



## Teachers Attend 1990 Water Institute

Eleven elementary, junior high, and high school teachers from around Wyoming (with one from Nebraska) participated in the 1990 Water Institute for Teachers (WIT) held July 9-20 at the University of Wyoming in Laramie. This is the third year the WIT has been offered. The Institute gives teachers the opportunity to expand their knowledge about water resources through classroom sessions, field trips and hands-on activities.

This year's classroom session topics included Wyoming water law, water sources and uses, water quality, and instream flow evaluation methods. Instructors included UW professors, state and federal government officials, and elected representatives.



Marceyes Schmaus, a teacher at Tongue H.S., reads the water level of the Little Laramie River at the route 130 gauging station during a WIT field trip.

Field trips to the Snowy Range Observatory in the Medicine Bow National Forest, Red Buttes Environmental Laboratory near Laramie, and Cheyenne water supply and waste water treatment plants provided on-site

experience in snowpack and water measurement, aquatic toxicology, and water quality and treatment. The "snow pillows" (large, flat, pressure-sensitive, snow measurement devices) *Continued on Page 4*

### WWRC Gains Access to EPA Databases

The Water Resources Data System (WRDS) of the Wyoming Water Research Center recently gained access to two Environmental Protection Agency (EPA) databases. Both systems contain information about Wyoming's water resources and will increase the number of data sources available to WRDS requestors.

The first of these systems is the Federal Reporting Data System (FRDS) of the Office of Drinking Water. This database contains information about public water supply systems throughout the country. Public water supply systems for the purpose of this database are defined as systems serving a population of at least 25 or having 15 or more service connections. This includes, but is not limited to: municipal water treatment facilities, trailer parks, rest areas, campgrounds, and other remote facilities. Specific infor-

mation includes population served, geographic location, ownership, primary and secondary sources of water, treatment processes, on-site visits by the EPA, violations and enforcements. More than 1,200 public water supply systems located within the State of Wyoming are catalogued on the system.

WRDS also acquired access to STORET, the Water Quality Control Information System of the EPA. This system was created for the STORAGE and RETRIEVAL of data relating to the quality of the waterways within and contiguous to the United States. Encompassing not only the centralized database of water quality data, the system contains associated software for storing and retrieving data on water quality, water quality standards,

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### Get a Job!

There is a program on the University of Wyoming campus which could make a big difference in your life. As an employer you could hire superior temporary, and potentially permanent, workers. As a student you could gain professional experience before graduation.

The program which can make this happen is in the Career Planning and Placement Center located on the second floor of Knight Hall in Laramie. It's called the Career Exploration Opportunity Program (CEOP).

The goal of the CEOP is to help UW students at all levels integrate classroom learning with hands-on, degree-related work experience. Through CEOP, students can get a paid job for academic credit in the field of their

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# GPAC Forms Water Quality Task Force

Stimulated by widespread concern about water quality, the Great Plains Agriculture Council (GPAC) has formed a water quality task force. Water quality emerged as one of the most pervasive issues of the 1980s, and agriculture is viewed as a potential major contributor of nonpoint source (NPS) contaminants in the form of sediments and adsorbed chemicals.

While regulatory controls on point sources of contamination have improved surface water quality, additional improvements will require that more attention be given to NPS water pollution. In addition, the possibility of contamination of groundwater by nitrates and pesticides renders the agricultural industry a likely target for control through state and federal regulation. Agriculture in the Great Plains could be greatly impacted by changes

in regulations dealing with water quality and quantity.

Specific objectives of the GPAC Water Quality task force include: defining the extent to which agricultural activities in the Great Plains States have resulted in surface and ground water pollution; assessing the need for increased emphasis in water quality research, extension and technical assistance programs; evaluating the impact of current and proposed state and Federal regulatory options to reduce NPS pollution; and recommendation of alternative policies for control of agricultural NPS pollution that minimizes the impact on Great Plains agriculture.

The task force is composed of representatives from universities in Colorado, Kansas, Nebraska, New Mex-

ico, Oklahoma, South Dakota, Texas and Wyoming, and USDA Soil Conservation Service, Economic Research Service, Animal & Plant Health Inspection Service, Extension Service, and Agricultural Research Service officials. The work timetable calls for a November meeting of the full task force in Denver, Colo., to discuss subcommittee progress toward accomplishing the objectives and for a report (drafted by the subcommittees) to be ready for full task force review by March 1991.

