

# DHS Bulletin



FY08 - No. 3

January through March 2008

## Presentations and Publications

### Journal Articles

- Chen, D. and J.G. Duan, 2008. Case study: numerical simulation of channel migration process of the West Jordan River, Utah. *Journal of Hydraulic Engineering*, ASCE, 134(3), 315-327.
- Coming, D.S. and O.G. Staadt, 2008. Velocity-aligned discrete oriented polytopes for dynamic collision detection. *IEEE Transactions on Visualization and Computer Graphics*, 14(1):1-12, Jan/Feb issue.
- Yin, J., M.H. Young, and Z. Yu, 2008. Effects of paleoclimate and time-varying canopy structures on paleorecharge. *J. Geophys. Res.*, 113, D06103, doi:10.1029/2007JD009010.

### Book Chapter

- French, R.R., J. J. Miller, and K. Al-Qudah. 2008. Approaches to Estimating the Depth and Duration of Playa Lake Flooding. In *Trends in Water Resources Research*, A. Prescott and T. Barkely (eds). Nova Science Publishers, Inc.

### Conference Abstracts

- Humphrey, S., D. Reeves, G. Pohll, G. Oppliger, and J. Huntington. 2008. A stochastic approach to a groundwater flow model for the southern Honey Lake Valley in Lassen County, California and Washoe County, Nevada. Nevada Water Resources Association Annual Conference, Mesquite, Nevada, March 4-6, 2008.
- Naranjo, R., J. Brock, R. Susfalk, A. McKay, M. Stone, L. Saito, and S. Tyler. 2008. Nutrient and Hyporheic flow Dynamics through a Riffle-Pool Sequence, Truckee River at Fleish, CA. Nevada Water Resources Association Annual Conference, Mesquite, Nevada, March 4-6, 2008.

### DHS Reports

- Berli, M., L. Chen, and M. Young, 2008. Wildfire Effects on Watershed Hydrologic Processes: An Introduction for Hydraulic Engineers, Watershed Managers, and Planners. Desert Research Institute, Division of Hydrologic Sciences Publication No. 41243.

### Reports

- Earman, S. and Dettinger, M., 2008. Monitoring networks for long-term recharge change in the mountains of California and Nevada—A meeting report. California Energy Commission Public Interest Energy Research (PIER) Workshop Paper CEC-500-2008-006.

## New Projects

Nitrate Assessment of the Cactus Flat Watering Hole, Nevada Test and Training Range

PI: Ron Hershey  
Agency: DOI- Bureau of Land Management  
Amount: \$80,630  
Summary: The objective of this study is to determine the cause of high nitrates in an excavated pond located on a dry lake bed that is commonly used by wild horses as a water source.

DRI/SNWA Climate Change and Water Resources Proposal

PI: Jim Thomas  
Agency: SNWA  
Amount: \$158,000  
Summary: This project presents a list of tasks developed by the Desert Research Institute (DRI) and the Southern Nevada Water Authority (SNWA) from a collaborative white paper entitled "Reliability of Southern Nevada Water Supplies in the Future--Understanding and Managing the Impacts of Climate Change on Water Resources" and from subsequent DRI/SNWA meetings. This proposal was developed for a one-year period to initiate the process of addressing the integrated tasks needed to evaluate climate change impacts on water resource sustainability in eastern Nevada.

SGER - Impact of the Angora Fire on Colloidal Black Carbon in Lake Tahoe and Fallen Leaf Lake

PI: Ross Edwards  
Agency: NSF  
Amount: \$75,727  
Summary: The primary goal of the project is to collect and quantify black carbon colloids (BC) in water samples from Lake Tahoe and Fallen Leaf Lake in the wake of the Lake Tahoe basin Angora fire. The sampling program will collect near-shore, mid-lake and outlet river samples from Fallen Leaf Lake and Lake Tahoe. In addition to sampling conducted by the project, we will leverage pre-existing sampling programs such as the UC-Davis Mid-Lake Tahoe Profile (MLTP), which collects depth profiles from the lake every 30 days.

