SYNERGISTIC EFFECTS OF POLYDISPERSE NANOPARTICLES AND CONCENTRATION POLARIZATION ON DESALINATION PROCESS

Alexey S. Belyaev, Mechanical Engineering, New Mexico Tech, 801 Leroy Place, Socorro, NM 87801; abelyaev@nmt.edu; 505-715-2356

Sayavur Bakhtiyarov, Mechanical Engineering, New Mexico Tech, 801 Leroy Place, Socorro, NM 87801

Poster Abstract 1

This paper presents a new method to separate water from brine solution. The proposed method utilizes a combination of hybrid membrane and nano-technology. The method is based on the filtering of nanoparticles from solution. During filtration, a layer of these particles is formed on the surface of the membrane. Because these particles are the same size as the pores of the reverse osmosis membrane, they possess selective properties at both molecular and ionic levels. This layer will be formed if the membrane is working at a concentration polarization regime. The effect of polydisperse nanoparticles on the selective layer of both nano filtration (NF) and reverse osmosis (RO) membranes is studied. The effect of the hydrodynamic parameters on both concentration polarization and selective properties of the membrane is presented.

Contact: Alexey S. Belyaev, Mechanical Engineering, New Mexico Tech, abelyaev@nmt.edu, 801 Leroy Place, Socorro, NM 87801, 505-715-2356

EFFECTS OF ACEQUIAS AND GROUNDWATER LEVELS ON RIPARIAN VEGETATION, EVAPOTRANSPIRATION, AND RESTORATION

Ciara Cusack, Animal and Range Sciences, NMSU, Knox Hall, rm. 202, Box 30003, MSC 3-I Las Cruces, NM 88003-8003; ccusack@nmsu.edu; 208-863-3762

Sam Fernald, Animal and Range Sciences, NMSU, Knox Hall, rm. 202, Box 30003, MSC 3-I Las Cruces, NM 88003-8003; fernald@nmsu.edu; 575-646-1041

Poster Abstract 2

Traditional irrigation systems, known as acequias, as well as the fields they irrigate have been shown to recharge the shallow groundwater along the northern Rio Grande. The increase in shallow groundwater from the field and acequia seepage may supply additional water to the river during drier months and could have beneficial implications for the sustainability and restoration of riparian areas. We are expecting to find that a large amount of the shallow groundwater is withdrawn by riparian vegetation, depending on vegetation composition, decreasing but not entirely depleting the amount of return flow to the river. We also expect to find that acequia-related seepage creates localized areas where riparian plantings are highly successful and that this seepage helps to support the existing riparian vegetation as a whole. An estimate of the riparian ET can be formed using a model that takes into account the ecophysiology of the plants present and the amount of available groundwater. To determine acequias' role in riparian restoration and sustainability, cottonwood pole cuttings will be planted at varying distances from the acequias and the amounts of growth will be measured and compared at each location. This information can be used to determine possible acequia benefits and the overall water budget, which will help in future management decisions regarding the region and the Rio Grande.

Contact: Ciara Cusack, Animal and Range Sciences, NMSU, ccusack@nmsu.edu, Knox Hall, rm. 202, Box 30003, MSC 3-I, Las Cruces, NM 88003-8003, 208-863-3762, Fax 575-646-5441

EVALUATION OF DISTRIBUTED SOIL MOISTURE SIMULATIONS IN A FORESTED MOUNTAIN WATERSHED, NEW MEXICO

Taufique H. Mahmood, Earth and Environmental Science, New Mexico Tech, Socorro, NM 87801; tmahmood@nmt.edu; 575-835-5465

Enrique R. Vivoni, Earth and Environmental Science, New Mexico Tech, Socorro, NM 87801; vivoni@nmt.edu; 575-835-5634

