,500.00

Gates,Timothy K--1371 Civ Eng--DOI-Bureau of Reclamation--*Identification, Public Awareness, & Solution of Waterlogging & Salinity in the Arkansas River Valley*--$18,200.00

Macdonald,Lee H--1472 For Range Water Steward--USDA-USFS-Rocky Mtn. Rsrch Station - CO--*Cumulative Watershed Effects Sediment Prediction Tools*--$10,008.00

Randall,David A--1371 Atmos Sci--NASA - Natl Aeronautics & Space Admin.--*Analysis of Precipitation Variability as Observed by Emerging Satellite Systems*--$120,000.00

Hannah,Judith L--1482 Geosci--DOI-NPS-National Park Service--*Continuation of Inventory and Monitoring Natural Resources Status and Trends in the National Park System, Geologic Reso*--$433,675.00

Austin,Richard T--1371 Atmos Sci--NASA - Natl Aeronautics & Space Admin.--*Combined Active/Passive Retrieval of Snowfall* --$75,000.00

Child,R Dennis--1472 For Range Water Steward--USDA-USFS-Rocky Mtn. Rsrch Station - CO--*Criteria & Indicators of Sustainable Rangeland Management*--$18,000.00

Wilkins-Wells,John Reese--1784 Soc--Washington State University--*Navajo Nation Small Farmer Risk Management Project* --$39,961.00

Parkinson,Bruce Alan--1872 Chem--DOE - US Department of Energy--*A Combinatorial Approach to Realization of Efficient Water Photoelectrolysis*--$180,001.00

Loftis,Jim C--1371 Civ Eng--DOI-NPS-National Park Service--*Design Expertise & Tech Support to the NRPC of the NPS, Web Technology*--$59,699.00

Ward,Robert C and Eileen Poeter, Colorado School of Mines--1033 CWRRI--DOI-USGS-Geological Survey--*Development of Characterization Approaches and a Management Tool for Groundwater-Surface Water System in the Vicinit...*--$132,731.00

Loftis,Jim C--1371 Civ Eng--DOI-NPS-National Park Service--*Continuation of Inventorying & Monitoring Natural Resources Status & Trends in the National Park System*--$727,956.00

Loftis,Jim C--1371 Civ Eng--DOI-NPS-National Park Service--*Guidance & Technical Support to the Soundscapes Program Center*--$166,183.00

Loftis,Jim C--1371 Civ Eng--DOI-NPS-National Park Service--*Development of Natural Resource Education & Outreach Programs & Techniques* --$131,776.00

Loftis,Jim C--1371 Civ Eng--DOI-NPS-National Park Service--*Bibliographic Design Expertise & Technical Support to the NRPC of the NPS*--$281,290.00

Loftis,Jim C--1371 Civ Eng--DOI-NPS-National Park Service--*Support of Research and Technical Assistance with the NPS, Natural Resource Program*--$42,335.00

Noon,Barry R--1474 Fish Wldlfe Bio--DOI-USGS-Geological Survey--*Assessment of the status and distribution of amphibian populations in the Kawuneeche Valley of Rocky Mountain ...*--$43,137.00

Vonderhaar,Thomas H--1375 CIRA--DOD - US Department of Defense--*CG/AR Hydro-Soil Moisture/WindSat* --$93,000.00

Pielke,Roger A--1371 Atmos Sci--DOI-USGS-Geological Survey--*Modeling Assessment of LULC Change Influences on Land Surface Hydrology, Regional Weather, and Climate Variability*--$77,997.00

Wilkins-Wells,John Reese--1784 Soc--University of Colorado--*Western Water Assessment - Providing Increased Focus on the Crucial Agricultural Sector*--$15,992.00

Knapp,Alan Keith--1878 Bio--NSF-Biological Sciences--*Collaborative Research: LTREB Long Term Ecosystem Responses to More Extreme Precipitation Patterns and Warming*--$97,929.00