For additional information in Wyoming, contact Ari Michelsen at the Wyoming Water Research Center.



# Drought May Impact Grazing

This spring Bureau of Land Management officials held meetings with ranchers in Evanston, Kemmerer, Cokeville and Mountain View to discuss the need for implementing grazing management and drought contingency plans. Drought conditions in southwest Wyoming are among the worst in the nation. Although spring rains have improved forage production, particularly at higher elevations, the Palmer Drought Index rating of -6.1 for the area has not improved. A rating lower than -4 represents extreme drought conditions.

Timely moisture was received in late June when up to three inches of precipitation helped create average or above-average forage production at higher elevations and average or slightly below-average forage produc-

tion at lower elevations. However, many allotments still have a water shortage. Rangeland reservoirs have gone dry or are going dry, and springs are producing below-average yields. One concern is that areas close to water will be overused. According to Ray Christensen, Rock Springs District Range Conservationist, "the use of some allotments later on in the summer will depend on ranchers hauling water to livestock." Ranchers may also consider other management alternatives such as moving stock to private land. If water conditions do not improve, or management alternatives are unworkable, livestock may have to be sold. Green River and Kemmerer are the grazing areas most affected by the drought.

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**WWRC Research**

## Blue-green Algae Degrades Flaming Gorge

Flaming Gorge Reservoir, 42,000 surface acres located in southwestern Wyoming and northeastern Utah, is one of the largest fresh water bodies in the five state inter-mountain region. In the 1970s, Flaming Gorge became a nationally renowned trout fishery which produced a world's record brown trout in 1977. In recent years the reservoir has become well-known for the large lake trout it produces. Its scenic beauty attracts a wide variety of recreationists.

Each summer, in the upper reaches of Flaming Gorge Reservoir, high concentrations of phosphorus produce intense blooms of blue-green algae which seriously degrade water quality for game fish and recreational boating. These blooms in the early 1980s prompted the U.S. Environmental Protection Agency to name Flaming Gorge Wyoming's number one surface water quality problem.

### Consortium Formed

In response to this problem, a consortium was formed to evaluate restoration strategies for reducing the intensity of the algal blooms in the reservoir. Consortium members include the U.S. Bureau of Reclamation, Utah Water Research Laboratory, the Wyoming Department of Environmental Quality, the Wyoming Water Research Center, Western Wyoming Community College, the University of Wyoming, the Wyoming and Utah Game and Fish Departments, and the U.S. Environmental Protection Agency. This consortium has contributed funding, expertise, and materials for a multi-year study of the reservoir aimed at providing the needed management information.

A task force was appointed to spearhead the project. Task force members include Dr. Michael Parker, Department of Zoology and Physiology, University of Wyoming; Craig

Thompson, Western Wyoming College; Jerry Miller, Water Quality Division Chief, Bureau of Reclamation, Salt Lake City; and Dr. Jay Messer, formerly of Utah State University. Beth Pratt of the Wyoming Department of Environmental Quality, Water Quality Division, is responsible for overall coordination of the task force.

### Economic Impact Study

As a part of the project, a study of the economic value of recreation at Flaming Gorge Reservoir and the potential economic loss from reduction in recreation due to algal blooms was funded by the Wyoming Water Research Center and conducted by the Department of Agricultural Economics, University of Wyoming. The investigators were Jeanette Oster, Dr. David Taylor, Dr. James Jacobs, and Dr. Edward Bradley. Information from this part of the project will be used in evaluating the economic feasibility of mitigating the algal bloom in the reservoir.

A survey and studies conducted in 1986-87 showed that individuals made a total of 245,000 recreational trips to Flaming Gorge Reservoir annually. The net benefit value of recreation per trip to the reservoir is estimated to be \$10.67 for day trips and \$17.65 for multi-day trips. These figures represent the net benefit value, that is the amount of benefits over and above trip costs, of one recreational trip to the Gorge by an individual. Total annual recreation net benefits at Flaming Gorge Reservoir are estimated to be \$3.4 million.