Poster Abstract 3

Soil moisture is an important ecohydrologic variable that connects vegetation biophysical activity with hydrologic processes. However, only few studies have investigated the detailed spatiotemporal variations of soil moisture in forested mountainous watersheds. Therefore, we simulate soil moisture in Redondo Creek watershed of northern New Mexico for the 2005 summer monsoon period using a parameterized tRIBS model and evaluate the simulated soil moisture by comparing them with observations at distributed locations in the basin. We utilize hourly soil moisture observation at Redondo VCNP weather station and daily soil moisture observation at distributed locations during a field campaign to evaluate the model. Sampling points during the field campaign are classified as wetland, grassland, and forest. Our results indicate that simulated soil moisture agrees with observed soil moisture at Redondo VCNP weather station and a set of distributed locations in the basin. The tRIBS model captures the temporal dynamics of soil moisture at Redondo VCNP weather station. The high temporal RMSE indicate weak prediction by the model in wetland, and low temporal RMSE for grassland and forest indicate strong model performance. Precipitation is found as a key-controlling factor for seasonal fluctuation of soil moisture dynamics at Redondo VCNP weather station and sampling points of the field campaign. Basin average hydrologic responses indicate a strong link between precipitation and evapotranspiration via soil moisture. Visual comparison of the spatial fields of watershed characteristics and hydrometeorological variables with soil moisture spatial fields at different times of the monsoon season indicate strong influence of precipitation, soil hydraulic properties, and vegetation parameters on the spatiotemporal distribution of soil moisture. Strong model performance through this exercise can open avenues for process studies and basin-scale predictions of mountain ecohydrology.

Contact: Taufique H. Mahmood, Earth and Environmental Science, New Mexico Tech, tmahmood@nmt.edu, EES, New Mexico Tech, 801 Leroy Place, Socorro, NM 87801, 575-835-5465

INUNDATION MAPS AND FLOOD RISK ASSESSMENT USING GIS AND HYDRAULIC MODELING DOWNSTREAM OF AMISTAD DAM, TEXAS

Elizabeth Verdecchia, NMSU and International Boundary and Water Commission, 4171 N Mesa C-100, El Paso, TX 79902; liz_zenker@hotmail.com; 915-832-4701

Christopher Brown, Geography, NMSU, MSC MAP, PO Box 30001, Las Cruces, NM 88003-8001; brownchr@nmsu.edu; 575-646-1892

Poster Abstract 4

Safety inspections in 2007 of Amistad Dam revealed that the structure is conditionally unsafe. The International Boundary and Water Commission (IBWC), the federal agency that maintains the dam, currently has no flood maps of a possible dam break. This research uses four IBWC HEC-RAS hydraulic model scenarios for Del Rio, Texas: 100-year flood, 1974 flood, operation Release Band 11, and a dam break, and integrates them into a Geographic Information System (GIS). Three terrain surfaces were tested: Low-resolution USGS Digital Elevation Models (DEMs), high-resolution Light Detection and Ranging (LIDAR) derived DEMs, and high-resolution DEMs resampled to low-resolution. HEC-GeoRAS converts HEC-RAS outputs to GIS format, which are then converted to raster grids in an ArcGIS model using 3D and Spatial Analysts. Map Algebra calculations find flooded areas as the intersections of the surface terrain and water surface elevations. Model results are verified by comparing with flood delineation from an MSS Landsat scene taken after the 1974 flood, and low-resolution Lidar exhibited 85% coincident area with the historic flood delineation. USGS DEMs, which offer only 90m resolution for the Mexican side of the study area, underestimate the flood area between 36 to 49% when compared to Lidar DEMs. Low- and high-resolution Lidar DEMs produced 96-99% similar model results. Risk assessment for the US portion of the study area using HAZUS-MH revealed that 34 buildings in the Del Rio area would be damaged in a storm like the 1974 flood, whereas 3,901 would be damaged if the dam broke, costing an estimated $490 million.

