COLORADO WATER

Newsletter of the Water Center at Colorado State University

APRIL 2003

WATER

MEETINGS

WELL

ATTENDED

DURING

TIME OF

DROUGHT!

From top left, clockwise: Tom Pointon and Lloyd Walker, WATERING YOUR FUTURE, Arkansas River Basin Forum - see page 24; Jim Hall and Gary Lancaster, THE LOWER SOUTH PLATTE RIVER – HOW IT WORKS!, Lower South Platte Forum - see page 22; Darell Zimbelman, Tim Gates and Dale Heermann, STRETCHING AGRICULTURAL WATER SUPPLIES, a workshop for northern Colorado's agricultural community - see page 27; and David Little and Mary Gray, WEATHERING TOUGH TIMES TOGETHER, 2003 Colorado Agricultural Outlook Forum. - see page 24.

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WATER ITEMS AND ISSUES . . .

The February issue of Colorado should be numbered Vol. 20, No. 1. It was mistakenly published as Vol. 19, No. 2.

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Vol. 20, No. 2 April 2003
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Writers: Marian Flanagan and Alex Jacobson

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INTERNET SITES

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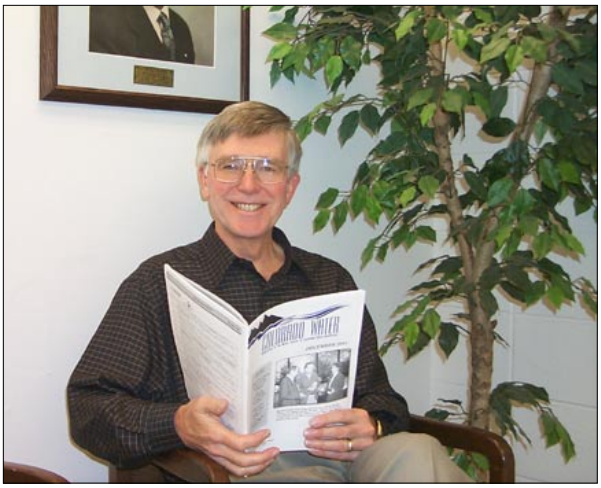
EDITORIAL

PROMOTING COLLABORATION IN WATER RESEARCH

by Robert Ward, Director



The Colorado Water Resources Research Institute (CWRRI) is part of a network of 54 water institutes authorized and funded by Congress under the Federal Water Resources Research Act. The institutes (one in each state, the District of Columbia, and three territories) are located on land-grant university campuses, and serve to connect the broad array of water expertise in all institutions of higher education in each state with the education and research needs of local and state water managers. The water institute program is administered by the U.S. Geological Survey and collaborates, where appropriate, with other federal water-related agencies, including the National Science Foundation, the Bureau of Reclamation, the Corps of Engineers, the Environmental Protection Agency, and the U.S. Department of Agriculture.
Please note, in the above paragraph, the range and array of water-related organizations each water institute attempts to connect in the conduct of water research and education: (1) Congress; (2) federal agencies; (3) state agencies; (4) local water organizations; and (5) university water scientists and educators. While water research connections with federal agencies are often established through national, water–related research competitions, connections with local water needs are forged through advisory committees that provide guidance for each water institute director in setting research and education priorities and ranking proposals for relevance to local and state needs.

Thus, as an institute director I find myself, day-by-day, working with the members of CWRRI's advisory committee; with USGS and Bureau of Reclamation scientists; with staff of the Colorado Water Conservation Board and the State Engineer's Office; with Colorado water conservancy/conservation districts and municipalities; with the USGS submitting reports and proposals electronically; and yet another day reporting accomplishments of this collaboration to members of Colorado's Congressional delegation. During these networking efforts, I am constantly informing Colorado's 'water' faculty of the needs and opportunities for their scientific expertise within the broad water management community, while also informing water managers of the availability of such expertise.

The Federal Water Resources Research Act establishes the basis for this water research cooperation and collaboration, with a very small amount of federal funding. The nature and extent of collaboration generated by the water institute program is unlike any other research collaboration effort in the water arena. In my obviously biased opinion, the program is a model of research collaboration and worthy of increased support from Congress.

The water institutes coordinate their accountability to Congress through an organization called the National Institutes for Water Resources (NIWR). NIWR is requesting $8.775 million in the FY 2004 U.S. Geological Survey budget to support the water institute program and its water research collaboration activities. NIWR held its annual meeting in Washington, D.C. March 16-18, 2003. The purpose of the annual meeting, besides reporting water research and education accomplishments to Congress, is to also constantly improve the national water institute program; to share among institute directors ways to improve the organization and operation of individual state water resources research institutes; and to discuss future plans, in cooperation with Federal agencies, regarding national water-related research competitions.

To illustrate how NIWR constantly strives to improve water research collaboration and operational efficiency, I will describe a new information technology system that supports stronger research collaboration within the nationally-networked water institute program. In

cooperation with the U.S. Geological Survey, NIWR is developing and implementing an electronic system for submission of annual water institute grant applications and reports to the USGS, submission of proposals for the national competition, conduct of peer reviews, and reporting of research results. The water research management system is now being employed by some of the state institutes to manage state-based water research competitions. The resulting databases of current research plans and activities, as well as past results, are increasingly being made readily available to the public and professionals alike via the internet. Electronic administration of water research assists in fostering research collaboration in ways not dreamed of just 10 years ago.

To review the water institute electronic management website and review its capabilities, check out the URL: http://niwr.org/ (to get beyond the opening page requires a password due to intellectual property rights protection for unfunded proposals). Information from the water institute electronic management system is tabulated and made available on the URL: http://water.usgs.gov/wrri/. Check out the proposals funded since 1996 at this site. Final project reports are available from the institutes via the 'Visit an Institute' button.

For purposes of reporting to Congress and the public, NIWR prepares an annual water institute Program Executive Summary. The 2003 version can be viewed at: http://wrri.nmsu.edu/niwr/sum2003.pdf.

In addition, NIWR prepares a more extensive overview of specific water research findings from all institutes that can be viewed at: http://wrri.nmsu.edu/niwr/highlights2003.pdf. When these sites are combined with the 'NIWR.org' site noted above, accountability of the water institute program is well documented.

After you review the above websites I believe you will agree, the United States taxpayer is obtaining a huge return on its appropriation for the water institutes program. Where else will you find a program that coordinates research for so many levels of water organizations, produces such a volume of research findings, and does this all for such a small appropriation from Congress?

SILVER FOX OF THE ROCKIES
Delphus E. Carpenter and Western Water Compacts
By Daniel Tyler, with Foreword by Donald J. Pisani

Delphus E. Carpenter (1877-1951) was Colorado's commissioner of interstate streams during a time when water rights were a legal battleground for western states. A complex, unassuming man as rare and cunning in politics and law as the elusive silver fox of the Rocky Mountain West, Carpenter boldly relied on negotiation instead of endless litigation to forge agreements among states first, before federal intervention. In Silver Fox of the Rockies, Daniel Tyler tells Carpenter's story and that of the great interstate water compacts he helped create. Those compacts, produced in the early 20th century, have guided not only agricultural use but urban growth and development throughout much of the American West to this day. In Carpenter's time, most western states relied on the doctrine of prior appropriation – first in time, first in right – which granted exclusive use of resources to those who claimed them first, regardless of common needs. Carpenter feared that population growth and rapid agricultural development in states sharing the same river basins would rob Colorado of its right to a fair share of water. To avoid that eventuality, Carpenter invoked the compact clause of the U.S. Constitution, a clause previously used to settle boundary disputes, and applied it to interstate water rights. The result was a mechanism by which complex issues involving interstate water rights could be settled through negotiation without litigating them before the U.S. Supreme Court. Carpenter believed in the preservation of states' rights in order to preserve the constitutionally mandated balance between state and federal authority. Today, water remains critically important to the American West, and the great interstate water compacts Carpenter helped engineer constitute his most enduring legacy. Of particular significance is the Colorado River Compact of 1922, without which Hoover Dam could never have been built.

Daniel Tyler is Professor Emeritus of History at Colorado State University. He is the author of The Last Water Hole in the West. Donald J. Pisani, who wrote the Foreword, is the Merrick Chair of Western American History at the University of Oklahoma, Norman. He is the author of Water, Land, and Law in the West: The Limits of Public Policy, 1850-1920.

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RESEARCH

FOUR COLORADO PROPOSALS SUBMITTED TO FY2003 USGS/NIWR NATIONAL GRANTS PROGRAM COMPETITION

Three proposals from the Colorado School of Mines and one proposal from the University of Colorado, Boulder, were submitted to the FY2003 U.S. Geological Survey/National Institutes for Water Resources National Grants Program competition. The proposals are listed below.

- Multivariate Spatial Statistical Approach for Regional Ground Water Vulnerability Assessment to Pesticide Contamination: Application to the High Plains Aquifer. Principal Investigator: John E. McCray, Department of Geology and Geological Engineering, Colorado School of Mines; Co-Investigators: Geoffrey Thyne, Department of Geology and Geological Engineering, Colorado School of Mines; Kevin Dennehy, Supervisory Hydrologist, U.S. Geological Survey, Denver Federal Center; Jason J. Gurdak, Hydrologist, U.S. Geological Survey, Colorado District Office.

- The Role of Iron Precipitates in Buffering Metal Content in Natural, Metal-Rich Waters: Developing Sorption Constants for Natural Systems. Principal Investigator: Geoffrey Thyne, Department of Geology and Geological Engineering, Colorado School of Mines; Co-Investigators: John E. McCray, Department of Geology and Geological Engineering, Colorado School of Mines; and Richard Wanty, U.S. Geological Survey, Colorado District.

- Adsorption of Arsenic by Hydroxylapatite and Bone as a Means of Treating Drinking Water. Principal Investigator: Wendy J. Harrison, Department of Geology and Geological Engineering, Colorado School of Mines; Co-Investigators: Suzanne S. Paschke, Research Hydrologist, U.S. Geological Survey Water Resources Division, Colorado District; Richard Wendlandt, Department of Geology and Geological Engineering, Colorado School of Mines; and Bruce D. Honeyman, Division of Environmental Science and Engineering, Colorado School of Mines.

- Understanding the Mechanisms of Water Cycle Variability in the San Juan Basin: Implications for Water Resources Management. Principal Investigator: Rajagopalan Balaji, Department of Civil, Environmental and Architectural Engineering, University of Colorado; Co-Investigator: Edith A. Zagona, Interim Director, Center for Advanced Decision Support for Water and Environmental Systems (CADSWES), University of Colorado; and George Leavesley, U.S. Geological Survey, Colorado District Office.

2003-2004 RICH HERBERT MEMORIAL SCHOLARSHIP
Offered by the COLORADO SECTION, AMERICAN WATER RESOURCES ASSOCIATION

QUALIFIED APPLICANTS – must meet the following criteria: Enrollment as a student in a degree program at any accredited Colorado public or private college or university. Involvement in research in independent study pertaining to hydrology, engineering, hydrogeology, geomorphology, aquatic biology, water law, water-resources policy or planning, environmental science or other topics concerning water resources in Colorado. Applications must include: resume, abstract of current research, and letter of recommendation from a faculty advisor, and must be received no later than June 1, 2003. Completed applications should be sent to the AWRA-Colorado Section, Scholarship Committee, Dave Mueller, U.S. Geological Survey, P.O. Box 25046, MS 415, Lakewood, CO 80225-0046.

SELECTION - A standing committee of the AWRA-Colorado Section will review applications and make recommendations to the Board of Directors. Recipients will be selected by August 1 and announced in the AWRA-Colorado Section newsletter.

STIPEND – Scholarships are awarded for one academic year. The amount is determined by the AWRA–Colorado Section Board of Directors. Previous awards have ranged from $750 to $1500. The stipend is delivered in 3 payments: August and December 2003, and May 2004. Funding for the scholarships is provided by donations of individual, corporate, and institutional members of the AWRA-Colorado Section.

REPORTS – Each scholarship recipient will be required to make an oral presentation on research results or progress at a meeting of the Colorado Section of AWRA in May, 2004.

FOR MORE INFORMATION – Contact Dave Mueller, 303/236-2101 ext. 235, mueller@usgs.gov; or Jerry Kenny, 303/764-1525, jkenny@hdrinc.com.

FRONT RANGE FUELS TREATMENT PARTNERSHIP AIMED AT REDUCING WILDLAND FIRE RISKS

by Katherine Timm

Colorado's Front Range includes an explosive mix of homes located within forested areas. These zones in the wildland urban intermix place homes, numerous communities and natural resources at significant risk from catastrophic wildfire.

"We recognize the critical need to increase our efforts in fuels treatment to better protect the communities, watersheds and unique ecosystems we have along the Front Range," said Jim Bedwell, forest supervisor, Arapaho Roosevelt National Forests.

In addition, the increasing size and frequency of catastrophic wildfires threatens community and ecosystem sustainability. More than 735,000 people live within the intermix area along the Front Range, and more than 30,000 homes are located within the boundaries of the Arapaho and Roosevelt National Forests alone. Several million residents and farmers also depend on national forests for the majority of their water.

In an effort to reduce the risk from catastrophic wildfires to lives, property and the state's natural resources, the Colorado State Forest Service, USDA-Forest Service, USDA-Rocky Mountain Research Station and USDI-Rocky Mountain National Park created the Front Range Fuels Treatment Partnership (FRFTP). Increased community sustainability and safety that result from the FRFTP strategy will benefit local landowners, governments, and the state.

The primary goal of the strategy is to enhance community sustainability and restore fire-adapted ecosystems through identification, prioritization and rapid implementation of hazardous fuels treatment projects along the Front Range.

The Strategy

The strategy emphasizes treating areas with integrated values at risk—homes, watersheds, threatened or endangered species—to enhance community and ecosystem sustainability. Specifically, it will increase the partners' ability to reduce risks to:

- Public and firefighter safety,
- Housing in the wildland urban interface,
- Watersheds that provide municipal and agricultural water,
- Ecosystem function, and
- Threatened and endangered species.

The FRFTP builds on previous fuels treatment successes such as the Upper South Platte, Cheesman Reservoir, Polhemus Burn, Trout Creek Timber Sale projects and Winiger Ridge. Many of these projects were key in reducing extreme, erratic fire behavior during the Hayman Fire.