Clements,William H--1474 Fish Wldlfe Bio--EPA - Environmental Protection Agency--*Ecological Thresholds and Responses of Stream Benthic Communities to Heavy Metals*--$295,760.00

Yang,Chih Ted--1371 Civ Eng--DOI-Bureau of Reclamation--*Taiwan River Restoration and Sedimentation Studies* --$120,000.00

Rathburn,Sara L--1482 Geosci--City of Fort Collins--*2005 Halligan Sediment Study* --$7,035.00

Kalkhan,Mohammed--1499 Nat Res Eco Lab Nat Res Eco Lab--DOI-USGS-Geological Survey--*ISS Tamarisk and Emerald Ash Borer Mapping Research*--$183,722.00

Yang,Chih Ted--1371 Civ Eng--DOI-Bureau of Reclamation--*Taiwan River Restoration and Sedimentation Studies* --$0.00

Wilkins-Wells,John Reese--1784 Soc--DOI-Bureau of Reclamation--*Social Factors Affecting The Transfer Of Modern Water Management Technologies And Water Banking/Marketing Mechanism...*--$94,925.00

Kummerow,Christian D--1371 Atmos Sci--NASA - Natl Aeronautics & Space Admin.--*A Physical Validation Approach for Precipitation* --$41,771.00

Norton,Andrew P--1177 Bioag Sci and Pst Mgmt--DOI-Bureau of Reclamation--*Monitoring Saltcedar (Tamarix) Biological Control (Diorabda elongata) Insectary Establishment at Bonny Reservoir, Yum...*--$12,000.00

Clements,William H--1474 Fish Wldlfe Bio--DOI-USGS-Geological Survey--*Effects of heavy metals in Rocky Mountain streams* --$40,404.00

Paschke,Mark W--1472 For Range Water Steward--USDA-CSREES-Coop State Rsrch Edu & Ext--*Integrated Control of Spotted Knapweed: Utilizing Spotted Knapweed-Resistant Native Plants to Facilitate Revegetation...*--$160,000.00

Bauder,Troy A--1170 Soil Crop Sci--Colorado Department of Agriculture--*The Training and Education for Agricultural Chemicals and Ground Water*--$125,600.00

Fausch,Kurt D--1474 Fish Wldlfe Bio--Colorado Division of Wildlife--*Effect of Agricultural Water Use & Drought on Groundwater that Sustains Critical Habitats for State-Listed Fish…*--$91,282.00

Paschke,Mark W--1472 For Range Water Steward--University of Wyoming--*Exploring the Use of Native Alleopathic Plants for Combating Exotic Weeds on Reclaimed Coal Mines*--$75,834.00

Brown,Cynthia S--1177 Bioag Sci and Pst Mgmt--Colorado Department of Agriculture--*Assessments of Riparian Wetland Communities Before & After Tamarisk Removal*--$15,293.00

CSU SEMINARS

Colorado State University Water Center
WATER RESOURCES SEMINAR
Fall 2005 Offering of GS 592

The Role of Negotiation and Dialogue in Securing Future Water Supplies in the West

4:10pm, Tuesday - Room C-142 Clark Building
CSU Campus, Fort Collins

The Fall 2005 offering of the Water Resources Seminar (GS 592) will introduce students to modern concepts of water resources negotiation and plans for use of dialogue and negotiation in implementing HB 1177.

Date	Topic/Speaker
October 11	"History of Water Negotiations in the West" – **Jared Orsi**, Asst. Prof., Department of History, CSU
October 18	"Balancing Gains and Losses in Water Negotiations" – **MaryLou Smith**, Vice President, Aqua Engineering, Fort Collins
October 25	*no seminar*
November 1	"Role of Negotiation and Dialogue in Development of the Northern Integrated Supply Project" – **Nicole Seltzer,** Water Resources Planning & Environmental Liaison, Northern Colorado Water Conservancy District, Berthoud (Background information on NISP can be found at: http://www.ncwcd.org/project&features/nisp_main.asp)
November 8	"How does the Agricultural Water User Community Approach the 1177 Process?"-- **Reagan Waskom**, State Water Resources Extension Specialist, CSU
November 15	"Transitioning Communities as Water Leaves Rural Colorado" – **Lou Swanson,** Head, Department of Sociology, CSU