Contact: Elizabeth Verdecchia, New Mexico State University and International Boundary and Water Commission, liz_zenker@hotmail.com, 4171 N Mesa C-100, El Paso TX 79902, 915-832-4701, Fax 915-832-4167

VARIATIONS IN FLOW AND CHEMISTRY WITH DEPTH IN A PUBLIC-SUPPLY WELL IN ALBUQUERQUE, NEW MEXICO

L.M. Bexfield, U.S. Geological Survey (USGS), 5338 Montgomery Blvd. NE, Suite 400, Albuquerque, NM 87109; bexfield@usgs.gov; 505-830-7972

G.P. Stanton, USGS, 8027 Exchange Dr., Austin, TX 78754

M.B. Nyman, USGS, 5563 De Zavala Rd., Suite 290, San Antonio, TX 78249

D. Crilley, USGS, 5338 Montgomery Blvd. NE, Suite 400, Albuquerque, NM 87109

B. Gastian, Albuquerque Bernalillo County Water Utility Authority (ABCWUA), PO Box 1293, Albuquerque, NM 87103

H. Greear, ABCWUA, PO Box 1293, Albuquerque, NM 87103

Poster Abstract 5

Flow and chemistry data were collected from multiple depths of a public-supply well in Albuquerque, New Mexico, by the U.S. Geological Survey as part of a national study to increase understanding of factors affecting water quality in supply wells. Using an electromagnetic flowmeter, flow data were collected at 20-foot intervals throughout the more than 800-foot length of screened interval in the supply well under both non-pumping and pumping conditions. Based on the flow data under pumping conditions, five depths were selected for collection of ground-water samples. Depth samples were collected using a Bennett sample pump while the supply well was being pumped at about 650 gallons per minute.

Under non-pumping conditions, flowmeter results indicated generally upward ground-water flow of as much as 200 gallons per minute through the wellbore of the supply well, with ground water entering the well across deep sections of the screened interval and generally moving back out to the surrounding formation across the upper 165 feet of screened interval. Under pumping conditions, nearly two-thirds of the water being pumped from the supply well entered the well across the upper 200 feet of screened interval. Ground-water samples collected under pumping conditions from five depths within the supply well and from the wellhead indicated that water entering the well across deeper sections of the screened interval had the highest concentrations of chloride and arsenic (about 45 mg/L and 23 µg/L, respectively). Ages of ground water entering the well at various depths were estimated to range over several thousand years.

Contact: Laura Bexfield, U.S. Geological Survey, New Mexico Water Science Center, bexfield@usgs.gov, 5338 Montgomery Blvd. NE, Suite 400, Albuquerque, NM 87109, 505-830-7972, Fax 505-830-7998

PLANNING FOR A DATABASE OF NEW MEXICO WATER RIGHTS PRICES

Shawn Landfair, NMSU, PO Box 30003, MSC 3169, Las Cruces, NM 88003;
shawn@nmsu.edu; 575-646-4773

Frank Ward, NMSU, PO Box 30003, MSC 3169, Las Cruces, NM 88003;
fward@nmsu.edu; 575-646-1220

Poster Abstract 6

The transfer of water rights is an important method used for stretching available water supplies to meet new water demands. In the Lower Rio Grande Basin it is used to support sustained population and economic growth. Potential sellers are unsure of what price to charge for a water right, while buyers are unsure of what price to pay. This lack of information on water right prices creates an uncertain and unpredictable market, which makes it more difficult to transfer water rights to meet growing demands. Improved understanding of the economic forces influencing water right prices will help buyers and sellers, while adding vital information to support continued economic development of the region. Starting in the Lower Rio Grande Basin (LRG) this project will assemble actual verified water rights market data into a database that can be used to characterize the price of water rights. The database will include data from 2003 to present and updates a previously developed database. The database and models derived from it will support a better understanding of the economic and hydrologic forces affecting the demand, supply, and price of water. This will act as the basis for a possible future economic model for the basin. The model will be used to explain factors affecting water rights prices for the Lower Rio Grande Basin. With the success of the LRG model, the same process can be applied to other basins in New Mexico where similar development pressures increase the demands for scarce water.