IPY: Adding Continuous Black Carbon Analysis to the Norwegian-US Traverse Ice Core Measurements

PI: Ross Edwards  
Agency: NSF  
Amount: \$245,077  
Summary: The primary goal of this project is to add high-resolution continuous black carbon measurements to the IPY Norwegian-US traverse glaciochemical analyses. At present, very little is known regarding black carbon particles over Antarctica or its presence in Antarctic snow and ice. We have very recently developed a new analytical method for measuring black carbon in water that is nearly a million times more sensitive than existing methods. During the development, we analyzed an ice core from West Antarctica at very high temporal resolution and have made a number of discoveries. We wish to analyze seven intermediate depth ice cores as part of the Norwegian-US traverse and an existing ice core from South Pole. From this array of millennial scale black carbon records, we will investigate the spatial and temporal history of black carbon deposition to Antarctica and its relationship to black carbon aerosol and climate in the Southern Hemisphere.

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WAIS DIVIDE - High Temporal Resolution Black Carbon Record of Southern Hemisphere Biomass Burning

PI: Ross Edwards

Agency: NSF

Amount: \$213,755

Summary: The primary objective of the project is to use the main WAIS Divide ice core to develop a record of seasonal Southern Hemisphere biomass burning over the past 2,000 years. We intend for the research to serve as a waypoint to the eventual analysis of the entire core.

## Nevada Water Resources Research Institute Projects

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Agency: USGS

Amount: Total: \$92,335

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Quagga Mussel Invasion in Lake Mead: Ecological Impact and Containment

PIs: Kumud Acharya and Lambis Papelis

Summary: Lake Mead is the largest reservoir in the US and one of the most important water resources in the West. In January of 2007, Quagga mussels (*Dreissena bugensis*) were discovered in Lake Mead, for the first time west of the 100th meridian. This invasive species and the related Zebra mussel (*Dreissena polymorpha*) have disrupted ecosystems in a number of waterways elsewhere in the US and have cost billions of dollars in control efforts. Given the seriousness of the recent Quagga mussel invasion for the ecology and economy of the broader region, and for the overall management of the important water resources of the region, the primary goal of the proposed research is to study the ecology and biology of Quagga mussels and their impact on aquatic biodiversity and water quality in Lake Mead. Specifically, under the proposed research plan we will study 1) the scale of invasion; 2) the ecological impact of the invasion; 3) the physiological ecology of the Quagga mussel; 4) the phylogenetics and population structures of the Quagga mussel; 5) the potential of Quagga mussels to bioaccumulate metalloids under local conditions; and 6) we will complete a preliminary ecological modeling and risk assessment. This study will use and contribute to the collection of data on Quagga mussels already under way by local, state, and federal agencies. The proposed study will also contribute to the development of local expertise, necessary to address this serious ecological and economic problem. Results will be published in peer reviewed journals and communicated to the public, in an effort to educate the public and to limit the negative impacts of the invasion. Finally, the experience and data collected from the proposed study will be used to support competitive proposals to national funding agencies to further contribute to our understanding of the problem and viable management strategies.

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Estimation of spatio-temporal statistics of precipitation and snow-water equivalent in the Truckee River watershed

PIs: Rina Schumer and Anna Makowski

Summary: Precipitation-runoff models are used in the Truckee River watershed and other regions of Nevada to support river and reservoir operations. Physically based runoff models are used to estimate water yield based on the accumulation and depletion of snowpack and various water distribution processes (e.g. infiltration, runoff), subject to an energy balance and a water balance. Results are used to forecast the timing and volume of seasonal water supply as well as the effects of climate variability and land use change. The spatial and temporal distribution of precipitation and snow-water equivalent (SWE) are used in the calibration of precipitation-runoff models, yet our knowledge of these variables is highly uncertain because 1) field measurements of SWE and precipitation are sparse and 2) both SWE and precipitation are sensitive to physiographic factors such as elevation and aspect. In this study, we will compile and analyze a previously undocumented dataset that includes up to 30 years of precipitation and SWE measurements recorded at 29 sites in the Truckee River watershed. The inclusion of this dataset with measurements from established monitoring stations in the watershed, will more than double the spatial sampling resolution, and the combined datasets can be used to 1) estimate temporal and spatial statistics of precipitation and SWE in the Truckee River watershed, 2) improve calibration of precipitation-runoff models in the watershed sub-basins, and 3) test independent models (e.g. SNODAS, PRISM) designed to estimate the distribution of precipitation and SWE.