A key to the success of this strategy is extensive participation from local governments, as well as public involvement and collaboration that identifies and supports specific treatment areas and types of treatment. The strategy also creates a unique partnership between management and research to capitalize on adaptive management practices in fuels treatment.

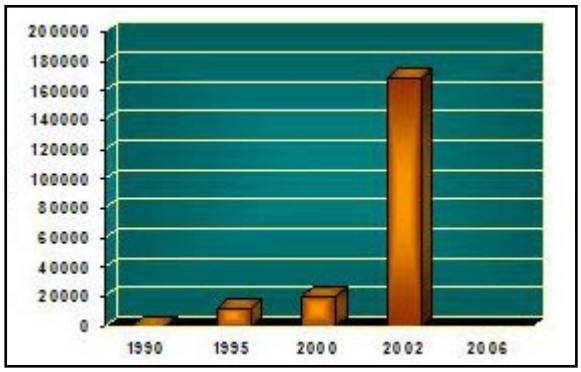
Recent Fire History

Catastrophic wildfires have been increasing in size and frequency since the late 1980s. Nationally, wildfires during the 2000 fire season were the largest and most costly in history. The 2002 fires season has been even more costly in terms of the number of people evacuated, homes burned and economic impacts to the economies of the Western states. Impacts to Colorado's Front Range were some of the most devastating in the United States.

Colorado's fire season set numerous records in terms of evacuations; damage to homes, watersheds and wildlife habitat; and negative impacts on local economies. Wildfires burned at high intensities causing extreme difficulties with suppression efforts due to explosive wildfire behavior.

Fire Behavior

- The Hayman Fire, the largest wildfire in Colorado history, burned more than 137,000 acres, 133 homes and 466 other structures. It burned more than 19.5 linear miles in one day covering nearly 62,000 acres and causing the evacuation of more than 5,000 people.
- Nine other large and damaging wildfires occurred within Front Range forests in 2002.



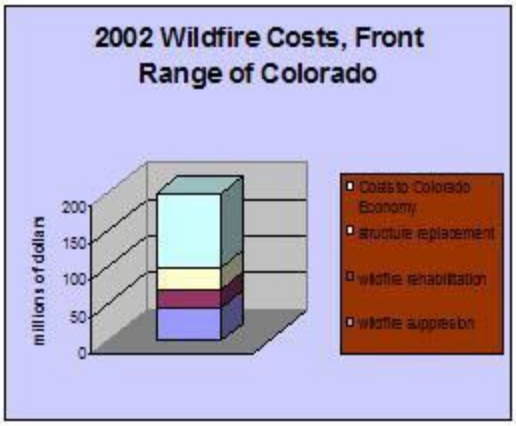
Acreage Burned

Evacuations

- Officials came within three hours of ordering the evacuation of 40,000 people because of the extreme fire behavior associated with the Hayman Fire.
- Approximately 12,000 people were evacuated during the 2002 fire season, some for several weeks, resulting in significant hardships and substantial economic loss.

Costs

- The cost to Colorado's economy was substantial. Many people cancelled vacation plans to the state, adversely affecting towns that were not even directly threatened by wildfires. For example, visitation at the Arapaho National Recreation Area dropped 30 percent in 2002.
- Wildfire suppression costs in the Front Range are estimated at $50 million. This cost was, in large part, related to the number of homes at risk and the substantial use of aircraft to attack these wildfires. In addition, almost $24 million is being spent on burned area emergency rehabilitation, including $4 million on Denver Water properties in the critical South Platte watershed, which supplies 80 percent of Denver's drinking water.



Impacts on Watersheds

- Major ash and sediment flows resulting from the Hayman Fire have impacted water quality and storage capacity at Cheesman Reservoir, which is a primary

water storage facility for Denver. Substantially increased maintenance costs are expected to continue for years.

Smoke Effects

- Smoke from the 2002 wildfires significantly degraded the air quality in the areas surrounding the wildfires and throughout the Denver metropolitan area and other Front Range cities.

Resource Effects

- Forest vegetation could be lost for up to a century without aggressive revegetation efforts. Old growth killed by the wildfires will take 400-500 years to recover.
- Wildfires adversely affected five federally threatened and endangered species.

Foundations for Success

Fuel reduction treatments have been successful in reducing wildfire intensity. A recent study of the Hi Meadow Fire in the Upper South Platte Watershed by the Rocky Mountain Research Station concluded that fuel treatments are effective in reducing crown fires in short return interval systems. On June 9, the Hayman Fire ran northeasterly on a broad front with erratic fire behavior and split at Cheesman Reservoir. The eastern head ran northeasterly toward two recently burned areas, the Schoonover Fire that occurred 3 weeks prior to the Hayman and the 8,300-acre Polhemus prescribed burn accomplished in 2001. The eastern head of the Hayman Fire did not progress beyond the area of these two burns, while the western head of the fire burned approximately 4 miles further during the same burning period. It appears that the eastern head of the Hayman Fire would have burned further to the northeast if it had not encountered these two previously burned areas. In addition, fuelbreaks at Cheesman Reservoir saved 15 structures valued at $400,000.

Rapid Assessment

The FRFTP strategy employs a large-scale rapid assessment of hazardous fuel conditions along the Front Range that enables the identification of large areas where treatment needs are greatest. As a result of this assessment, maps were developed that delineate areas of low to very high hazard, risk and value. The maps also provide an indication of overall treatment opportunities and of areas with greatest immediate need. The most immediate needs occur where the ratings for hazards, risk and value are very high.

These assessments indicate that approximately 510,000 acres fall in the high priority category for treatment. Three hundred thousand acres reside within the Pike and San Isabel National Forests, 140,000 acres are within the Arapaho and Roosevelt National Forests and 70,000 acres are on non-federal lands.

Prioritization and Collaboration

The partnering agencies will implement a collaborative process to identify and prioritize fuels treatment projects for Colorado's Front Range. This will be done in collaboration with local governments, agency cooperators, landowners and other interested stakeholders. The collaboration process will also be used to identify areas where community assistance grants will be of highest value in aiding the implementation of the strategy. Community assistance will focus on two primary areas: providing assistance to aid in the execution of fuels-reduction projects that complement treatments on National Forest System lands, and providing assistance to develop and expand markets for traditionally underutilized wood products such as those that are removed during hazardous fuels management activities.

"By forming this partnership, we can be more effective at identifying priority treatment areas and getting the resources and expertise needed to implement our projects. We must move quickly to treat larger areas in order to reduce the hazards of catastrophic wildfires," said forest supervisor Bob Leaverton, Pike National Forest.

Proposed Activities and Funding Levels

The FRFTP strategy emphasizes fuels reduction treatments in ponderosa pine/Douglas fir forest types where high hazard conditions combine with high value areas such as housing developments, key watersheds or threatened and endangered species habitat. However, high hazard lodgepole and spruce-fir forest types will also be treated when high value areas occur within these forest types and treatment will have a positive effect in reducing risks.

In 2003, fuels treatments will be accelerated to treat 5,450 acres on the Arapaho and Roosevelt National Forests (ARP) and 23,000 on the Pike and San Isabel National Forests (PSI). Cooperative fire funds will be used to assess private lands, facilitate additional fuels treatments on 1,000 acres of non-federal land and aid in community assistance. In addition, landscape analyses will be conducted on 30,000 acres on the PSI and 150,000 on the ARP. Research will focus on fire history of mixed conifer stands, mapping, treatment plans and fuels treatment model development.

In 2004, fuels treatment efforts will escalate to 10,250 acres on the ARP and 24,000 acres on the PSICC; cooperative fire funds will be used to facilitate additional fuels treatments on 1,500 acres of non-federal lands and aid in community assistance; and landscape analyses will be completed on 55,000 acres on the PSI and 90,000 acres on the ARP. Research will focus on fuels treatment model development and technology for disposal of treated materials.

Fuels treatments will accelerate to an annual rate of 12,000 acres in 2005 to 14,000 acres in 2006 on the ARP and more than 30,000 acres on PSI. Cooperative fire funds will be used to facilitate additional fuels treatments on 2,500-3,500 acres of non-federal land and to aid in community assistance. Landscape analyses will be conducted on 70,000 acres on the PSI and 90,000 acres on the ARP. Research will focus on social acceptance of treatments, improved cost effectiveness, new fuels treatment technologies and habitats that are more quickly restored.

"It will be challenging to implement the plan because of long-term funding issues, treatment costs and lack of viable markets for the raw materials generated, but it's imperative that we proceed in order to effectively treat fuels on a meaningful scale across private and public landownerships," said State Forester Jim Hubbard.

WATER SUPPLY

A wetter February boosted the SWSI and snowpack values over most of the state. The March 1 statewide snowpack is 83 percent of average. The Colorado River basin has the highest value at 93 percent of average, and the Rio Grande basin has the lowest at 73 percent of average.

The Surface Water Supply Index (SWSI) developed by the State Engineer's Office and the USDA Natural Resources Conservation Service is used as an indicator of mountain-based water supply conditions in the major river basins of the state. It is based on snowpack, reservoir storage, and precipitation for the winter period (November through April). During the winter period, snowpack is the primary component in all basins except the South Platte basin, where reservoir storage is given the most weight. The following SWSI values were computed for each of the seven major basins for March 1, 2003, and reflect the conditions during the month of February.

The SWSI values are negative, but not in the severe drought category that covered the state through most of 2002. However, water users should take care in viewing this index, because although the index and current snowpack are higher than last year, spring and summer stream flows are still anticipated to be well below average because the runoff will have to build from the current low winter base flows, and dry soil and low ground water levels will take up some snow melt before it reaches the streams.

The three eastern slope index stream flow gages shown in this report had lower flows this February than they did in February 2002; the western slope index stream gages had about the same flows. Total reservoir storage in Colorado is at about one-half of normal. Reservoirs are storing what they can during the winter, but low winter flows mean less water is being stored than in a normal year.

Basin	3/1/03 SWSI Value	Change From Previous Month	Change From Previous Year
South Platte	-2.6	+0.4	-0.6
Arkansas	-2.3	-0.3	+0.2
Rio Grande	-1.0	+1.0	+2.1
Gunnison	-1.4	+0.5	+1.3
Colorado	-0.1	+0.8	+1.8
Yampa/White	-1.8	+0.3	+1.4
San Juan/Dolores	-1.4	+0.9	+1.7

SCALE								
-4	-3	-2	-1	0	+1	+2	+3	+4

FEATURES

PREPARING FOR A CHANGING CLIMATE
The Potential Consequences of Climate Variability and Change
Central Great Plains

A Report of the Central Great Plains Regional Assessment Group
for the
U.S. Global Change Research Program

Compiled by
Dennis S. Ojima and Jill M. Lackett
Natural Resource Ecology Laboratory
Colorado State University

INTRODUCTION

There are many current stresses for residents of the Great Plains, including climate variability, economic variability, economic volatility, and market pressures. Climate change is just one additional stress that increasingly is affecting Great Plains residents. Projections of climate change in the region include increased temperatures, mainly minimum temperatures, and increased precipitation in many areas. These changes have the possibility of affecting, either positively or negatively, many sectors in the Great Plains including agriculture, ranching and livestock, natural systems, and water.

The possible alterations in climate patterns (extreme events, trends, and variability in seasonal precipitation and temperatures) in the region due to ongoing and projected climate changes will likely add to uncertainty for the social and environmental well-being of the region. If adaptations are considered now in order for the residents to take advantage of opportunities that may arise from the changed climate, or to prepare for vulnerabilities that may occur, the residents of the Great Plains will be better prepared for a change in the future climate.

There are four main areas in the design of this assessment.

Stakeholder Input.—To better engage stakeholders in the assessment process and to make the assessment more meaningful to the stakeholders, the following was accomplished:

- Identify the critical climate information needed to improve management decisions.
- Identify the climate assessment questions important to the stakeholders.
- Design assessment experiments that will be useful for decision-making in evaluating climate variability, climate change, and land-use options.

Climate Analysis

- Historical and general circulation model-generated (GCM) climate data for the region were available for use in the assessment.
- Two time frames were considered – the decades of 2025-2034 and 2090-2099.

Impact Response

- Conduct simulations of ecosystem responses to climate variability and change based on the historical and scenario-derived climates. Possible socio-economic responses were also evaluated, although to a lesser degree.

Stakeholder Evaluation

- Evaluate the results of the impact analysis with stakeholders to determine the sectoral significance of the impacts and to determine what coping strategies are available or need to be developed.

The four sectoral focus groups that were addressed in this assessment are: agricultural land use and adaptation (i.e., cropping systems); ranching, rangeland, and livestock; conservation and natural areas; and the cross-cutting sector, water. These sectors were picked because of their importance in the Great Plains.

In addition to focusing on four sectoral groups, this report also addresses four main points that are of concern to the stakeholders in the region.

First, climate variability and extreme events concern stakeholders much more than changes in averages. It was stated time and again that it is much easier to adapt and cope with a steady change than with erratic conditions.

Second, the adaptability of both human systems and ecosystems are discussed at length. Humans in the Great Plains have proved highly adaptive to perturbations over the years, but there is skepticism of the ability of natural or less-managed systems to adapt quickly to climatic changes. The rate of change, fast versus slow, will undoubtedly influence the rate of adaptation.

Third, water is an important concern for all stakeholder groups, including quantity, quality, timing, distribution and form of precipitation.

And fourth, conservation of soil organic matter, and the positive role this may play in buffering operators from climate change, was discussed at length by many groups. From this also stems the possibility of developing a carbon, or other conservation, credit system.

The possible changes in demographics and economics were also considered when evaluating potential climatic changes and their impacts. Particularly important are the economics of coping with climatic changes. Climate change does not happen in a vacuum, and the social and economic situation of the region will have many implications for the way in which people cope or adapt, and with the speed at which they do so.

CONCLUSIONS: RESULTS

Results showed increased warming, and for some areas, greater precipitation. Maximum and minimum temperatures rise in both scenarios. Minimum temperature increases are greatest, indicating increased nighttime warming; by the 2090s, the increase is over 7 degrees F (3.9 C). Increases are greatest in the western parts of the Great Plains, particularly along the Front Range of the Rocky Mountains.