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

MEETINGS

Colorado Water Congress Workshops for 2005

Seminars and workshops will all be held in the Colorado Water Congress Conference Room, 1580 Logan Street, Suite 400, Denver, Colorado. More programs will be posted as available. *CLE credits will be shown on the forms for the workshops when awarded.*

October 12, 2005 – Water Quality Workshop

October 13, 2005 – Endangered Species Conference

October 20, 2005 – The Initiative Process: What You Need To Know

November 8, 2005 – Legal Ethics In Water & Environmental Law

Complete programs and registration forms are available from the webpage at http://www.cowatercongress.org/meeting_notices.htm

MEETINGS

Colorado State University Water Dialogue

Creating and Sustaining Constructive Conversations about Water

December 13, 2005
8:45 a.m. to 5 p.m.

Lory Student Center - Colorado State University - Fort Collins, Colorado

As the 21st century began in semi-arid Colorado, the State was gripped by a drought that magnified already stiff competition for water supplies. The competition, to date, has, in the minds of some water users, resulted in grid lock in new water developments. Resolving water disputes and conflicts, in mutually acceptable ways, is of increasing interest to many Colorado citizens and the Colorado Legislature, as witnessed by passage of the Interbasin Compacts bill (HB 1177) in the 2005 Session. In the spirit of enhancing water communication in Colorado, Colorado State University (CSU), with its long and rich traditions in water education, research and outreach, is organizing a one-day CSU Water Dialogue on December 13, 2005, on the CSU campus in Fort Collins.

The purpose of the CSU Water Dialogue is to examine rapid changes taking place in our society and the resulting impacts and pressures on Colorado's limited water resources; establish common points of discussion; and suggest ways to facilitate constructive dialogues about the future of water supplies in Colorado. It is anticipated that the CSU Water Dialogue, and its proceedings, will help foster constructive dialogue in the Water Roundtables currently being organized and initiated in Colorado.

Proceedings of the CSU Water Dialogue's talks and discussions will be published by CWRRI/CIPP. The appendix of the proceedings will include a list of participants.

Co-sponsors:
Colorado Water Resources Research Institute (CWRRI)
Colorado Institute of Public Policy (CIPP)
Colorado Water Congress
Colorado Department of Natural Resources

Registration available after October 20th at www.conferences.colostate.edu/register

Registration Fee: $50
Registration inclues morning coffee, lunch, and a copy of the proceedings.
Seats for the event are limited.

Colorado State University Water Dialogue

Creating and Sustaining Constructive Conversations about Water

December 13, 2005: Schedule of Events

7:30am Information Booth Opens in the Lory Student Center, Second Floor

8:45am Opening Session in Main Ballroom
Moderator: **Robert Ward**
Welcome – **Tony Frank**, CSU Provost
Introduction – **Larry Penley**, President, CSU

9:30am Water Roundtables: How Are We Doing? – **Russ George**, Director, Department of Natural Resources

10:15am Break

10:45am KEYNOTE PANEL
Role of the Federal Government in Colorado Water Dialogues
Moderator: **David Robbins**, Hill and Robbins and Chair, CWRRI Advisory Committee
Rep. Mark Udall*
Rep. Bob Beauprez*

12:00pm Lunch - Keynote speaker - Justice Greg Hobbs, Colorado Supreme Court, "History of Water Conversations in Colorado"

1:30pm CSU Water White Paper – **Lyn Kathlene**, Colorado Institute of Public Policy (CIPP)

1:50pm Contributions of Faculty to Addressing Colorado's Water Challenges
Moderator: **Reagan Waskom**
Panel members:
- **Lou Swanson** – Transitions in society as water use shifts
- **Luis Garcia** – User centered water research as a way to connect university research with needs of Colorado water managers
- **Dan Smith –** Options for agricultural production in Colorado
- **Kurt Fausch –** Protecting species while managing water