Expenditures (costs) associated with recreational trips to Flaming Gorge are estimated to be \$24.86 per trip for day trips and \$53.13 per trip for multi-day trips. Total annual recreation expenditures are estimated to be \$9.4 million.

### Loss in Recreation Benefits

From an economic standpoint, the effects of blue-green algae on recreation is determined by measuring the loss in net benefits to recreation users of Flaming Gorge. A loss of benefits occurs if people's recreational activities are altered or reduced as a consequence of algal blooms. Based on the study results, it is estimated that the maximum potential annual loss to recreational users due to algae would be approximately \$457,000. This estimate is based on the assumption that algal blooms would make the northern end of the reservoir unusable for recreation from July through October. The net present value (with a 100-year time horizon and a 4 percent discount rate) of the maximum annual recreation loss is \$11.2 million.

Since undertaking mitigation measures would affect recreation benefits in future years, the cost associated with actions to mitigate the algae should be compared with the net present value of the recreation use that would have been lost without the mitigation measures. If the costs of the action are less than the estimated loss in benefits without the actions, the mitigation measure would be justified from an economic standpoint. Information on the costs of mitigation are being developed by members of the task force from ongoing research on the biological aspects of the algal blooms.

Details of this research are presented in Reservoir Eutrophication and the Value of Recreational Activities: A Case Study of Flaming Gorge Reservoir, a joint publication of the Department of Agricultural Economics and the Wyoming Water Research Center, June 1987. For additional information, contact Associate Professor David T. Taylor or Professor James Jacobs, Department of Agricultural Economics, (307) 766-3714.

**Water Institute** *Cont. from Page 1*  
that are a part of the Soil Conservation Service Snotel network (an automated snow measurement system) were particularly fascinating to the students.

Throughout the course, teachers learned and participated in hands-on activities to take back to the classroom. Joe Vogler, Wyoming Game and Fish Department, taught the highly acclaimed Project Wild - Aquatic concepts and activities used for teaching about water resources.

Several of the students (teachers) commented that the highlight of the Institute was the teleconference panel session on water law and policy issues. The water issues panel was composed of: Malcolm Wallop, U.S. Senator; Robert Grieve, State Sena-

tor; Beryl Churchill, Member, Wyoming Water Development Commission; Jane Cator, Wyoming Assistant Attorney General; and John Zelazny, Conservation Programs Director, Wyoming Wildlife Federation. The panel provided the teachers an unparalleled opportunity to listen and discuss in person and via teleconference, Wyoming water issues and policy.

WIT was sponsored jointly by the Wyoming Water Research Center and the University of Wyoming Center for Teaching and Learning.



**Databases** *Cont. from Page 1*  
point sources of pollution, pollution-caused fish kills, waste abatement needs, implementation schedules, and many other water quality related items. The system is used by Federal, state, and local water quality agencies to solve such problems as defining the causes and effects of water pollution, measuring compliance with water quality standards, checking the status of waste treatment plant needs, and determining pollution trends.

Requests for data retrievals from the WRDS databases or any other system accessed by WRDS personnel, such as FRDS or STORET, should be addressed to the WRDS staff at the Wyoming Water Research Center, P.O. Box 3067, Laramie, Wyoming 82071, (307) 766-2143.

#### **Job!** *Cont. from Page 1*

choice. It's called a cooperative position, and it is usually highly structured academically and professionally. An undergraduate co-op position ordinarily lasts two semesters, separated by at least one semester of course work on campus. Graduate co-op positions are often more flexible. Most co-op job opportunities are in engineering, agricultural or government organizations.

Unfortunately, some of the best jobs with government agencies within Wyoming are going to students from outside the state because most UW students are unaware of the opportunities available. For example, last year the U.S. Geological Survey (USGS) office in Cheyenne offered a hydrology trainee co-op job, but no UW student applied before the application deadline. To alleviate this problem, the CEOP staff encourages all interested students to register with the CEOP office early in the fall semester and to check in at the CEOP office regularly for new job listings.

Sometimes the CEOP office will voluntarily send student information to agencies which advertise positions. More often, however, students identify those jobs which are of particular interest to them before "official" student data (including a resume and GPA) is mailed out. The CEOP office is the contact point for both students and employers, but CEOP staff are only facilitators. Students and employers work out the details of each position to develop a mutually beneficial relationship.