In general, the Canadian Climate Centre model experiment produced a greater increase in temperature, especially in the winter, than did the Hadley model experiment. Both model experiments showed both increases and decreases in precipitation over the region and seasons, although there seems to be a slightly wetter trend in the region, especially at 2090. The snow season in the Great Plains is projected to end earlier in the spring, reflecting greater warming in winter and spring.

Regional change in climate variability and extreme events may affect various aspects of agricultural systems and people in the Great Plains.
First, changes in winter moisture may impact cool season invasives, the extent of sagebrush and other woody perennials on the range, shallow aquifer recharge, streamflow timing, forage availability and quality, and disease incidence.

Second, warmer winters may impact the incidence of pest outbreaks, soil organic matter, community composition, grass, and the invasion of exotics. For example, leafy spurge and Japanese brome may move further south.

Results were generated by experiments using the Canadian Climate Center (CGCMI) model (herein referred to as CCC) and the UKMO-Hadley Center (HADCM2) model (herein referred to as Hadley).

Both GCM model experiments project a continuation of the historical trends seen in Great Plains climate over the last 100 years with increased warming, and for some areas, greater precipitation.

Third, summer increases in temperature and precipitation may impact hail, tree invasives, and fire management.

Last, a change in the frequency and duration of extreme events can lead to the opposing problems of drought and deluge, as well as early and late spring snowstorms which can bring problems all their own.

In addition to the potential impacts discussed above, there were many other potential impacts of climate change in the Great Plains identified by stakeholders. These possible impacts will directly impact farmers and ranchers in the region. Many identified the modified vulnerability of farm/ranch families to climate and market stresses as an impact. This means there will be winners and losers from climate change, depending on the direction of the change and the adaptations employed. Next, crop and livestock production will be modified. This could include increases or decreases in production, as well as changes in crops, crop varieties, animal breeds, or species. Further, water use competition will likely be impacted by climate change and variability as will water quality. These impacts will likely have important implications for natural resource management and human settlement patterns.

General Results

- There is a strong likelihood that the Great Plains may be a warmer place in the future. The precipitation pattern in the future is uncertain, with areas of both increased and decreased precipitation in the region. The potential warming and altered precipitation regime could have serious impacts for ecosystems and agriculture in the Great Plains.
- There will be both favorable and unfavorable consequences of changing climate in the future. For example, productivity of crops and grasses in the region may increase due to atmospheric carbon dioxide fertilization, whereas decreased soil moisture may decrease productivity.
- Extreme events, seasonal patterns, and variability are important to consider (more than just changes in means).
- Invasive species and shifting ecosystems will be important to monitor in the future.
- Water resource declines, and competition among water users, may increase in the future due to the pattern of altered precipitation and warming, and the urban development in many areas of the region.
- Not all change will necessarily happen gradually. There will likely be some surprises, or rapid change events.
- There is still much uncertainty about the magnitude of climate change and the impacts of those changes.

CONCLUSIONS: COPING STRATEGIES

The possible impacts identified above may include both opportunities and vulnerabilities; therefore, exploitation or coping strategies to deal with the possible changes were also identified. The resiliency of communities and building sustainability are two main issues that were considered when discussing coping strategies. Stakeholders emphasized that production and conservation need to be equally important for building sustainability in the region. Short-term goals, such as those often addressed by policy and economic considerations, should be formed so that they will advance long-term goals, such as sustainability.

The importance of adaptive management was stressed by the stakeholders as an important coping strategy. It is critically important to learn by doing, and there needs to be constant evaluation of what works and what fails to work in an attempt to lessen the possible negative impacts of climate change, and to take advantage of positive impacts in the region.

Effective coping strategies depend on informing the public and decision makers about the implications of climate change for natural systems, agriculture, and human systems, as well as what the effects of changes to systems mean to the quality of human life. This principle is an overarching concern that is fundamental to the discussions of climate change in the Great Plains. It is also an effective way to educate the general public and decision makers about the related issues involved in the climate change debate.

One general coping strategy that was discussed in all sectoral groups is to develop a decision-support system to improve how land in the Great Plains is managed. This tool will help landowners decide how best to use their land for the mutual benefit of their operations and natural systems. This will not be easy, as it will require looking at profitability while considering the critical periods for all species and for different systems of land use. The decisions made will certainly differ by area, and the particular strategy of land use for each area will also vary. This decision-support system must also recognize the dynamic nature of natural systems, and allow for continual evaluation of management decisions as conditions change in order to make necessary alterations to adjust for the desired outcome. If these items are monitored as conditions change, many problems can be avoided at later dates.

Recommendations for Coping With Climatic Changes

Various coping strategies already exist in the region due to the need to deal with historic events involving climate variability. Farmers and ranchers in the region have proved themselves to be very adaptive historically. In addition, many adaptive management strategies used today are appropriate to deal with the more comlex interactions between

broader societal goals (urban, conservation, community issues) and greater environmental constraints (water competition, agricultural programs, and water and air quality issues).

- Coping or adaptation strategies should be flexible and responsive to changing ecological and social trends.
- The rate of potential changes is especially important when trying to cope, particularly when a change of management is needed.
- Diversification may be a key to coping with potential climatic changes.
- Community-based adaptive management is important to stakeholders for future planning.
- Decision-making aids for land managers will be extremely important when coping with or adapting to climate change.

Future Research Needs

- A synthesis of the current knowledge relevant to climate impacts relating to the Great Plains would be helpful for developing appropriate future research activities. This data needs to include current conditions and stresses in the region.
- Better forecasting and methods to prepare for extreme events will be important in the region.
- Continuing development of climate models is needed for more accurate future climate projections.

This assessment of the impacts of climate variability and change stemmed from the original Office of Science and Technology Policy (OSTP)/US Global Change Research Program (USGCRP) scoping workshop held May 27-29, 1997 at Sylvan Dale Guest Ranch in Loveland, CO. The focus of this more detailed assessment is on the Great Plains, which includes all or part of four states – Colorado, Kansas, Nebraska and Wyoming. The Central Great Plains region is one of 19 regions and six sectors included in the current US National Assessment of the Potential Consequences of Climate Variability and Change. Although these are the region's strict boundaries, many of the analyses were done for the entire Great Plains, defined as all or parts of 10 states: Montana, North Dakota, South Dakota, Wyoming, Nebraska, Colorado, Kansas, New Mexico, Oklahoma and Texas.

The assessment is mainly a stakeholder-driven assessment, with two-way information flow between private citizens, academics, industry representatives, and governmental representatives. It is organized by a steering committee, but the stakeholders in each sectoral group really directed the analyses performed, and provided plausible coping strategies.

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Stakeholders: Farmers, Ranchers, Academics, Water Managers, Public Land Managers, Industry Representatives, Commodity Groups, Rural Organizations, State and Local Government, Conservation Groups, Scientists, Agricultural Extension Agents.

This assessment was funded by the U.S. Department of Energy (DOE) through Argonne National Laboratory, under contract number 981982301. The material is also based on work supported by the DOE, through the Great Plains Regional Center of the National Institute for Global Environmental Change, under Cooperative Agreement No. DE-FC03-90ER61010. The project was conducted at the Natural Resource Ecology Laboratory at Colorado State University.

To access the full report, go to the website http://www.nrel.colostate.edu/projects/gpa/gpa_report.pdf.
For a hard copy contact Jill Lackett at 970/491-2343 or E-mail jlackett@nrel.colostate.edu

PROPOSALS SOUGHT BY RESEARCH FOUNDATION

The Awwa Research Foundation requests proposals for 30 research projects scheduled to be launched in 2003. The projects, with nearly $12 million in funding, focus on a wide range of topics related to the drinking water community. Requests for proposals (RFPs) for the projects are available on the Foundation's Web site at <www.awwarf.com>. Proposals must be postmarked by either May 5 or July 15, as specified in each RFP. All projects, unless otherwise indicated, must include 25 percent of the total project budget as in-kind or cash contribution. In-kind contributions can be in the form of labor, materials, or laboratory and other services, and may come from project participants such as water utilities, consulting firms, and universities. For each project, an appointed project advisory committee will evaluate proposals based on responsiveness to the RFP, scientific and technical merit, and qualifications of the researchers. A complete list of the projects for which proposals are being requested, categorized by the strategic goal area, is below:

Efficient And Customer Responsive Organization

- A Knowledge Management Approach to Drinking Water Utility Business (RFP 2933)
- Benchmarking Water Utility Customer Relations Best Practices (RFP 2947)
- Best Practices for Integrating Worker Health and Safety Into the Design and Operation of Water Systems (RFP 2943)
- Disaster Response, Recovery, and Business Continuity Planning for Water Utilities (RFP 2929)
- Implementing Reliability Centered Maintenance (RCM) Programs at Water Utilities (RFP 2953
- Strategic Communication Planning for Drinking Water Utilities (RFP 2955)
- Risk Analysis Strategies for More Credible and Defensible Utility Decisions (RFP 2939)
- Water Efficiency Programs for Integrated Water Management (RFP 2935)

Environmental Leadership

- Developing an Environmental Management System for Water Utilities (RFP 2930)
- Environmental Impacts of Non-Treatment Discharges From Drinking Water Utilities (RFP 2937)
- Identify Knowledge Gaps With Total Maximum Daily Loads (TMDL) and Drinking Water Utilities (RFP 2944)
- Regional Solutions to Developing Water Supplies (RFP 2950)
- Update the AwwaRF Manual Water Treatment Plant Waste Management (RFP 2934)

High Quality Water

- Characterization of Waterborne Aeromonas spp. for Their Virulence Potential (RFP 2957)
- Contribution of Wastewater to DBP Formation (RFP 2948)
- Criteria for Quality Control Protocols for Various Algal Toxin Methods (RFP 2942)
- Dosimeters for UV Dose Verification and Monitoring (RFP 2949)
- International Workshop and Report on Pesticides, Their Degradates and Inert Ingredients (RFP 2938)
- Long-Term Effects of Disinfection Changes on Water Quality (RFP 2940)
- Natural Organic Matter Fouling of Low Pressure Membrane Systems (RFP 2952)
- Optimizing the Generation and Capacity of Adsorptive Sites on Oxide Surfaces for Manganese Control (RFP 2951)
- Rejection of Trace Organic Contaminants by Reverse Osmosis and Nanofiltration Membranes (RFP 2945)

Infrastructure Reliability

- Condition Assessment of Water Treatment Plant Structures – Filter Beds (RFP 2936)
- Distribution Water Quality Issues Related to New Development or Low Usage (RFP 2954)
- Guidelines to Minimize Downtime During Pipe Lining Operations (RFP 2956)
- Impact of Petroleum-Based Hydrocarbons on PE/PVC Pipes and Pipe Gaskets (RFP 2946)
- Installation, Condition Assessment, and Reliability of Service Lines, Connections, and Fittings (RFP 2927)
- Leakage Management Technologies (RFP 2928)
- Life Cycle Analysis of Epoxy Lining (RFP 2941)
- Performance and Life Expectancy of Elastomeric Gaskets in Contact With Potable Water (RFP 2932)

More information is available at <www.awwarf.com>.

Big underground lake found in China

Scientists have discovered a massive underground lake in China's arid northwest, giving hope for reducing poverty in one of the country's most remote and sparsely populated regions. The lake beneath the Taklamakan desert has a capacity about the same as the 244-square-mile reservoir being filled behind China's massive Three Gorges Dam, according to the official News Agency. The find resulted from a survey of water resources in the Zinjiang region, iwhich found about that about 35 billion cubic feet of underground water cound be exploited annually. Newly found supplies coming from about 50 different underground sources could alleviate the need to construct 10 major reservoirs.

Denver Post, February 10, 2003

THE U.S. NATIONAL CLIMATE CHANGE ASSESSMENT: DO THE CLIMATE MODELS PROJECT A USEFUL PICTURE OF REGIONAL CLIMATE?

by
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From testimony presented to the House Subcommittee on Oversight and Investigations, July 25, 2002

In this reproduction of my House testimony, I'd like to convey the following two points:

1. The perspective I am presenting does not easily fit into the conventional two-sided debate over climate change. This third perspective, as I have written elsewhere, "suggest[s] that humans have an even greater impact on climate than is suggested by [international and national assessments]. The human influence on climate is significant and multi-faceted."[1]

2. Any attempt to accurately predict future climate is fundamentally constrained by the significant and multi-faceted characteristics of the human influence on climate. By focusing on vulnerabilities rather than prediction as a focus of research, I believe that the scientific community can provide more comprehensive and likely more useful, information to decision makers.

These points are consistent with the American Association of State Climatologists Policy Statement on Climate Variability and Change which was approved on October 25, 2001. The American Association of State Climatologists is a professional scientific organization composed of state climatologists (one per state), directors of the six Regional Climate Centers of the National Oceanic and Atmospheric Administration within the Department of Commerce, and associate members who are persons interested in the goals and activities of the Association. State Climatologists are individuals who have been identified by a state entity as the state's climatologist and who are also recognized by the Director of the National Climatic Data Center of the National Oceanic and Atmospheric Administration as the state climatologist of a particular state.

State Climatologists currently exist in 47 states and Puerto Rico. They are typically either employees of state agencies or are staff members of state-supported universities. Associate members may be assistant state climatologists or other climatologists under the employ of the state climatologist, representatives of federal climate agencies, retired state climatologists, or others interested in climate services. The total membership of the Association is approximately 150.

AASC Policy Statement on Climate Variability and Change

Our statement provides the perspective of the AASC on issues of climate variability and change. Since the AASC members work directly with users of climate information at the local, state, and regional levels, it is uniquely able to put global climate issues into the local perspective needed by the users of climate information. Our conclusions are as follows:

1. Past climate is a useful guide to the future – Assessing past climate conditions provides a very effective analysis tool to assess societal and environmental vulnerability to future climate, regardless of the extent the future climate is altered by human activity. Our current and future vulnerability, however, will be different than in the past, even if climate were not to change, because society and the environment change as well. Decision makers need assessments of how climate vulnerability has changed.

2. Climate prediction is complex with many uncertainties – The AASC recognizes climate prediction is an extremely difficult undertaking. For time scales of a decade or more, understanding the empirical

accuracy of such predictions – called "verification" – is simply impossible, since we have to wait a decade or longer to assess the accuracy of the forecasts.