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Uncertainty and Sensitivity of Ground-Water Discharge Estimates for the Shrublands in the Great Basin Area

PI: Julian Zhu

Summary: Limited water supply in Nevada and the American Southwest in general will not be enough to support its rapidly growing population growth. With future needs of water resources in mind, local water authorities are looking northeast to the Great Basin. One plan – among many others – proposes to pump water from the Great Basin aquifers. Before such action can be taken, it is necessary to investigate the way in which the water budget for the area is influenced by pumping and the potential for long-term pumping to affect water availability to phreatophytic vegetation. This proposed project focuses on the water budget component of ground-water discharge by evapotranspiration (ET). The volume of water lost to the atmosphere through ET can be computed as the product of the ET rate and the area of combined vegetation, open water, and moist soil that contribute to ET. The three main variables that determine the ground-water discharge by ET are ET rates of individual ET units, the areas associated with the ET units and precipitation rates for the areas. Given the large area that contributes to the ground-water discharge by ET (a total of more than 4 billion m<sup>2</sup> in 12 valleys), and the dearth of previous studies of the valleys, ground-water discharge through ET was estimated using a rather sparse dataset. As a result, the ET rate and area uncertainty have significant influence on the ground-water discharge estimates. Because discharge estimates are expected to be an important component of the overall water budget, it is beneficial to

quantify the uncertainty associated with the ET estimates in order to help maximize future data collection efforts. The major effort of this project will be to identify the most influential variables that contribute most to estimate uncertainty of the ground-water discharge by ET. The analysis will be based on more physically based conditions of input variable correlations and the restraint of deterministic total area value for every valley in the area. The findings of this study will enable one to utilize limited resources more efficiently on the most influential variables in order to better understand and reduce the estimation uncertainty of ground-water discharge by ET, so that the limited resources can be used in reducing uncertainty to greatest extent for future efforts. In contrary to the previous study of ground-water discharge uncertainty, we will consider the constraint of total area in each valley and the possible correlations among the input variables, which in reality is the case. The other important novel aspect in this project is that we will use a suite of probability density functions aimed at quantifying the significance of distribution effects on ground-water discharge estimation uncertainty. This will in turn help decide the most influential features required to be characterized in future data collection efforts. In addition, we will also perform uncertainty analysis by systematically varying the variances of the input variables in each category to examine the sensitivity of the total ground-water discharge estimate to the three input variable categories (i.e., ET rates, areas, and precipitation rates) in general.

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**Black Carbon in Sierra Nevada Snow: Impacts on Snowmelt and Water Supply**

*PI:* Joe McConnell,

*Summary:* Because >85% of Nevada's water supplies originate as mountain snow, quantitative understanding of processes that influence snow melt and spring runoff is critical to Nevada's economic growth and ecological sustainability. Although the sources and impacts are poorly understood, black carbon (BC) aerosols emitted during combustion and deposited on snow decrease reflectance, leading to enhanced snow pack warming, sublimation and melt. Because local emissions are significant, abatement efforts in Nevada and California could help preserve Sierra Nevada snow resources. We propose the first comprehensive field and laboratory study of BC in eastern Sierra Nevada snow. This research is only possible because of a recent analytical breakthrough in DRI's snow chemistry laboratory which lowered detection limits for BC in water by four orders of magnitude. Collaborative snow radiation and energy balance modeling will be used to synthesize field and laboratory studies and to evaluate the impact of measured BC concentrations on snow melt and runoff.