Contact: Shawn Landfair, NMSU, shawn@nmsu.edu, PO Box 30003, MSC 3169, Las Cruces, NM 88003, 575-646-4773, Fax 575-646-3522

ADSORPTION OF *E. COLI* AND *STAPHYLOCOCCUS AUREUS* ON CARBON NANOTUBES

Dipendu Saha, Chemical Engineering, NMSU, PO Box 30001, MSC 3805, Las Cruces, NM 88003; dipendu@nmsu.edu

Shuguang Deng, **Venkata K.K. Upadhyayula**, **Geoffrey B. Smith**, **Martha C. Mitchell**, NMSU

Poster Abstract 7

Adsorption equilibrium and kinetics of *E. coli* and *Staphylococcus aureus* on single-walled carbon nanotubes (CNT) were studied in an effort to develop CNT-based biosensors for quick detection of these bacteria in water and other fluids. Carbon nanotubes have emerged as promising candidates for sensors because of their unique electrical conductivity and the possibility of manipulating adsorption affinities for biological molecules by functionalizing the CNT surface. Adsorption equilibrium and kinetics are key data to correlate sensor outputs and sample concentrations.

Batch experiments were carried out to measure the adsorption kinetics and equilibrium of pure culture and mixture of these two bacteria on a commercial CNT sample at ambient temperature. Fast adsorption uptake of *E. coli* and *Staph* on CNT was observed. The diffusivity calculated from the adsorption kinetics data is 2.8×10^{10} and 1.7×10^{10} cm^2/s for *E. coli* and *Staph*, respectively. Adsorption kinetics data of mixed culture will also be reported.

Adsorption isotherms of pure *E. coli* and *Staph* on CNT were measured by repeating the kinetics experiments at different initial bacteria concentrations. It appears linear isotherms were obtained in a log-log scale, which suggests these isotherms can be correlated with the Freundlich adsorption isotherm equation. Adsorption equilibrium of mixed culture was determined to examine the validity of existing adsorption equilibrium models for mixtures of bacteria. SEM images were taken to study the morphology of the adsorbed phase on CNT.

Contact: Shuguang Deng, Chemical Engineering, New Mexico State University, sdeng@nmsu.edu, PO Box 30001, MSC 3805, Las Cruces, NM 88003, 575-646-4346, Fax 575-646-7706

IMPACT OF INDUSTRIAL EFFLUENT APPLICATION UNIFORMITY ON SOIL CHEMICAL PROPERTIES

Pradip Adhikari, NMSU, PO Box 30003, MSC 3Q, Las Cruces, NM 88003-8003; adhikari@nmsu.edu; 575-646-3158; 202-404-1829

Manoj K. Shukla, NMSU, PO Box 30003, MSC 3Q, Las Cruces, NM 88003-8003; shulamk@nmsu.edu; 575-646-2324

John G. Mexal, NMSU, PO Box 30003, MSC 3Q, Las Cruces, NM 88003-8003; jmexal@nmsu.edu; 575-646-3335

David Daniel, NMSU, PO Box 30001, MSC 3CQ, NMSU, Las Cruces, NM 88003-8001; ddaniel@nmsu.edu; 575-646-4173

Poster Abstract 8

Industrial effluent was applied onto the 36-ha study site partially covered with the desert shrubs Mesquite and Creosote by a fixed-head, 4-point sprinkler irrigation system beginning in 2002. The objectives of this study were to determine (1) the quality of wastewater applied, (2) uniformity of application, and (3) influence on local soil chemical properties. The electrical conductivity of applied effluent during 2002-2007 ranged from 2.90 to 4.30 dS/m, SAR 15.40 to 45.44, chloride 329 to 1134 mg/L, and sodium 600 to 1120 mg/L. From 2002 to 2007, the site received about 197.37 cm of effluent, 133.10 cm of precipitation, while the average evapotranspiration (ET) of Mesquite and Creosote shrubs was about 878.91 cm. ET far exceeded the water inputs and the ratio of total water applied and ET was about 0.38. Christiansen's uniformity coefficient was 49.34% for plot-I and 61.57% for plot-II. The low distribution uniformity was primarily due to wind speed and interception of effluent by desert shrubs. Average wind speed during the tests in plot-I and II were 32 and 5.6 km/h respectively. Soil sample analysis collected immediately after the uniformity test showed some positive relation between volume of water collected and EC in the counter map. Average volume collected was higher under canopy (129 cm^3) than in bareground (95 cm^3). Higher sodium and lower saturated hydraulic conductivities were observed in the bareground than under canopies at 0-20 cm depth. Long-term wastewater application should take into account the uniformity of application.