Climate prediction is difficult because it involves complex, nonlinear interactions among all components of the earth's environmental system. These components include the oceans, land, lakes, and continental ice sheets, and involve physical, biological, and chemical processes. The complicated feedbacks and forcings* within the climate system are the reasons for the difficulty in accurately predicting the future climate. The AASC recognizes that human activities have an influence on the climate system. Such activities, however, are not limited to greenhouse gas forcing and include changing land use and sulfate emissions, which further complicates the issue of climate prediction.

Furthermore, climate predictions have not demonstrated skill in projecting future variability and changes in such important climate conditions as growing season, drought, flood-producing rainfall, heat waves, tropical cyclones, and winter storms. These are the types of events that have a more significant impact on society than annual average global temperature trends.

1. Policy responses to climate variability and change should be flexible and sensible. The difficulty of prediction and the impossibility of verification of predictions decades into the future are important factors that allow for competing views of the long-term climate future. Therefore, the AASC recommends that policies related to long-term climate not be based on particular predictions, but instead should focus on policy alternatives that make sense for a wide range of plausible climatic conditions regardless of future climate. Climate is always changing on a variety of time scales and being prepared for the consequences of this variability is a wise policy.

2. In their interactions with users of climate information, AASC members recognize that the nation's climate policies must involve much more than discussions of alternative energy policies – climate has a profound effect on sectors such as energy supply and demand, agriculture, insurance, water supply and quality, ecosystem management and the impacts of natural disasters. Whatever policies are promulgated with respect to energy, it is imperative that policy makers recognize that climate – its variability and change – has a broad impact on society. The policy responses should also be broad.

Thus, to address the issues of climate variability and change, modernizing and maintaining high-quality, long-term climate data must be a high priority in order to permit careful monitoring. With rapid dissemination of these data, State Climate Offices, as well as the Regional Climate Centers and the National Climatic Data Center, can better monitor emerging climate threats to critical national resources such as our water supply, agriculture, and energy needs. The climate data must include all-important components of the climate system (e.g., temperature, precipitation, humidity, and vegetation health and soil moisture). We also recommend that the nation strengthen its local, state, and regional climate services infrastructure to develop greater support capabilities for those decision makers who have to respond to climate variability and change.

Finally, ongoing political debate about global energy policy should not stand in the way of common sense action to reduce societal and environmental vulnerabilities to climate variability and change. Considerable potential exists to improve policies related to climate; the AASC is working to turn that potential into reality.

In the remainder of this text, I provide several examples of the scientific bases that underlie the AASC Statement. Greater detail is available in the peer-reviewed scientific publications that are listed at the end of my testimony.

A fundamental basis of the U.S. National Assessment is the use of the Canadian and Hadley Centre General Circulation Models (GCMs) to project the future state of the climate as the basis for discussion of climate impacts and ultimately alternative courses of action by decision makers. The perspective I offer here suggests that in relying on GCMs to, in effect, bound the future state of the climate, the U.S. National Assessment may have had the effect of underestimating the potential for change and overestimating our ability to accurately characterize such changes with computer models.

The hypothesis for using these models is that including human-caused increases of carbon dioxide and other greenhouse gases and aerosols in the models are sufficient to predict long-term effects on the climate of the United States. The

*Impacts on climate are compared in terms of radiative forcing, which can be considered as perturbations to the earth's radiation budget prior to feedbacks from the rest of the climate system.

position presented here is that such forcings are important, but a subset of those needed to develop plausible projections, and even if all forcings were included, accurate long-term prediction would remain challenging, if not impossible. To test the hypothesis that GCMs can accurately project climate, it is possible to compare model performances with observed data for the period 1979-2000. One test is the ability of the model to predict the averaged temperatures of the earth's atmosphere over this 20-year period. Such a test is a necessary condition for regional projection skill, since if globally-averaged, long-term changes cannot be skillfully projected; there will necessarily be no regional skill. During this period, for example, at around 18,000 feet above sea level, the Canadian GCM projects a 0.7° C warming of the global averaged temperature.[2] The Hadley Centre model also has atmosphere warming for this time period. The observations, in contrast, have no statistically significant change in these averaged atmospheric temperatures.[3] Thus, either the models or the observations must be incorrect; both cannot be correct. Since, for the 1979-2000 time period, satellite, radiosonde, and National Center for Environmental Prediction model reanalysis each agree closely with respect to global averages, the observations should be interpreted as our best estimate of reality.

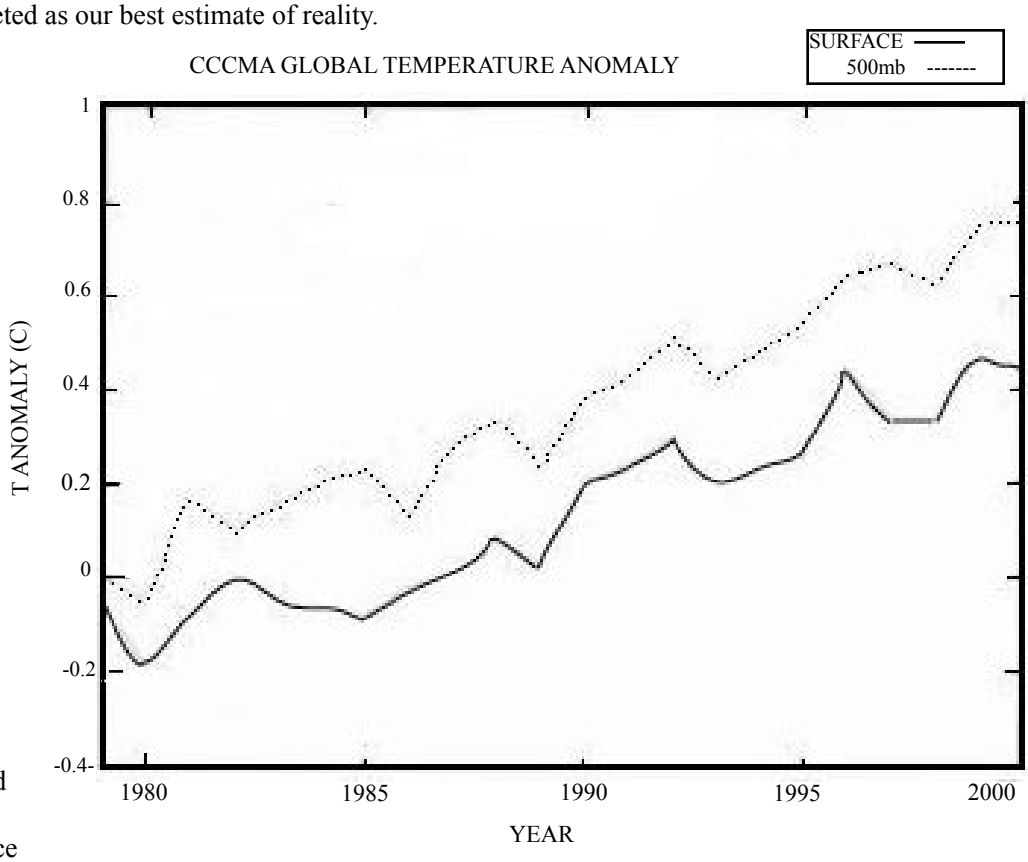

Figure 1: Canadian GCM projection of surface and 500 mb temperature for the period 1979-2000. Plot prepared by Dr. Thomas Chase from data at http://www.cccma.bc.ec.gc.ca/data/cgcm2/cgcm2.shtml.

The scientific evidence, therefore, is that the models have failed to replicate the actual evolution of atmospheric temperatures over the time period 1979-2000. Thus, using the results of these models as the basis for assessments, much less for particular decisions, for the next several decades is not justified. Such models clearly have usefulness as scientific tools with which to conduct sensitivity experiments, but it is important to not overstate their capabilities as predictive tools.

Moreover, there are overlooked issues concerning the spatial representativeness of the surface land data. The National Climate Data Center (NCDC),under the leadership of Tom Karl, has contributed significantly to develop representative data sets, but as yet there has been no attempt within the scientific community to incorporate regional and local land-use change, except urbanization effects, into these data sets.[4] Even with urbanization, there is no adjustment for the different effect on temperatures depending on the geographic location. Denver, for instance has a distinctly different effect on local temperature variations than Washington D.C.

The temperature measuring sites themselves have not been investigated to determine their exposure to the air, and whether local biases are affecting the temperature. In eastern Colorado, for example, several of the Historical Climate Reference sites[5] have exposure which would result in a non-spatially representative warming. As an example, Figure 3 shows that one of the sites is located adjacent to the south face of a brick building next to an air conditioner unit. Since this data is part of the U.S. Historical Climate Network, it presumably has been used in the construction of the global surface analysis which is the basis for the claim of global averaged surface warming.

The GCM projections clearly have difficulty capturing the actual evolution of the earth's climate system. One major reason for this difficulty is the absence and/or inadequate representation of significant human-caused forcing of the climate.

These include land-use changes over time, the effect of aerosols on clouds and precipitation, and the biogeochemical effect of carbon dioxide. The Intergovernmental Panel on Climate (IPCC), itself, concludes that there is "a very low level of scientific understanding" of these forcings.[6]

The importance of one of the effects can be illustrated by a newly published study of the influence of human-caused land-use change on the global climate.[7] Even with a conservative estimate of land-use change, the global redistribution of heat is at least as large as simulated by the existing GCM model projections. As an example,

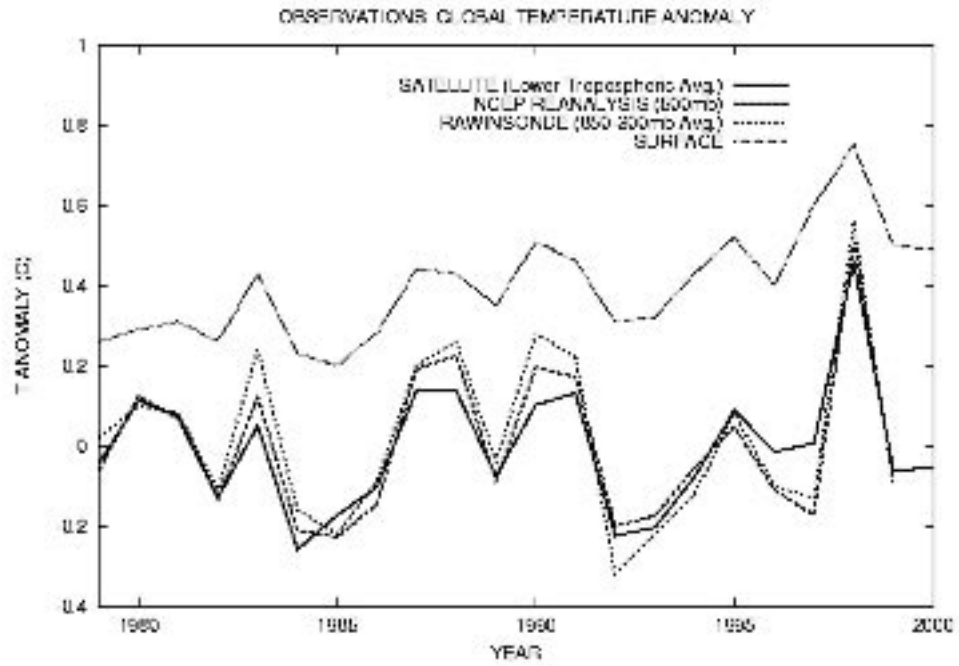

Figure 2: Observations of global temperature anomalies from surface, satellite, rawindsonde and model reanalysis for the period 1979-2000. Plot prepared by Dr. Thomas Chase. Data are from http://www.cru.uea.ac.uk/ (surface; http://weather.msfc.nasa.gov/MSU/msusci.html (satellite); http://cdiac.esd.ornl.gov/ (rawindsones); http://dss.ucar.edu/pub/ (NCEP model reanalysis).

Figure 3: Fort Morgan Colorado Climate observing

Figure 4 illustrates the near-surface 10-year averaged January temperatures that resulted from this simulation study.

A model comparison of the regional effect of land-use change on the thunderstorms in the central Great Plains is shown in Figure 5. In the top Figure the current landscape is applied in the model. In the bottom Figure, the natural short grass prairie is imposed. A major effect on weather clearly results. Even when these forcing are included, however, the complex interactions among the components of the climate system will likely limit our ability to skillfully predict the future. Indeed, we cannot even predict with any skill beyond a season in advance, and then only under special situations such as an evolving El Niño.