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## New Hires (January thru March)

-  **Anna Knust - Assistant Research Hydrologist (NNSC)**
-  **Chris Garner - Assistant Research Hydrologist (NNSC)**
-  **Elizabeth Johnson - Hourly Scientist (SNSC)**
-  **Achyut Adhikari - Graduate Research Assistant (SNSC)**
-  **Judy Dillon - Hourly Tech (NNSC)**
-  **John Byers - Hourly Tech (SNSC)**
-  **Lisa Nay - Hourly Tech (NNSC)**

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## DHS Announcements

-  Joe McConnell received the Ansari Medal in January 2008
-  Michael Young's NSF/EPSCoR research in Boulder City was featured in the Las Vegas Review Journal and on KLAS Channel 8 in February 2008
-  Matt Reeves' student, Stephen Humphrey, won the best student poster award at the Nevada Water Resources Association Annual Conference held March 4-6, 2008, in Mesquite, Nevada.
-  Ramon Naranjo's poster won 3<sup>rd</sup> place at the Nevada Water Resources Association Annual Conference held March 4-6, 2008, in Mesquite, Nevada. Ramon received some \$ and took his lovely wife, Jen, to Sushi Pier II for dinner.
-  Bill Sherman and Daniel Coming, along with other CAVCaM members, were involved in the 2008 IEEE Virtual Reality conference held March 8-12 in Reno. Bill Sherman was the Chair of the conference; Daniel coming was Exhibits Chair; Fred Harris (Interim Senior Director, CAVCaM) and Phil McDonald (DAS) were Local Arrangements Chairs; and Patrick O'Leary (DEES) was Posters Chair. DRI sponsored part of the conference, and hosted a reception in the Stout conference room to demonstrate current CAVCaM projects.

## Proposals (submitted this quarter)

Date	PI(s), CO-PI(s)	Sponsor	Title	Funding (\$)	Fed. Init.
04-Jan-08	Lancaster, Nick (PI) Dana, Gayle	NSF (EPSCoR)	Nevada Infrastructure for Climate Change Science, Education, and Outreach	4,968,742	
29-Jan-08	Papelis, Lambis (PI) Acharya, Kumud Stone, Mark	NV NDEP	Impacts of Nonpoint Sources of Selenium and Phosphorus on Las Vegas Wash Restoration: Anthropogenic Versus Geologic Origins	71,911	
29-Jan-08	Acharya, Kumud	NSF	Collaborative Research: Linking Zooplankton Dietary Constraints With Sources and Nutritional Attributes of Particulate Matter in River and Estuarine Ecosystems	64,928	
29-Jan-08	Berli, Markus (PI) Young, Michael	NSF	Collaborative Research: Root Induced Changes of Soil Physical Properties Using Synchrotron X-ray Microtomography (CMT) and Micromechanical Simulations	388,580	
29-Jan-08	Young, Michael	NSF	MRI: Acquisition of Microfocus Computer Tomography for Imaging Natural Materials	375,000	
30-Jan-08	McConnell, Joe	Western Wash. Univ. / NSF	Collaborative Research: Ice Core Paleoclimate Records from British Columbia	50,402	
07-Feb-08	Heyvaert, Alan	Nevada Tahoe Conservation District; NDEP	Demonstrating an Ecologically-Based Process for Nutrient and Fine Sediment Removal in the Lake Tahoe Basin	20,653	
08-Feb-08	Schumer, Rina	Oak Ridge Associated Universities	New Insights in Predicting the Recurrence of Extreme Events	5,000	
11-Feb-08	Heyvaert, Alan	Lahontan Regional Water Quality Control Board	Angora Fire Effects and Restoration Water Quality Monitoring	141,649	
Feb-8	Kuhns, Hampden (PI) Roberts, Morien Stone, Asako	NSF	Resolving Consumer Uncertainty with Energy Conservation Decisions	749,893	
03-Mar-08	Reeves, Matt	Washoe County Department of Water Resources	Honey Lake Valley Interbasin Water Transfer - Investigation of Potential Water Quality Impacts from Interception of Saline Water	196,375	
03-Mar-08	Decker, Dave	DOD - Strategic Environmental R&D Program	Improved Methodology for the Characterization of Emissions from Open Detonations	1,564,658	
31-Mar-08	Zhu, Julian	DOE	The Non-Fickian Mechanism and Scale Effects of Contaminant Transport in Unsaturated Heterogeneous Soils	622,081	