Contact: Pradip Adhikari, New Mexico State University, adhikari@nmsu.edu, PO Box 30003, MSC 3Q, Las Cruces, NM 88003-8003, 575-646-3158, Fax 575-646-6041

ARSENIC ADSORPTION AND DESORPTION IN STORRIE LAKE SEDIMENTS

Celestine S. Ngam, Daniel B. Stephens and Associates Inc., 6020 Academy NE, Suite 100, Albuquerque, NM 87109; cngam@dbstephens.com; 505-353-9140

Michael L. Meyer, New Mexico Highlands University, Box 9000
Las Vegas, NM 87701; 505-426-2267

Poster Abstract 9

In humans, epidemiological studies have shown inorganic arsenic (As) to be carcinogenic, causing higher incidences of respiratory, skin, and liver cancers as well as cancers of the GI tract (Opresko 1992; Lippmann 2000). Arsenic (As) in underlying bedrock and weathered materials is the primary source in soil and water (Kabata-Pendias and Pendias 1984; O'Neill 1990; Thornton and Farago 1997).

Storrie Lake is located 5 miles north of Las Vegas via NM 518, San Miguel County, New Mexico. It is an artificial reservoir that covers about 1,100 acres. The dam was built in 1921 for the purpose of storing irrigation water. At present it serves as a recreational area and drinking water storage for the city, serving 18,000 people and storing approximately 20% to 40% of its drinking water.

This study will determine the effect of pH (8 and 5) and As concentration changes (2, 8, 18, 33, 63 ppb) to sediment As adsorption/desorption. At pH 8, results show that the sediment As adsorption rate increased steadily with an increase in reaction time and available As in solution. However, at pH 5 adsorption showed fluctuations in the amount of As adsorbed with time. Results indicated that As removal by sediments is more efficient at the natural pH of the water (pH 8) than acidic pH.

Contact: Celestine Ngam, Daniel B. Stephens and Associates, Inc., cngam@dbstephens.com, 6020 Academy NE, Suite 100, Albuquerque, NM 87109, 505-353-9140

HYDROLOGIC MODELING ON THE RIO GRANDE USING THE AUTOMATED GEOSPATIAL WATERSHED ANALYSIS (AGWA) TOOL

Ashraf N El-Sadek, Plant and Environmental Sciences, NMSU, MSC 3Q, PO Box 30003, Las Cruces, NM 88003; elsadek@nmsu.edu; 575-645-9011

Max P. Bleiweiss, Entomology, Plant Pathology, and Weed Science; maxb@nmsu.edu; 575-646-3225

Manoj Shukla, Plant and Environmental Sciences, MSC 3Q, PO Box 30003, Las Cruces, NM 88003; shuklamk@nmsu.edu; 575-646-2324

Steve Guldan, Agricultural Science Center at Alcalde, sguldan@nmsu.edu; 505-852-4241

Sam Fernald, Animal and Range Sciences, MSC 3-I Las Cruces, NM 88003; afernald@nmsu.edu; 575-646-1041