The inherent limitations on predicting future climate have led the International Geosphere-Biosphere Programme to conclude their new book, entitled Vegetation, Water, Humans and the Climate: A New Perspective on an Interactive System. A Synthesis of the ICBP Core Project, Biospheric Aspects of the Hydrologic Cycle, with a

NEAR SURFACE TEMPERATURE DIFFERENCE

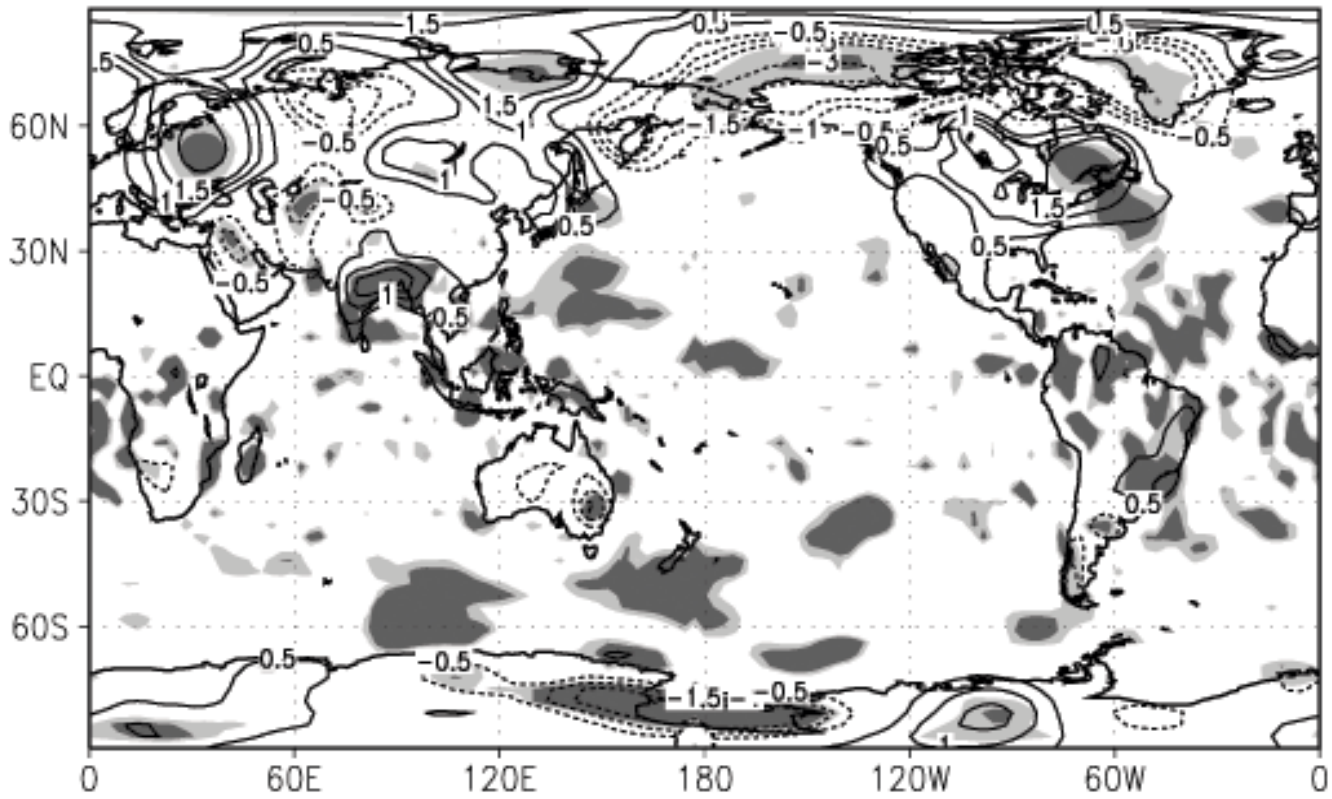

Figure 4: From Chase, T.N., R.A. Pielke Sr., T.G.F. Kittel, R.R. Nemani, and S.W. Running, 2000: Simulated impacts of historical land cover changes on global climate in northern winter. Climate Dynamics, 16, 93-105.

chapter entitled "How to evaluate the vulnerability in changing environmental conditions." That chapter proposes an approach to environmental assessment focused on vulnerability which first seeks to identify the exposure of human and environmental systems to human and environmental driven change and variability. After such vulnerabilities are assessed, all available tools should be used to create plausible scenarios for future societal and environmental outcomes, as a function of alternative courses of action. This includes the historical record (e.g., what would happen today or in 10 years, if the weather of the dust bowl years of the 1930s reoccurred?), the paleo-record (e.g., what would occur if the megadrought of the 16th Century happened again?), synthetic analysis (e.g., connecting the most serious drought years of the last 100 years into a consecutive ten-year

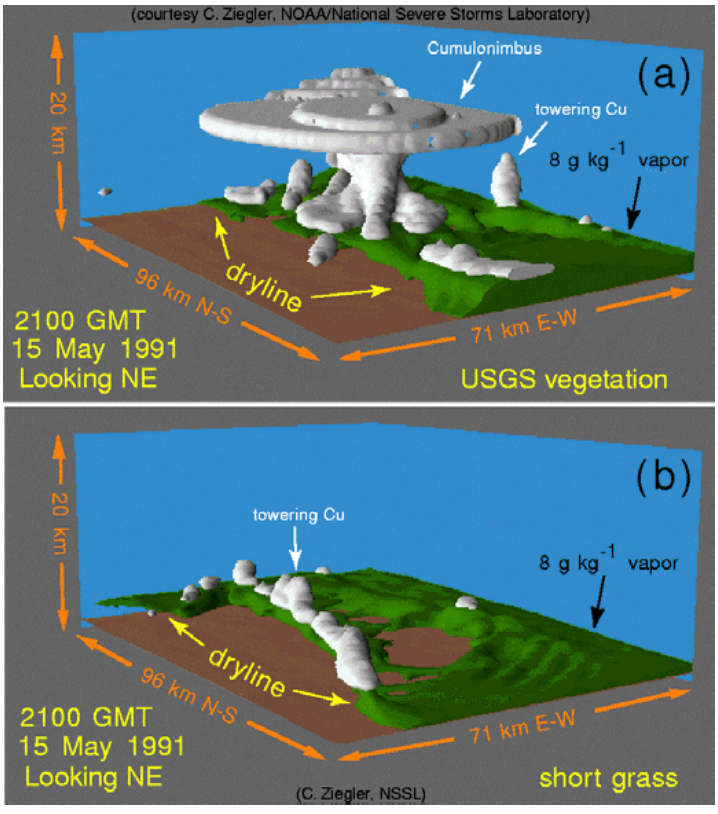

Figure 5: Model simulation of afternoon weather over the Texas-Oklahoma panhandle region for May 15, 1991 with the current landscape (top) and if the natural landscape existed instead (bottom). (From Pielke, R.A., T.J. Lee, J.H. Copeland, J.L. Eastman, C.L. Ziegler, and C.A. Finley, 1997: Use of USGS-provided data to improve weather and climate simulations. Ecological Applications, 7, 3-21.)

period), and plausible GCM simulation results in which all important feedbacks and forcings are included. In this vulnerability framework, GCMs play an important role in science and assessment, but cannot be depended on to accurately define the entire range of possible future conditions.

The Intergovernmental Panel on Climate Change, I have been told by colleagues, is embracing a greater focus on vulnerability, and several U.S. programs, most notably the Regional Integrated Science and Assessments (or RISA) program of NOAA, have also acknowledged the importance of vulnerability as a scientific organizing theme.

Finally, I wish to underscore that the inability of the U.S. National Assessment models to skillfully predict climate change does not mean that the radiative effect of anthropogenic greenhouse gases on climate is not important. Nor does it suggest which policy responses to the issue of climate change make the most sense. Such matters of policy go well beyond any discussion of the science of climate and well beyond the information presented in my testimony today.

Effective mitigation and adaptation policies in the context of climate variability and change do not depend on accurate prediction of the future, and consequently a lack of ability to generate accurate predictions should not be used as justification to ignore the policy challenges presented by climate. Too often debate over the science substitutes for debate over policy.

List of Figures

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For a complete listing of papers see the project website at http://blue.atmos.colostate.edu/.

WATER SCIENCE AND TECHNOLOGY BOARD

Assessment of Water Resources Research.--In 2002, Congress mandated that the NRC conduct a study to determine the federal investment in water resources research. This activity is partly a follow-up to the WSTB's report, Envisioning the Agenda for Water Resources Research in the Twenty-First Century. NRC will determine the adequacy of the nation's investment in water resources research, given budget information that is being supplied by over 30 federal agency liaisons. Presentations on budget and program information from each of the liaisons will be the focus of a meeting scheduled for April 29-May 1, in Washington, D.C. Henry Vaux of the University of California (and former CA Water Institute Director) serves as committee chair.

Assessment of U.S. Army Corps of Engineers' Economics and Environmental Analysis and Peer Review for Water Resources Project Planning.—River Basins and Coastal Systems Panel. This panel is reviewing the Corps' methods and approaches for planning and coordinating water projects across watershed and river basin systems. Larry Roesner of Colorado State University chairs the panel.

Platte River Endangered and Threatened Species.—The Board on Environmental Studies and Toxicology, in cooperation with the WSTB, is studying habitat needs for several endangered species along the Platte River. A study committee will assess the Central Platte River habitat needs for the whooping crane, piping plover, and interior least tern, and will assess Lower Platte River habitat needs of the pallid sturgeon. The committee will review federal assessments of how current Platte River operations affect the likelihood of survival of and/or limit the recovery of these species. It will also consider whether other Platte River habitats provide similar values that are essential to the survival and/or recovery of these species. The committee will consider the scientific foundations for the current federal designation of Central Platte habitat as "critical habitat" for the whooping crane and Northern Great Plains breeding population of the piping plover. This activity is being conducted in response to a request from the U.S. Department of the Interior. Appointment of the committee is pending. For information contact Lauren Alexander, WSTB, at 202/334-3422 or E-mail lealexander@nas.edu.

Source Removal of Contaminants in the Subsurface.—In August, the WSTB commenced a study on the effectiveness of source removal as a strategy for cleaning up contaminated groundwater and soil at hazardous waste sites. The study is considering such source removal technologies as in situ chemical oxidation, thermal treatment, and surfactant flushing, and it will focus on recalcitrant organic compounds, including explosives. John Fountain of North Carolina State University is chair of the committee, and Thomas Sale of Colorado State University, is a committee member. The sponsor is the Army Environmental Center.

Red Feather Lakes reported 62 inches of snow during March's big snowstorm.

The picture at right is of a former carport.

Photos by Charles W. Miller.

MEETING BRIEFS

THE LOWER SOUTH PLATTE RIVER – HOW IT WORKS!

In the midst of severe drought, organizers of the Lower South Platte Water Symposium offered attendees the opportunity to reflect upon the 'Big Picture' of water use, movement and management in the Lower South Platte River. On February 13, 2003, over 500 people gathered at Northeastern Junior College in Sterling to hear a series of excellent overview talks by Hal Simpson, State Engineer; Luis Garcia, CSU Professor of Civil Engineering; Nolan Doesken, CSU Colorado Climate Center; Jim Hall, Division One Engineer; Don Ament, Commissioner of Agriculture; Alexandra Davis, Colorado Attorney General's Office; Jon Altenhofen, Northern Colorado Water Conservancy District; and Justice Greg Hobbs, Colorado Supreme Court.

Topics covered included the climate and water supply, hydrology and water movement, groundwater recharge and augmentation, legal aspects of augmentation, and the history of water development. In addition, updates on water rights administration and legislative activities were provided.

Above: Symposium organizers Joel Schneekloth and Jan Nixon, CSU Coopertive Extension. Good Job, Joel and Jan! You survived!

During the day, the critical issues facing the Lower South Platte were carefully articulated along with descriptions of efforts to protect the water resources of the region. The presentations reflected the fact that drought is forcing many people to pay much more attention to water supplies and better understand how water is managed in Colorado. 'Emergency response,' as a part of water management in a semi-arid region, is receiving much more attention as the drought creates severe economic impacts in the Lower South Platte Basin.

How will the lessons being learned during this time of drought be translated into improved water management in the future? Among the suggestions were: legal issues will be resolved, better data will be collected, and more sophisticated management tools will be developed and implemented.

The people of the Lower South Platte Valley are reacting to the current drought, just as their ancestors did to previous droughts, with determination and adaptation to new realities.

Pictures on page 23, from top left clockwise:

Large audience -- over 500 people attended. Bottom front: Luis Garcia (left) and Hal Simpson (right) wait to speak.

Jon Altenhofen, No. Colorado Water Conservancy District.

Don Ament, Colorado Commissioner of Agriculture.

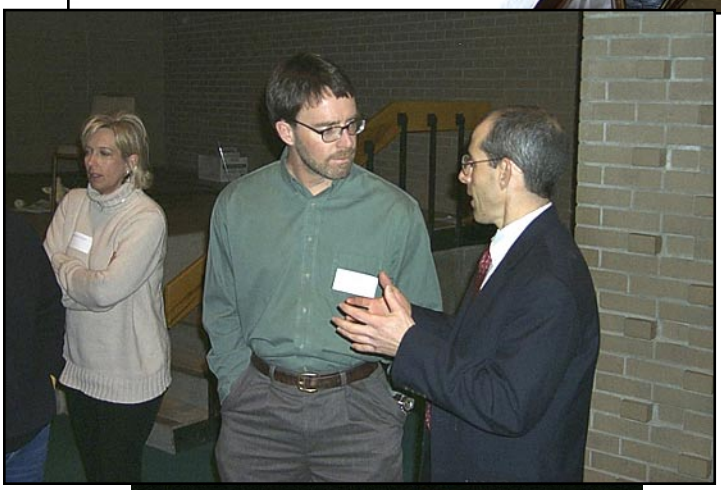
Colorado Chief Justice Greg Hobbs.

Colorado State Engineer Hal Simpson.

Jim Hall, Division I Engineer (left) and Gary Lancaster, CSU Cooperative Extension.

Bret Bruce, South Platte NAWQA, US Geological Survey, and Luis Garcia, Dept. of Civil Engineering, CSU.

Webb Jones, East Larimer County Water District (ELCO) (left), Stephen Smith, Aqua Engineering, Inc. and Colorado State University (middle), and Don Magnuson, New Cache la Poudre Irrigating Company (right).



WATERING YOUR FUTURE: 10TH ANNUAL ARKANSAS RIVER BASIN FORUM

The 10th annual Arkansas River Basin Water Forum was held on March 29 – 30 in Pueblo on the University of Southern Colorado campus. Approximately 165 water users, water managers and other interested parties in attendance were treated to keynote addresses by former Senator Hank Brown and Mr. Alan Hamel addressing the challenges of weather and politics that buffeted Colorado and the Southeastern Colorado Water Conservancy District in the past year. Discussions centered around water banking, the Kansas-Colorado lawsuit and compact, the newly created Lower Arkansas River Conservancy District, well augmentation, and drought. Julie Scaplo, a member of Pueblo Board of Water Works, was introduced as the newly appointed general manager of the Lower Arkansas Valley Water Conservancy District, which was created last November by voters in five Southeastern Colorado counties. James Broderick, newly appointed General Manager of the Southeastern Colorado Water Conservancy District, addressed the Forum and discussed ways the District serves the Arkansas River Basin. Local students were honored for their submissions of art, poetry and prose on the value and beauty of the river.

WEATHERING TOUGH TIMES TOGETHER: 2003 COLORADO AGRICULTURAL OUTLOOK FORUM

Almost 500 people attended the 12th annual Colorado Agricultural Outlook Forum held in Denver February 20, 2003. Don Ament, Colorado Commissioner of Agriculture, said the forum brought an opportunity for leaders in agriculture, business, education and government to come together and explore strategies for responding constructively to the challenges facing agriculture in Colorado. Ament said feedback from the event was very positive, with some calling it "one of the best forums ever."