2:45pm Break

3:15pm Constructive Conversations Among Competing Water Uses
Moderator: **Marc Johnson**, Vice Provost, CSU
Panel members:
Don Ament, Commissioner of Agriculture (Agriculture's Perspective)
Rep. Kathleen Curry (West Slope Perspective)
John Hickenlooper*, Mayor, Denver (Urban Demand Perspective)

4:30pm Wrap Up Comments:
James Pritchett, Asst. Professor, Agricultural and Resources Economics, CSU
Mark Squillace, Director, Natural Resources Law Center, CU

5:00pm Reception for CSU Water Dialogue Participants and Retirement Reception for Robert Ward

* Invited

SCADA and Related Technologies for Irrigation District Modernization

A USCID
Water Management Conference

October 26-29, 2005
Vancouver, Washington

For more information go to
http://www.uscid.org/future.html

Water Education Foundation
and Department of Water Resources - State of California
along with
U.S. Buerau of Rec, U.S. Fish and Wildlife Service and the
U.S. Geological Survey present

Selenium Summit: Problems and Solutions for the West

November 2-4, 2005
Costa Mesa, CA

Contact Gloria.Blumanhourst@ colostate.edu for a copy of the brochure.

Colorado Water Congress

2006 Annual Convention
January 26-27, 2006
Denver, Colorado

General Theme
"My support of reclamation can be best explained by saying it makes the desert bloom"
– Wayne N. Aspinall

CWRRI has organized the following sessions for the 2006 CWC Annual Convention:

Protecting, Preserving, and Promoting Colorado's Water History: Update on Water Archiving Efforts in Colorado
Panel:
Karen Rademacher, DARCA
Hal Simpson, State Engineer's Office
Rod Kuharich, Colorado Water Conservation Board
Janet Bishop, Archivist, Colorado State University's Morgan Library
Moderator: Robert Ward

Contributions to the 1177 Process from Water Research
Panel:
New USDA ARS Water Management Research Leader, Fort Collins, CO
James Pritchett, Agricultural and Resource Economics, CSU
Lyn Kathleen, Colorado Center of Public Policy, CSU
Moderator: Reagan Waskom

For more information go to : http://www.cowatercongress.org/meeting_notices.htm

HB1177 Water Basin Roundtable Cooperative Extension Contacts

Service Area	Name	Phone	email
South Platte	Thad Gourd (Adams County)	(303) 637-8117	tgourd@co.adams.co.us
Denver Metro Area	Carl Wilson (Denver County)	(720) 913-5273	carl.wilson@ci.denver.co.us
Arkansas	Jeff Tranel (Southern Region)	(719) 549-2049	jtranel@coop.ext.colostate.edu
Rio Grande	Marvin Reynolds (San Luis Valley)	(719) 852-7381	reynolds@coop.ext.colostate.edu
Yampa/White	CJ Mucklow (Routt County)	(970) 879-0825	cjmucklow@co.routt.co.us
Colorado River	Rod Sharp (Grand Junction)	(970) 245-9149	rsharp@colostate.edu
Dolores / San Miguel/San Juan	Dan Fernandez (Dolores County)	(970) 677-2283	danfern@coop.ext.colostate.edu
North Platte	Deb Alpe (Jackson County)	(970) 723-4298	dalpe@coop.ext.colostate.edu
Gunnison	Wayne Cooley (Tri River Area)	(970) 874-2195	wcooley@coop.ext.colostate.edu
Campus Coordinator	Lyn Kathlene (Campus)	(970) 491-2544	Lyn.Kathlene@colostate.edu
Campus Coordinator	Reagan Waskom (Campus)	(970) 491-2947	Reagan.Waskom@colostate.edu