The CEOP office has a fat notebook filled with government agency job listings including positions with the U.S. Forest Service, Bureau of Land Management, USGS, National Park Service, and the Soil Conservation Service. Most of these jobs are co-op positions, but some are volunteer positions offering a foot-in-the-door for highly desirable permanent government jobs.

Employers and students both benefit from participation in cooperative education because it represents a non-threatening environment in which to make a job match or prevent a mismatch. Students have a chance to look over career possibilities, and employers have a chance to evaluate students without making long-term commitments on full-time positions. Cooperative education has proven to be highly advantageous in terms of both human and cost-effective factors. In fact, nationwide, student co-op positions have been so successful that 63 percent end in permanent jobs!

Sound intriguing? There is a lot more information and great opportunities waiting for you in the CEOP office which is open Monday through Friday, 7:30 a.m. to 4:30 p.m. in the summer and 8:00 to 5:00 p.m. the rest of the year. Call (307) 766-2398 for an appointment.

## WWRC PUBLICATIONS

Reconnaissance Survey: Trace Metals Concentration in Wind River Glaciers, Technical Completion Report, Wyoming Water Research Center, 1990.

## OTHER PUBLICATIONS

The Universities Council on Water Resources (UCOWR) has completed a listing of federal and private sponsors of water resources research on which water resources issues have an impact. Their guide, Funding Opportunities in Water Resources Re-

search, 1989-1990, provides basic information about the funding agencies and their current priorities in the area of water research. The listing includes information on research programs involving theoretical issues, policy issues, basic science, and practical applications.

The guide lists the agency's title, address, and phone number; guidelines for contacting sponsors; geographical restrictions; program objectives and areas of interest; and the types of awards offered for each funding opportunity.

For more information contact: Dr.

Duane B. Baumann, Executive Director, Universities Council on Water Resources, 4543 Fanner Hall, Southern

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The USGS has copies of Wyoming Water Supply and Use which is one of the state reports in the just released 1987 National Water Summary. This report includes maps and charts showing surface and groundwater supplies for Wyoming and its river basins and provides estimates of domestic/commercial, industrial/mining, thermoelectric and agricultural use and return flows. For a copy of this publication contact the USGS Cheyenne District Office (307) 772-2153.

## WWRC Calendar

### AWRA - Wyoming

The Wyoming section of American Water Resources Association will hold its Third Annual Meeting October 3-5, 1990, in Laramie, Wyo. The meeting is co-sponsored by the Wyoming Water Research Center. The first session will begin at 1:00 p.m. on Wednesday, October 3, with an afternoon of technical presentations. Thursday, October 4, will open with a morning of technical presentations followed by a luncheon with invited speaker Dr. Diane McKnight. Dr. McKnight will discuss her hydrologic research in two desert lakes in Antarctica. A hydrologic field tour of the Snowy Range Observatory is planned for the remainder of Thursday afternoon. The meeting will conclude at noon on Friday, October 5, after a morning technical session. Additional information can be obtained from: David Nafz or Kirk Miller, USGS, 2617 E. Lincolnway, Suite B, Cheyenne, WY 82001 (307) 772-2153.

### Conserve 90

Conserv 90, a national conference and exposition on Water Supply Solutions for the 1990s will be held in Phoenix, Ariz., August 12-15, 1990. For more information, call (614) 761-1711.

### AWWA/WPCA

A joint conference with the Rocky Mountain Section, American Water Works Association and the Rocky Mountain Water Pollution Control Association will take place in Vail, Colo., September 9-12, 1990. For further information, contact AWWA/WPCA, 6666 W. Quincy Ave., Denver, CO 80235.

### AWRA - National

The 26th Annual AWRA Conference, "The Science of Water Resources—1990 and Beyond" and Symposium "Transferring Models to Users," will be held in Denver, Colo., November 4-9, 1990. For more information contact General Chairman John George, USGS, Denver Federal Center, Bldg. 25, Rm. 249, Denver, CO 80225.