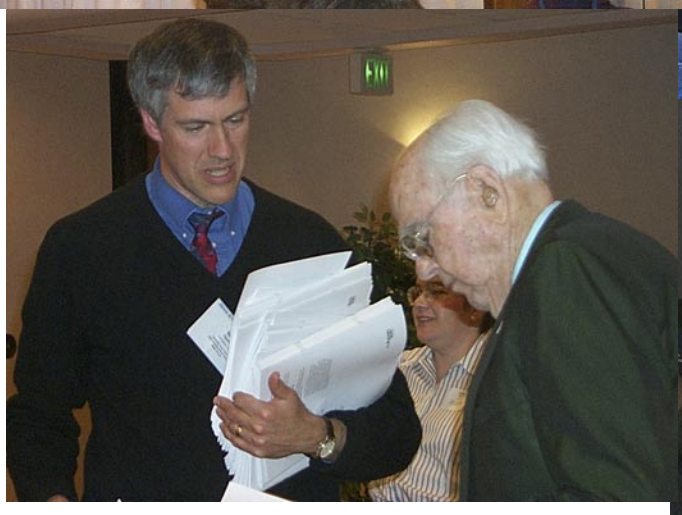
With Colorado's plunge into severe statewide drought last year after two years of declining precipitation, the conference focused on water. Allen Green, who supervises the statewide offices of the federal Natural Resources Conservation Service, said farmers and ranchers have reduced the risk of dust storms by leaving stalks and other crop residue in the fields, planting grasses through government funded programs and other conservation practices. Still, the state's 23 million acres of native vegetation have been stunted by drought, so wind erosion is on the increase, Green said.

David Little, manager of water resources planning for Denver Water, said the drought will pass, but the demand on water will increase as Colorado continues to grow. Growth is the issue the state's water users need to address, he said, and the one thing the current drought has done is focus nearly everyone in the state on water supplies, or the lack thereof. Metro Denver is expected to grow to five million people by 2040. "Conservation is not a panacea," Little said. Conservation and reuse mean less water downstream.

Eric Wilkinson, general manager of the Northern Colorado Water Conservancy District in Loveland, said agriculture is still the foundation of Colorado. He said the state must move away from the argument that agriculture uses 85 percent of the water while the rest of the state gets 15 percent. "The community needs to eat, so it's the community that uses 100 percent of the water we have," he said. Some in agriculture will survive the continuing drought by leasing water for municipal and industrial use – but it will be much more expensive. Last year, water supplied to northern Colorado through the Colorado-Big Thompson Project was available for lease at $500 an acre-foot. This year it is $1,660 an acre-foot, Wilkinson said. It's obvious, he added, that no one in agriculture can afford that price.

"Can we work together to solve the problems facing us," Dave Little asked the crowd? "If we don't, then we will perish together." (See page 26 for pictures from the forum). For additional information see the forum website at www.coloradoagforum.com.

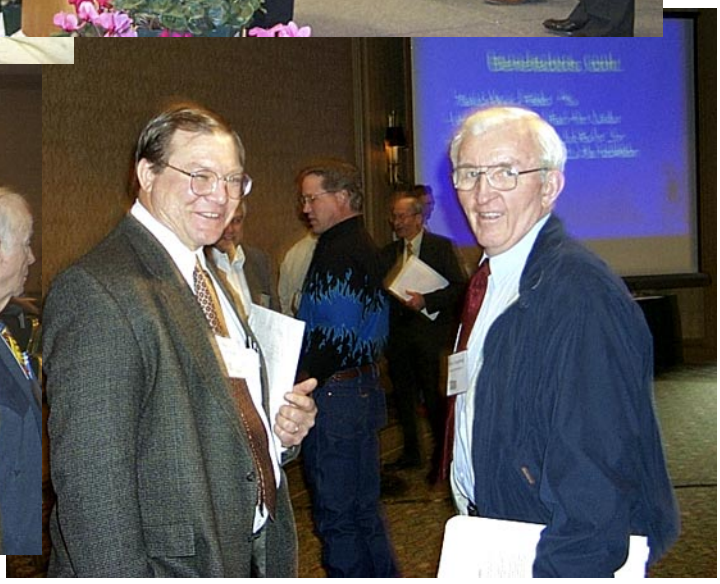
Sources: Don Ament, Colorado Commissioner of Agriculture; Rocky Mountain News, 2/21/03; Greeley Tribune, 2/21/03; Ag Journal, 2/28/03



THE ARKANSAS RIVER BASIN FORUM, 2003

From top left, clockwise: Nolan Doesken, Assistant State Climatologist, reports on the 2002 drought; Tom Pointon (left), retired Arkansas River Basin farmer, chats with Lloyd Walker, CSU Cooperative Extension; Shripad Deo, Cooperative Institute for Research in the Atmosphere (CIRA), discusses advanced hydrologic modeling; John Wilkins-Wells, CSU Department of Sociology, takes a break with Don Magnuson, New Cache la Poudre Irrigating Company; Nolan Doesken, Assistant State Climatologist, and Ralph Adkins, Arkansas Basin water consultant, exchange views on the 2002 drought; John Weiner, University of Colorado, hosts panel discussion on water banking.

Weathering Tough Times Together
2003 COLORADO AGRICULTURAL
OUTLOOK FORUM



From top right, clockwise: CSU President Al Yates, who presented opening remarks at the forum, with reporter; Franklin ("Pud") and Jean Stetson were one of two runners-up for the Leopold Conservation Award (Jean at Podium and Franklin 2nd from right); Steve Witte, Colorado Division of Water Resources and water consultant Bob Longenbaugh; David Little, Denver Water and Mary Gray, CSU Cooperative Extension; David Carlson, Colorado Department of Agriculture and Jan Van Schilfgaarde, retired USDA professional.

STRETCHING AGRICULTURAL WATER SUPPLIES

The Science and Technology Program, in collaboration with the Northern Colorado Water Conservancy District and the U.S. Department of Agriculture, sponsored a workshop for northern Colorado's agricultural community entitled, Stretching Agricultural Water Supplies, in Greeley, Colorado February 19, 2003. The workshop explored ways to stretch limited water supplies. Sessions included water management issues from a local, state, and federal perspective; new technology and funding sources to help irrigators conserve water; and opportunities to cooperate and share resources. The benefits of the workshop were to engage the end users of research in

learning about and discussing challenges,
looking at new and emerging water management tools and solutions,
ensuring that irrigation districts and farmers can remain profitable and viable, and
discussing what needs to be done in the future toward developing and implementing solutions that can help make a difference.

From top left clockwise: Soliciting input from stakeholders; Darell Zimbelman, Northern Colorado Water Conservancy District (left), Tim Gates, CSU Civil Engineering Department (middle) and Dale Herrmann, USDA/ARS Water Management Research; Dan Crabtree (left), Bureau of Reclamation area office, Grand Junction, and John Wilkins-Wells, CSU Department of Sociology; and Dale Heermann and Steffen Meyer, U.S. Bureau of Reclamation.

CWRRI
CSM water news

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

2003 Short Course Schedule

APPLIED ENVIRONMENTAL STATISTICS, June 9 -13, 2003, Instructors : Dennis Helsel and Ed Gilroy

CALIBRATION AND UNCERTAINTY OF GROUNDWATER AND OTHER MODELS, September 10-12, 2003, Instructors : Mary Hill, John Doherty, and Claire Tiedeman

MODFLOW: INTRODUCTION TO NUMERICAL MODELING, September 13-16, 2003, Instructor : Eileen Poeter

POLISHING YOUR GROUND-WATER MODELING SKILLS, September 14-16, 2003, Instructors: Peter Andersen and Robert Greenwald

UCODE: UNIVERSAL INVERSION CODE FOR AUTOMATED CALIBRATION, September 15-16, 2003, Instructor: Eileen Poeter

ADVANCED MODELING OF WATER FLOW & SOLUTE TRANSPORT IN THE VADOSE ZONE, September 15-16, 2003, Instructors: Rien van Genuchten and Jirka Simunek

SUBSURFACE MULTIPHASE FLUID FLOW AND REMEDIATION MODELING, September 19-21, 2003, Instructor: John McCray

PHREEQC MODELING: THE BASICS, September 19-21, 2003, Instructor : Geoffrey Thyne

MODEL CALIBRATION AND PREDICTIVE UNCERTAINTY ANALYSIS USING PEST-ASP, September 19-21, 2003, Instructor: John Doherty

An International Ground Water Modeling Conference and Workshops
MODFLOW and More 2003: Understanding through Modeling
September 17-19, 2003
Ice-Breaker Evening of September 16
Co-sponsored by the US Geological Survey

Those interested in presenting a paper or poster should submit an approximately 200-word abstract via http://typhoon.mines.edu/events/modflow2003/abstract_form.shtml no later than April 20, 2003.

WESTERN STATES WATER COUNCIL

Nebraska hosted the 141st meeting of the Western States Water Council on March 18-20, 2003. Governor Michael Johanns of Nebraska noted that Nebraska and much of the West face a drought of historic proportions. Don Wilhite described the work of the National Drought Mitigation Center in Lincoln and current drought conditions that have set records in some parts of the West. Ironically, some WSWC members were unable to attend the meetings due to heavy snows that closed the Denver Airport.

Dave Osias, attending the meeting as a representative of the Imperial Irrigation District (IID), reported a San Diego district court granted IID an injunction on March 18 against the Department of Interior's allocation of Colorado River water.

Western States Water, March 24, 2003

CWRRI
CU water news

NASA awards $26 million for science education to UCAR

The University Corporation for Atmospheric Research (UCAR), The University of Colorado, has been awarded $26 million from NASA to operate GLOBE, an Internet-based science education program that involved students in 101 countries. UCAR was selected over 13 other groups that submitted proposals to the space agency. More than 1 million primary and secondary students from more than 12,000 schools have worked on GLOBE projects since the program was launched by the U.S. government in 1994. In the GLOBE program, students measure local temperature, precipitation, cloud cover, water transparency and acidity, soil acidity and texture and vegetation types. They report their data online, and the GLOBE program uses it to generate images, maps and graphs posted to the Website. Colorado State University will work with UCAR on the project. CSU researchers will maintain the program's Website and develop classroom-ready teaching materials.

Rocky Mountain News, March 1, 2003

WATER, CLIMATE AND UNCERTAINTY:
Implications for Western Water Law, Policy and Management
June 11-13, 2003 ******** Boulder, Colorado
Information on the Web at www.colorado.edu/Law/NRLC

24TH Summer Conference of the Natural Resources Law Center, University of Colorado

While drought has garnered the headlines recently, the prospect of more fundamental long-term climate change poses even more dramatic challenges. Exploring ways to meet these challenges is the subject of a 3-day conference aimed primarily at political, legal, academic, and resource management professionals seeking to learn from each other and from leading scientists. Conference attendees will:

- Learn how current conditions compare to past climatic eras and to projected regimes of temperature, precipitation, and water runoff.
- Explore how future climatic variability might influence a variety of western water challenges, including the management of transboundary conflicts (both interstate and international), endangered species, water quality, and long-term planning.
- Hear about ongoing experiments, investigations and partnerships in the West linking climate-related expertise and considerations to resource management activities.
- Identify barriers and opportunities regarding the use of climate knowledge in the management of western water resources.
- Learn how climate variability and change could affect tribal interests.
- Explore legal, administrative and market-based mechanisms for dealing with climatic uncertainty.
- Understand ways in which climate science and climatic uncertainty influences the shape of western water law, policy, and management.

Registration Fees: $250 for academics and non-profit/NGO representatives ($295 after May 18), and $325 ($375 after May 18) for all others. CLE credit (approximately 22 hours) is available for an additional $75.

Scholarships: A limited number of full and partial registration scholarships are available to students and others on the basis of need. Contact the NRLC for information.

Contact: Doug Kenney at 303/492-1296; Douglas.Kenney@Colorado.edu. For logistical information or to register, write or call the Natural Resources Law Center, University of Colorado School of Law, 401 UCB, Boulder, CO 80309-0401, 303/492-1272; 303/492-1297 (FAX) E-mail:nrlc@spot.colorado.edu; Web: www.colorado.edu/Law/NRLC

CALL FOR POSTERS

Researchers, water managers, and others looking to share their work with our mostly law/policy-oriented audience are strongly encouraged to present posters at the June 11th poster session. Posters will remain standing throughout the event. Registration fees are waived for poster presenters who only attend the poster session and do not attend other conference events. For consideration, please submit abstracts by April 23 to Doug Kenney.

Preliminary Agenda Topics

Climate History and Projections
- A History of Climate Variability and Change in the American West.
- Future Water Availability in the West: Will There Be Any:
- Is There a Dust Bowl in our Future? Lessons from the Central Great Plains Assessment.

The Legal and Political Environment
- The Legal and Political Salience of Climate and Water
- How Long do we Look Before we Leap? Scientific Uncertainty and Policy Making.
- Linking Imperfect Science to the Management of Uncertain Water Resources: Is Western Water Law Up to the Challenge?

Case Studies and Partnerships
- Evaluating the Future of the South Platte Basin (Western Water Assessment).
- What Might Climate Change Mean for the Southwest (CLIMAS).
- How Does the World's 7th Largest Economy Avoid Drying Up? Long-Range Water Resources Planning in California (CAP).
- Balancing Drought and Flood in the Pacific Northwest (Climate Impacts Group).
- A Water Manager's Perspective: A View From the Field.

Emerging Issues
- Implications for Interstate Compacts, with an Emphasis on the Colorado River.
- Climate Change and US/Mexico Water Conflicts: Mild, Medium or Hot?
- Policy Responses in the Pacific Northwest: Does Climate Change Force a Choice Between Salmon and Electricity?
- Climate Change and the Rio Grande in New Mexico: Throwing Gasoline on a Fire?
- The Tribal Perspective: Do Tribes Get Left Holding the Bag?
- Will Climate Change or Variability Affect Water Quality?

Poster Session: Water and Sustainability Public Lecture: Water Resources Allocation and Management in an Era of Scarcity.