CALENDAR

Oct. 11	**Water Resources Seminar: History of Water Negotiations in the West, by Jared Orsi.** 4:10-5 p.m., Room C-142 Clark Bldg, Colorado State University, Fort Collins.
Oct. 12	**Colorado Water Congress Water Quality Workshop.** Denver, CO**.** For more information go to: www.cowatercongress.org, or phone 303/837-0812, or email macravey@cowatercongress.org.
Oct. 12-15	**MODFLOW: Introduction to Numerical Modeling, Colorado School of Mines IGWMC Short-course.** Golden, CO. For information on registration deadlines, fees, or to register online, go to http://www.mines.edu/igwmc/short-course/
Oct. 13	**Colorado Water Congress Endangered Species Conference.** Denver, CO**.** For more information go to: www.cowatercongress.org, or phone 303/837-0812, or email macravey@cowatercongress.org.
Oct. 17-18	**UCODE: Universal Inversion Code for Automated Calibration**. Golden, CO. Postponed until May 24-26, 2004.
Oct. 18	**Water Resources Seminar: Balancing Gains and Losses in Water Negotiations by Mary Lou Smith.** 4:10-5 p.m., Room C-142 Clark Bldg, Colorado State University, Fort Collins.
Oct. 19-20	**A Water Conservation Training and Certification Class.** Westminster, CO. For more information go to www.coloradowaterwise.org.
Oct. 20	**Colorado Water Congress The Initiative Process: What You Need To Know.** Denver, CO**.** For more information go to: www.cowatercongress.org, or phone 303/837-0812, or email macravey@cowatercongress.org.
Oct. 26	**Is Marginal Cost Pricing of Municipal Water to Encourage Conservation Really Practical for Front Range Utilties, by Carol Malesky.** Noon to 1 p.m., Animal Science Bldg, Rm 110, Colorado State University, Fort Collins.
Oct. 25	**CRWA Training A and B Water Training.** Pueblo West. For more information go to www.crwa.net.
Oct. 26	**Is Marginal Cost Pricing of Municipal Water to Encourage Conservation Really Practical for Front Range Utilities? By Carol Malesky.** Noon to 1 p.m., CSU Animal Sciences Bldg, Rm 110, Fort Collins.

Oct. 26-29	**SCADA and Related Technologies Irrigation Distribution Modernization.** Portland, Oregon. For more information go to http://www.uscid.org/05scada.html .
Nov. 1	**Water Resources Seminar: Role of Negotiation and Dialogue in Development of the Northern Integrated Supply Project by Nicole Seltzer.** 4:10-5 p.m., Room C 142 Clark Bldg, Colorado State University, Fort Collins. For more information go to http://www.ncwcd.org/project&features/nisp_main.asp.
Nov. 3-4	**Introduction to Paleohydrology, University of Colorado At Denver and Health Sciences Center.** Denver, CO. For more information go to www.cudenver.edu/engineer/cont
Nov. 6-10	**American Water Resources Association 2005 Annual Conference.** Seattle, WA. For more information go to: http://www.awra.org/ .
Nov. 8	**Water Resources Seminar: How Does the Agricultural Water User Community Approach the 1177 Process, by Reagan Waskom.** 4:10-5 p.m., Room C-142 Clark Bldg, Colorado State University, Fort Collins.
Nov. 8	**Colorado Water Congress Legal Ethics in Water and Environmental Law**. Denver, CO**.** For more information go to: www.cowatercongress.org, or phone 303/837-0812, or email macravey@cowatercongress.org.
Nov. 15	**Water Resources Seminar: Transitioning Communities as Water Leaves Rural Colorado, by Lou Swanson.** 4:10-5 p.m., Room C-142 Clark Bldg, Colorado State University, Fort Collins.
Nov. 18	**Delph E. Carpenter and Family Papers Celebration**. Fort Collins, CO. See page 16 or contact CSU Morgan Libraries at 970-491-1844.
Dec. 13	CSU Water Dialogue. Fort Collins, CO. See page 28, 29.
2006	2006
Jan. 26-27	**Colorado Water Congress 48th Annual Convention.** Denver, CO. For more information go to: www.cowatercongress.org, or phone 303/837-0812, or email macravey@cowatercongress.org .

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

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