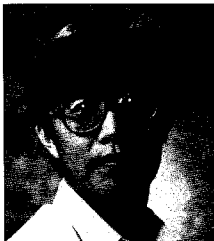
### Water Congress

The Northern Rocky Mountain Water Congress will be held September 30-October 5, 1990, in Butte, Montana. The Congress is a presentation of combined conferences, symposiums, and workshops covering a wide variety of hydrology topics. For further information, contact Brenda C. Scholes, Hydrology Division, Montana Bureau of Mines and Geology, Montana Tech, Butte, Montana 59701.

## Call for Papers

The Wyoming State Section of AWRA has issued a call for papers to be presented at its third annual meeting. Two copies of an extended abstract (up to three pages of camera-ready copy, including figures and tables) may be submitted for a 15-minute presentation. The abstract should include a title and the authors names and affiliations. The mailing address and phone number of the primary author should be submitted on a separate page. Extended abstracts will be published in a Proceedings of the Annual Meeting. Authors will be notified of acceptance of their abstracts by September 1, 1990. A \$100 cash scholarship will be awarded for the best student presentation. Meeting topics will include, but not be limited to, the following: chemical contamination of hydrologic systems in Wyoming, hydrology of Wyoming wetlands, computer applications in Wyoming hydrology, climate and weather modification in Wyoming and adjacent states, hydrology of Wyoming forests and plains, and hydrology of southeast Wyoming. The deadline for receipt of abstracts is August 20, 1990. Abstracts should be sent to Jim Rankl, USGS, 2617 E. Lincolnway, Suite B., Cheyenne, WY 82001.

## WWRC FOCUS



Dr. Yeou-Koung Tung

### Water Under the Bridge

One hundred years ago the Chevyenne Daily Leader reported on "An Awkward Accident." In a special dispatch the newspaper reported that "An exciting accident occurred at Bridger's Ferry yesterday while the passengers from Wendover to Douglas were being ferried across the Platte River." While the empty stage coach was being driven across the river "through some miscalculation the driver collided his team with the boat. A panic ensued among the passengers, several of whom were thrown into the river. All, however, were finally landed safely. One of the stage horses was drowned."

Dr. Yeou-Koung Tung is an associate professor in the Statistics Department and holds a joint research appointment with the Wyoming Water Research Center at the University of Wyoming. Dr. Tung is active in research and teaching in the areas of hydrology, hydraulics, water resource engineering systems, and applications of probability and statistics to water-related problems. He has been the principal investigator or co-investigator on numerous research projects including research on optimal conjunctive water use management; statistical analysis of hydrogeological data; optimal risk-based hydraulic designs of roadway crossings, flood levees, and storm sewer systems;

Also during the summer of 1890 the newspaper reported that Fish Commissioner Lewis Miller distributed 50,000 trout fry in Albany County streams. One hundred years later, Mel Oberholtzer, a biologist with the Wyoming Game and Fish Department, reports that they plan to stock 310,000 trout fingerlings and over 1,100,000 trout of all sizes in Albany County. The Game and Fish Department plans to stock 23,979,375 fish statewide in 1990, including 13,424,000 walleye and 10,000,000 trout.



analysis of uncertainty of water-quality modeling in stochastic stream environments; and probabilistic evaluations of water resource projects.

Dr. Tung received a B.S. degree in hydraulic engineering from Tamkang University in Taiwan in 1976, and M.S. and Ph.D. degrees in civil engineering from the University of Texas at Austin in 1978 and 1980, respectively. He joined the Wyoming faculty in 1985.

Dr. Tung has published extensively in various refereed journals, conference proceedings and books as well as technical reports, and in 1987, he was awarded the Collingwood Prize from the American Society of Civil Engineers (ASCE) for his research paper "Flood Routing by Nonlinear Muskingum Model." Dr. Tung is currently co-editing a book on the risk and reliability analyses of hydraulic design for the ASCE, and has recently co-authored a textbook on hydrosystems engineering and management. Since 1984 he has been a member (chairman in 1989) of the ASCE Technical Committee on Probabilistic Approaches to Hydraulics. He was also a member of the ASCE Task Committee on Reliability Analysis of Water Distribution Systems from 1984 to 1987. Currently, he is the chairman of a subcommittee on Reliability Analysis of Hydraulic Structure Designs.

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