WATER NEWS DIGEST

by Marian Flanagan

CONSERVATION

Denver Water flooded with requests

Denver-area residents are flooding lawn and tree experts with phone calls, packing meeting rooms for Xeriscape talks and swamping Denver Water with requests for low-flow toilet and washing-machine rebates. More than 3,300 residents have sought rebate applications in the past 3 months, according to Liz Gardener, Denver Water manager of conservation. The agency is paying homeowners $100 to replace aging toilets with those that use just 1.6 gallons per flush, and $125 to people who replace old washing machines with new models that use one-third to one-half as much water. As of Feb. 1, the agency had issued $361,150 worth of rebate checks. Landscape workshops dedicated to Xeriscape are becoming standing-room-only events. At the annual Colorado Garden & Home Show in Denver, 8,000 fact sheets - the number usually distributed during the entire nine-day show - were gone in two days, according to show officials.

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Rocky Mountain News, February 8, 2003

Denver Botanic Gardens moves to drought-tolerant plants

Denver Botanic Gardens will sell only drought-tolerant or drought-adaptable plants this year at its annual plant sale. Chad Brunette, assistant director of horticulture at Denver Botanic Gardens, said, "There are new varieties of native plants that bloom through two through three seasons. They're gorgeous, fragrant and come in all different colors and shapes." The Botanic Gardens also is offering classes to help gardeners pick drought-resistant plants to conserve water and maximize the use of moisture. The city of Denver also will use more drought-resistant plants in its parks and plant fewer flower gardens this year. Flower beds will be planted in the more visible public areas, such as Civic Center, City Park, Cheesman Park and Washington Park. But other beds will be covered in plastic or mulched. In Boulder, the city will not plant any trees this year. Normally, if a tree is cut down, it is replaced. Aurora won't be planting any flowers at all this year, with only trees and shrubs being watered in most of the parks and the new Municipal Center will be xeriscaped.

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Rocky Mountain News, March 5, 2003

A rational model for saving water

The Denver Water Board has proposed a ban on outdoor watering this summer if the drought doesn't ease and to quintuple the surcharge for excessive water use. No one knows whether a surcharge five times the base price of water is enough of a disincentive to wasteful use, because it hasn't been tried in this market. But a California water district renowned nationally for its success in conservation enforces a five-tiered water price structure that tops at eight times the base rate. And Irvine Ranch Water District does this despite the fact that it isn't facing nearly the water crisis that the Denver system is in today. Colorado Attorney General Ken Salazar has written Mayor Wellington Webb and Chips Barry of the Denver Water Board, asking them to consider the Irvine Ranch system, although actually adopting it may be impossible in the next few months. The Aurora City Council has also discussed a proposal for water bill surcharges that would be tailored to specific household usage.

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Rocky Mountain News, February 8, 2003; Denver Post, February 11, 2003

DROUGHT

Water levels at Lake Powell Drop

Lake Powell water levels have dropped to 50 percent for the first time since it filled in 1980. Lake Powell is down by some 87 feet. If Lake Powell drops an additional 28 percent, it will no longer generate hydroelectricity because water will no longer be able to turn the generators. There is also a problem with sediment, since fluctuating river flows that occur during low reservoir levels will speed the movement of sediment toward Glen Canyon Dam. The U.S. Geological Survey says that while major droughts of the past went largely unnoticed, we notice this drought because the West has four times the population and has been mining its groundwater.

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Denver Post, March 2, 2003

Reservoirs need 3 years of average moisture to fill

State officials have told legislators that most of Colorado's water storage facilities need three years of average moisture to fill up again. Another four years of 2002-like drought will threaten the state's ability to meet obligations to downstream states. State Engineer Hal Simpson said last year was the driest since 1579 according to studies on old-growth trees, but things seem to be improving. Randy Seaholm of the Colorado Water Conservation Board said it might take even longer to fill the reservoirs affecting the Colorado River, and that it might take as much as 10 years to get Lake Powell full.

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Denver Post, April 3, 2003

Golden can't give surplus to Arvada

The City of Golden, which has a surplus because it received more water from winter rights and residents used about a half-million fewer gallons per day than usual, offered in February to give surplus water to Arvada to help restore drought-devastated athletic fields. But the Colorado

Attorney General's Office said under current state law, Golden would have to submit an augmentation plan for a permanent change in water use. So, the water is going downstream to Nebraska. But alterations for the law could be in the works. State engineer Hal Simpson testified at the State Capitol for a bill sponsored by State Rep. Diane Hoppe that would give the state engineer the authority to allow short-term changes in water rights.

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Denver Post, February 27, 2003

Aurora may permit some lawn watering
City officials are eyeing a drought response plan that would allow citizens to water lawns once a week. The March snowstorm gave Aurora the flexibility to consider options less stringent than a complete ban on lawn watering. City Council members will decide on April 14, when more accurate snowpack readings and annual projections can be made.

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Denver Post, March 27, 2003

ENDANGERED SPECIES

Response good to Klamath Basin Water Bank
In response to the Bureau of Reclamation's offer to pay farmers in the Klamath River basin to fallow land, 341 applications have been received to idle over 24,000 acres – more than twice the 12,000-acre enrollment goal for the new Klamath Basin Water Bank. USGS hopes to make 33,000 acre-feet of water available to help endangered and threatened fish, and offered $187.50 per acre to farmers willing to fallow land this year. USBR is also offering $75 per acre to those willing to use ground water in lieu of surface water this year, and hoping to make another 25,000 acre-feet of water available.

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Western States Water, March 14, 2003

RECREATION

Despite lower water levels, fishing forecast is excellent
Despite low water levels, Southern Colorado fishermen can expect excellent fishing conditions this summer, says District Wildlife Manager Jim Melby. Drought conditions will not affect trout stocking in Southern Colorado except in two small La Veta lakes - the Wahatoya and the Daigre, Melby said. Both dried up last summer and are still suffering badly, he said. "Everything else is on schedule to be stocked as normal," said Melby. The only other area that has felt repercussions from the drought is the Arkansas River, where low water levels killed many of the river's fish below the Pueblo Dam. Areas such as San Isabel and La Veta will be limited to 60 percent of their normal stock due to the presence of whirling disease. Lower elevations will be stocked at about 140 percent of normal as a result.

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Pueblo Chieftain, March 14, 2003

WATER LEGISLATION

Water-rights transfers clear 1st House hurdle
A bill allowing temporary transfers of water rights during drought emergency years (H.B. 1334) unanimously passed committee. Rep. Shawn Mitchell (R-Broomfield) sponsored the bill, which is similar to parts of H.B. 1001 by Rep. Diane Hoppe (R-Sterling). Mitchell said he decided to introduce his bill in case Hoppe's is killed. Mitchell's bill changes state law to allow temporary transfers of water from farms to cities in years the governor declares drought emergencies.

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Denver Post, March 27, 2003

WATER QUALITY

Groundwater may be fit to drink by 2040
Instead of 300 years it could be as soon as the year 2040 when levels of vanadium in contaminated groundwater under an old uranium mill tailings pile reach acceptable levels, a DOE official has told Rifle and Garfield County officials. Don Metzler, program manager for DOE's uranium mill tailings remediation groundwater program, said a different analytical modeling approach led to the much shorter timeline. About 110,000 cubic yards of soil contains high levels of vanadium, left behind by a Union Carbide uranium refining mill that operated from 1958 to 1973. Vanadium, used to harden steel, is one of several contaminants of concern that leached into the groundwater at the 238-acre West Rifle site. Mill tailings were removed from the site in the 1990s. Previously, the agency estimated it could take as long as 300 years before vanadium levels reached acceptable drinking water standards with natural flushing. The Energy Department will release a draft environmental assessment and finding of no significant impact in May, with a 30-day public comment period and public meeting in Rifle to explain the findings and plans for further monitoring. Exposure to the other contaminants — ammonia, arsenic, fluoride, molybdenum, manganese, nitrate, selenium and uranium — will be controlled through zoning restrictions and a ban on new drinking water wells.

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Grand Junction Daily Sentinel, March 7, 2003

WATER REUSE

Agencies speed up plans to deliver recycled water - Communities target parks, golf courses, schools for use
Communities across the metro area are accelerating plans to deliver recycled water to parks, golf courses and power plants to relieve pressure on drinking water supplies. At least seven communities have built or are building water recycling plants, including Denver, Aurora, Broom-

field, Superior, Westminster, Parker and Castle Pines. Recycled water is created when cities reclaim wastewater and purify it enough to apply it to park grounds, athletic fields and golf courses. Few cities are able to supply individual homes, however, primarily because delivery is too expensive. Nationwide, recycled water not used for drinking constitutes about 3.4 percent of water supplies, according to the American Water Works Association. Use of recycled water is most prevalent in the West because of its semiarid climate and growing population, said AWWA Executive Director Jack Hoffbuhr. Whether recycled water programs can be accelerated even further isn't clear. Denver Water is reviewing its recycled water master plan this spring, in part to see if anything else can be done to hurry deliveries.

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Rocky Mountain News, February 24, 2003

WATER SUPPLY/DEVELOPMENT

Blizzard hasn't quenched Denver's thirst

Despite Colorado's March blizzard, Denver Water is expected to seek a reduction in the Shoshone Hydroelectric Power Plant's Colorado River water call to fill reservoirs that supply urban corridor. A tentative agreement was reached March 12 between Denver Water and the Colorado River Water Conservation District to allow spring runoff that normally flows down the Colorado River to be used instead to fill half-empty reservoirs. The plan, which would allow flows to be reduced from March 21 to May 21, will be voted upon by the river district's board of directors. If the Shoshone plan is approved by the river district, it's up to Denver Water and Xcel Energy, owner of the power plant and the senior water right, to finalize the deal.

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Glenwood Springs Post Independent, March 20, 2003

Water district signs contract on Long Lake

After months of negotiation, the Upper Gunnison River Water Conservancy District reached an agreement to purchase up to 65 acre-feet of water from Long Lake above Crested Butte. The total cost was capped at $1,050,000. The district has sought a source of upper basin augmentation water to protect local users against calls on the river such as the area experienced last year. A call is placed by senior water rights holders when they are unable to get their decreed amount of water out of the river, triggering action by the division water engineer to shut off junior users. To avoid shutting off wells and some irrigation to meet those calls, the UGRWCD has purchased water from the U.S. Bureau of Reclamation in Blue Mesa that can be released to cover the demand. The UGRWCD stepped up its efforts to acquire water from Long Lake, the most obvious source near the headwaters of the valley. Unlike Blue Mesa, however, Long Lake is privately owned. Water from the reservoir costs around $70 per acre foot, compared with $16,000 per acre foot from Long Lake.

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Gunnison Country Times, March 20, 2003

Black Canyon water will go to cities

In a move designed to reflect the administration's intent to let states set natural resource policies on federal land, the government will give up its 1933 right to Black Canyon water. The Park Service wants to give up all but 300 cubic feet per second, the minimum flow already protected by the state. The Colorado Water Conservation Board will file for peak flood-flow rights, but with a 2003 priority date. That means the park will get only the water left over from other users. Park Service deputy director Randy Jones said the deal will guarantee enough water at the right time of year to approximate the natural river regime. But environmental groups plan to challenge the agreement.

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Denver Post, April 3, 2003

U.S. District Judge grants preliminary injunction

On March 18, U.S. District Judge Thomas Whelan granted a preliminary injunction ordering the Department of Interior (DOI) to restore Colorado River water deliveries to the Imperial Irrigation District (IID) to its 2002 level. On January 1, Interior Secretary Gale Norton reduced IID's water supply by 330,400 acre-feet. The judge found DOI violated its procedures in reducing IID's apportionment, but the decision does not change the limit on California's use to 4.4 million acre-feet. Meanwhile, on March 14 the Navajo Nation sued DOI in U.S. District Court in Arizona, asking a federal judge to quantify the tribe's claim to the Colorado River before making a final decision on water apportionment.

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Western States Water, March 28, 2003

Larimer-Weld Water Issues Group floats water taxing authority

A regional water issues group, WARME (Water Asset Retention and Management Entity), has come up with a solution to prevent Northern Colorado water from being siphoned off to Denver suburbs. A taxing authority proposal is being floated by the Larimer Weld Water Issues Group, a volunteer organization that includes representation by cities, counties, water districts, Colorado State University, environmental groups and other parties in Northern Colorado. The group has been studying the issue of protecting Northern Colorado water for about seven years. What drives the group is the knowledge that Thornton has bought approximately 21,000 acres in the region, primarily for the water rights. Thornton has yet to draw any of that water south. The WARME proposal has two options: A water district that would have the power to raise money through a property tax; and A water authority that would require an intergovernmental agreement from all participants. The authority could either raise money from a property tax or a sales tax, voters would have to approve whichever option is recommended, and monies would be used to buy up as much of the region's remaining water rights as possible.

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Fort Collins Coloradoan, March 4, 2003

Erie, EPA reach agreement on reservoir
After almost three years, the town of Erie and the Environmental Protection Agency have reached an agreement that could mean completion of Prince One Reservoir construction within three months. But it will cost Erie $35,000 from its water fund. The Board of Trustees has unanimously approved a settlement to set up a $150,000 escrow account — paid in part by the contractor and engineer — to mitigate 12 acres of federally protected wetlands allegedly damaged during expansion of Prince One in March 2000. The federal government shut down the $1.4 million project after the EPA said the town violated the 1972 Clean Water Act when a town contractor dumped dirt on the area without a permit. In January, the town reached an agreement "in principle" with the agency. Under the final agreement, the town still does not admit any liability. Expansion of the reservoir will approximately double current capacity for water storage, a big plus during the ongoing drought, said Judy Ding, director of public works. Construction will begin in approximately two weeks, after a court signs the agreement.

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Boulder Daily Camera, February 12, 2003

$58 million earmarked for Animas-La Plata
President Bush's proposed budget includes $58 million for the Animas-LaPlata Project. Congressional approval is needed before the money can be appropriated. Congress has yet to appropriate $33 million budgeted for the current fiscal year, said the Bureau of Reclamation's Western Office.

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Denver Post, February 5, 2003

Water-use cut proposed for San Luis Valley
Farmers, ranchers and San Luis Valley municipalities are cooperating to reduce water use by 20 percent to save the valley's dwindling aquifer. The Rio Grande Water Conservation District recently proposed the water reduction. Drought and a less-than-expected snowpack have reduced the valley's aquifer to record low levels. A water engineer who has measured the aquifer since the early 1970s reports a general decline throughout the valley from a few feet to as much as 13 feet.

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Denver Post, February 18, 2003

Colorado 64 outlines 10 principles to shape future water deals and laws
Leaders representing all of Colorado's 64 counties have reached agreement on principles to shape future water deals and laws in Colorado. The announcement follows the adoption of the principles by the Denver Water Board, the 31-member Metro Mayors Caucus and the Denver Metro Chamber of Commerce. The principles include reasonable compensation for water transfers; the need for all water users to participate in solving water problems; concentration on developing local water sources before turning to new transfers; and pursuing additional storage through improving or rehabilitating existing structures and developing new ones. Also included is a statement calling for appropriate recognition of the need to preserve flows to support recreation, hydroelectric and environmental needs.

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Associated Press, Denver Post, February 20, 2003

Land deal a water boon for Arvada
When the City of Arvada bought 240 acres above the former Leydon coal mine, it also acquired water rights. More than 73,000 gallons of water seep into the Xcel Energy former natural gas storage cavern each day from a nearby aquifer. The city will use the cavern for drought water storage, making it unnecessary to build a new reservoir. It will also spare Xcel customers the cost of water to flood the mine, flushing out the remnants of the company's four decades of gas storage in less time than originally planned. The Colorado Department of Health and Environment required Xcel to ensure the water would remain pure enough to sustain aquatic life after the water was pumped from the mine and sent down Leyden Creek. That standard is more stringent than the standard for drinking water. The water from the cavern is otherwise untainted, because neither the coal nor the remaining natural gas is water-soluble. As Arvada withdraws water stored in the cavern, it will be pumped into Arvada-Blunn Reservoir, then through the city's water treatment plant before being sent to customers.

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Rocky Mountain News, February 22, 2003

WETLANDS

Bird refuges are drying up
Colorado's drought is draining wetlands for nesting ducks, decimating numbers of newly hatched ducklings and drying up many of the state's wildlife refuges. In a normal year, about 7,500 ducklings hatch at Arapaho National Wildlife Refuge. This year, only 750 were counted. Low water also has wiped out trout there and driven away moose. Of the 78 wetlands that waterfowl use for brooding, all but three were dry. Waterfowl also are hurt because ranchers and farmers are suffering from a lack of water and fewer hay fields, which are needed for nesting. A major concern in the San Luis Valley is the 15,000 to 20,000 greater sandhill cranes that rest at the Monte Vista refuge each spring.

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Rocky Mountain News, March 14, 2003

MEETINGS

COLORADO STREAMGAGING SYMPOSIUM 2003

MAY 8, 2003 – BRECKENRIDGE, COLORADO

The 2003 symposium will be held in Breckenridge, Colorado, at the Beaver Run Resort and Conference Center on May 8, 2003. Speakers at this year's symposium represent organizations such as: the Northern Colorado Water Conservancy District, Denver Water, Colorado Springs Utilities, the Colorado Department of Public Health and Environment, the Colorado River Water Conservation District, and the National Weather Service.

Colorado Streamgaging Symposium 2003 will provide an opportunity to share information about:

- major streamgaging programs in the state;
- importance and various uses of the streamflow data;
- historic and current coverage of streamflow gages in Colorado and perceived deficiencies in the current coverage; and
- opportunities that may be available to the water community to diversify and perhaps increase overall investments made to support the collection, dissemination, and archiving of the streamflow information.

Topics for the 2003 symposium will include discussion on the drought, post-wildfire burn area activity, Colorado Water Conservation Board projects, streamgaging activity, technology, and user feedback. Comments on agenda items are welcome and should be directed to Jana Riedesel at 303/866-3581 or Jana.Riedesel@state.co.us.

Additional information and registration forms can be found at http://water.state.co.us/., click on Colorado Streamgaging Symposium 2003. Space is limited so please send in your registration form early.

The first Colorado Streamgaging Symposium was held May 3, 2001 in Breckenridge, Colorado. The meeting brought together a diverse group of over 80 individuals and organizations interested in maintaining and improving the collection and use of Colorado streamflow data. The symposium was co-sponsored by the Colorado Water Resources Research Institute (CWRRI), the U.S. Geological Survey (USGS), the Colorado Water Conservation Board (CWCB), and the Division of Water Resources (DWR).

THE WEST OF JOHN WESLEY POWELL

CEH
COLORADO ENDOWMENT FOR THE HUMANITIES

The Colorado Endowment for the Humanities (CEH) announces The West of John Wesley Powell, a summer teacher institute. Even though this five day institute was especially developed for K-12 teachers, the general public is now invited to attend for a small additional fee. This institute will appeal specifically to those with an interest in the Colorado River, geology, Native American ethnology and linguistics, and western water history. Along with national humanities scholar Clay S. Jenkinson, the following scholars will be presenting at the institute: Environmental historian Dr. Mark Fiege, Geographer Dr. John Logan Allen, and water law historian Justice Gregory Hobbs. Don't miss this opportunity to attend this humanities-style seminar on the history of water in the west.

Materials are included in registration fee. For more information contact: Betty Jo Brenner, brenner@ceh.org, 303-894-7951, ext. 17.

Date:	June 23-27, 2003
Location:	Colorado State University, Ft. Collins, CO
Instructors:	Clay Jenkinson and other scholars
Cost:	Teachers, $175, Non-Teachers, $250
Certification:	3 semester hours of in-service credit (no fee)
Graduate Credit:	3 hours of graduate history credit (additional fee)
Materials:	Down the Great Unknown by Edward Dolnick Beyond the Hundredth Meridian by Wallace Stegner A 120- page anthology of articles, letters, and historical documents.

COLORADO WATER CONGRESS
FALL WORKSHOP SCHEDULE

The Colorado Water Congress prepares a series of six to ten workshops each fall for the purpose of increasing and updating water knowledge both for the actively involved water community and general public knowledge.

WORKSHOPS FOR 2003
These workshops will all be held in the Colorado Water Congress Conference Room, 1580 Logan Street, Suite 400, Denver, Colorado. The 2003 Water Law Seminar will be held on September 8-9, 2003. The following workshops are planned for Fall - 2003: Water Conservation/ Conservancy District Leadership; Initiatives - What You Should Know; Compacts - What You Should Know; Water Quality; Groundwater; Public Speaking; Internet, etc. (Technology); Endangered Species; Legislative Process - Advocacy; News Media Relations; Wetlands; Federal Environmental Laws; Ditch Company Operations; Instream Flow; Water Research - Practical or Pie-in-the-Sky; Dam Safety & Liability; Water Financing; International Water Solutions, Experiences, etc.; Water & Recreation; How to Write and Make Sense; Personnel Law; An Advance Course in Water Law by the Veterans (or the School of Hard Knocks in Water Law); and Forest Management.

The Colorado Water Law Seminar is scheduled for September 8 - 9, 2003 in the CWC Conference Room, 1580 Logan St., Ste. 400, Denver. Program and Registration will be posted when available.

Colorado Water Congress - Summer Convention
August 21-22, 2003

CALLS FOR PAPERS

THE 14TH ANNUAL SOUTH PLATTE FORUM
PLANNING FOR UNCERTAINTY
Oct. 22-23, 2003
Raintree Plaza, Longmont, Colorado

Call for Posters

Whether we remain in a drought or see abundant rainfall, the only thing certain in the South Platte Basin is uncertainty. Join us as we examine the thinking and real-life practices of planning for this uncertainty. You are invited to submit a one-page abstract to the organizing committee by Aug. 1, 2003. Selected posters will be displayed throughout the forum with a staffed session from 4-6 p.m., Wednesday, Oct. 22. Authors whose posters are selected for presentation will be notified by Sept. 1, 2003. All accepted abstracts will be published in the conference proceedings.

Contact Jennifer for more information, (970) 213-1618,
jennifer@jjbrown.com
WEBSITE: http://southplatte.jjbrown.com/

The South Platte Forum is sponsored by:

Colorado Division of Wildlife
Colorado State University Cooperative Extension
Colorado Water Resources Research Institute
Denver Water
Northern Colorado Water Conservancy District
US Bureau of Reclamation
US Environmental Protection Agency
US Fish and Wildlife Service
US Geological Survey

23rd International Symposium
NALMS 2003 -- PROTECTING OUR LAKES' LEGACY
November 4-8, 2003 -- Mashantucket, CT

Call for Papers--Preliminary Session Topics are: Smart Growth Tactics, Nutrient Loading/TMDLs, Regional Lake Management Strategies, Phosphorus Inactivation, Waterfowl Management, Fisheries Mnagement, Legilation/Government, Bioassessment, Fluvial Geomorphology, Atmospheric Deposition, World Lakes, Dioxins, Lake Management/Strategies, Watercraft Impacts, Stormwater Management, Aquatic Nuisance Species, Pathogens, New Technologies, Education and Outreach Programs and Strategies, Biodiversity/Reference Conditions, Cyanobacteria/Algae Problems and Management, Littoral one Management/Biocomplexity, Agriculture and Lake Management, Lake Classification, Paleolimnology, Effective Use of Resources.

Contact: NALMS Conference Services at 608/233-2836 or E-mail nalms@nalms.org. Website: http://www.nalms.org. For Technical Session Questions -- Contact Program Committee Co-Chairs: Amy Smagula, Phone 603/271-2248, E-mail asmagula@des.state.nh.us; Neil Kamman, Phone 802/241-3795, E-mail neilk@dec.anr.state.vt.us. ABSTRACT DEADLINE: APRIL 30, 2003.

GETTING IT DONE: THE ROLE OF TMDL IMPLEMENTATION IN WATERSHED RESTORATION
October 29-30, 2003 -- Stevenson, Washington

Call for Presentations and Posters--This regional conference will bring together regulators, researchers, educators, technical assistance providers, and others to focus on improving the efficiency and effectiveness of TMDL implementation strategies. Presentation and Poster Topic Suggestions: Urban and rural best management practices, Economic and institutional factors, Addressing political and social factors,
Implementation monitoring, Effectiveness monitoring, Roles for local input development and implementation, Educational outreach and technical assistance, Examples of on the ground efforts, Ongoing applied research. For information contact: Kelly Newell at 509/335-5531, E-mail watercenter@wsu.edu. Website: http://www.swwrc.wsu.edu/conference2003. Website: http://www.swwrc.wsu.edu/conference2003. ABSTRACT DEADLINE: MAY 1, 2003.

CALENDAR

April 23-25	NATIONAL MITIGATION BANKING CONFERENCE, San Diego, CA. Contact: Carlene Bahler, E-mail Cbahler@erols.com or call 703/837-9763, website http://www.mitigationbankingconference.com.
Apr. 30-May 2	AQUATIC RESOURCES IN ARID LANDS, Las Cruces, NM. For information see website http://leopold.nmsu.edu/dcowley/ARIAL_conference.htm.
May 8	2ND ANNUAL COLORADO STREAMGAGING SYMPOSIUM, Beaver Run, Breckenridge, CO. Contact: Jana Riedesel at 303/866-3581 x280 or Jana.Riedesel@state.co.us. Website: http://water.state.co.us/, click on Colorado Streamgaging Symposium 2003.
May 12-14	American Water Resources Association Spring Specialty Conference, AGRICULTURAL HYDROLOGY AND WATER QUALITY, Kansas City, MO. Contact: Call AWRA at 540/687-8390 or E-mail Harriette@awra.org. Website: http://www.awra.org/meetings/Kansas2003/KansasPP.pdf.
May 12-15	SECOND INTERNATIONAL CONFERENCE ON IRRIGATION AND DRAINAGE: WATER FOR A SUSTAINABLE WORLD -- LIMITED SUPPLIES AND EXPANDING DEMAND, Scottsdale, AZ. contact: Larry Stephens, Phone 303/628-5430, FAX 303/628-5431, E-mail stephens@uscid.org. Website: http://www.uscid.org.
June 29-July 2	American Water Resources Association 2003 International Congress, WATERSHED MANAGEMENT FOR WATER SUPPLY SYSTEMS, New York. Contact: AWRA, 4 W. Federal St., Middleburg, VA 20118-1626, Call AWRA at 540/687-8390 or see Website at http://www.awra.org/meetings.
July 23-25	28TH COLORADO WATER WORKSHOP, Western State College, Gunnison, CO. Contact: George Sibley, Western State College, Phone 970/943-2055, E-mail water@western.edu.
Aug. 21-22	COLORADO WATER CONGRESS Summer Convention, Steamboat Springs, CO. Contact: Dick MacRavey, Executive Director, at Phone 303/837-0812, FAX 303/837-1607, E0mail macravey@cowatercongress.org. Website: www.cowatercongress.org.
Sept. 17-20	SUSTAINABILITY ISSUES OF ARIZONA'S REGIONAL WATERSHEDS, Mesa, AZ. Contact: Dr. Pete Kroopnick at Phone 602/567-3850, FAX 602/567-4001, or E-mail PKroopnick@brwncald.com or Julie Rutkowski, Symposium Committee Chair, at 602/771-4411 or rutkowski.julie@ev.state.az.us. Website: http://www.azhydrosoc.org.
Oct. 12-15	10TH ANNUAL CONFERENCE ON TAILINGS AND MINE WASTE, Vail, CO. Contact: Linda Hinshaw, Coordinator, Dept. of Civil Engr., CSU, Phone 970/491-6081, FAX 970/491-3584, E-mail lhinshaw@engr.colostate.edu.
Oct. 22-23	14th ANNUAL SOUTH PLATTE FORUM, PLANNING FOR UNCERTAINTY, Longmont, CO. Contact Jennifer Brown at (970) 213-1618, jennifer@jjbrown.com. Website: http://southplatte.jjbrown.com/.
Oct. 29-30	GETTING IT DONE: THE ROLE OF TMDL IMPLEMENTATION IN WATERSHED RESTORATION, Stevenson, WA. Contact: Kelly Newell at 509/335-5531, E-mail watercenter@wsu.edu. Website: http://www.swwrc.wsu.edu/conference2003.
Nov. 4-8	NALMS 2003: PROTECTING OUR LAKES' LEGACY, 23rd International Symposium, Mashantucket, Ct. Co-Chairs: Amy Smagula, Phone 603/271-2248, E-mail asmagula@des.state.nh.us; Neil Kamman, Phone 802/241-3795, E-mail neilk@dec.anr.state.vt.us.

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