Poster Abstract 10

The absence of gaged streamflow data and the lack of climatic data contribute to the difficulty of understanding watershed hydrology. To this end, we are investigating the use of two models—the Soil Water Assessment Tool (SWAT) and Kinematic Runoff and Erosion Model (KINEROS2), which are integrated into an ArcGIS and/or ArcView interface: the Automated Geospatial Watershed Analysis (AGWA) tool. The watersheds that we are studying are the Santa Cruz and Mimbres rivers (both gaged) and the Rio de Truchas and Placitas Arroyo (both ungaged). Our study aims to implement the strategy of transforming hydrological information from gaged to ungaged watersheds on model calibration and validation and to compare conventional climate data systems with modified atmospheric model output (e.g., "reanalysis dataset"). The data requirements for these models are climatological and spatial. The climatological data consist of daily maximum and minimum temperature and precipitation. The spatial data consist of a 10 m DEM, soils map (STATSGO) and a land cover map (NLCD 2001). Daily stream flow records were obtained from the USGS gaging stations at the outlets of the two gaged watersheds for calibration purposes. For our study, we are performing simulations over the time period from 2005 until the present time. We have completed the simulation on the Mimbres and are in the process of calibrating the models. This is work in progress, and the results to date will be reported. When this project is completed, we will have a better understanding of runoff and erosion processes in ungaged basins.

Contact: Ashraf N El-Sadek, Plant and Environmental Sciences, elsadek@nmsu.edu, NMSU, MSC 3Q, PO Box 30003, Las Cruces, NM 88003, 575-571-7216

NITRATE-N LOADING BELOW THE ROOT ZONE AND IRRIGATION EFFICIENCY IN ONION FIELDS UNDER DRIP AND FURROW IRRIGATION SYSTEMS

P. Sharma, Plant and Environmental Sciences, NMSU, MSC 3Q, PO Box 30003, Las Cruces, NM 88003-8003; sharmap@nmsu.edu; 575-571-7589

M.K. Shukla, Plant and Environmental Sciences, NMSU, MSC 3Q, PO Box 30003, Las Cruces, NM 88003-8003; shuklamk@nmsu.edu; 575-646-2324

T. Sammis, Plant and Environmental Sciences, NMSU, MSC 3Q, PO Box 30003, Las Cruces, NM 88003-8003; tsammis@nmsu.edu; 575-646-2324

Poster Abstract 11

The solubility of nitrates in water causes rapid movement through the soil and is a major source of groundwater pollution in shallow rooted vegetable crops. Nitrate-nitrogen leaching has been traditionally determined by lysimeters. But as the lysimeter studies are expensive and the method is not practical for large areas, there is a need for an inexpensive method that can be used to determine NO_3–N leaching over large areas. The objectives of the study were to estimate irrigation efficiency and the deep percolation of NO_3 –N in onion fields using the chloride tracer technique. This study was conducted in two onion fields under drip and furrow irrigation systems in the Mesilla valley of Las Cruces, NM. Monthly soil samples were collected at six depths from two fields. A total of sixteen time domain reflectometry (TDR) sensors (CS 640), eight in each field, were installed at four locations at 20 and 40 cm deep. The monthly soil samples collected up to a depth of 110 cm were analyzed for nitrate-nitrogen and chloride. The evapotranspiration was calculated using crop production functions for the onion, measured irrigation, and meteorological data. Assuming piston flow, irrigation efficiency, calculated using actual irrigation, precipitation data, the concentrations of nitrate and chloride, and an empirical factor for root growth was 87% for onions under a furrow irrigation system and 94% under drip irrigation. Nitrogen loading below the root zone was 170 kg/ha for the furrow irrigated onion field, whereas it was 135 kg/ha for the drip irrigated onion field.

Contact: Parmodh Sharma, NMSU, sharmap@nmsu.edu, 1900 Cole Village, Las Cruces, NM 88005, 575-571-7589

LOS LUNAS HABITAT RESTORATION SITE FISHERIES AND NURSERY HABITAT MONITORING

Michael D. Hatch, SWCA Environmental Consultants, 5647 Jefferson Street NE, Albuquerque, NM 87109; mhatch@swca.com; 517-285-8142

Eric J. Gonzales, SWCA Environmental Consultants; egonzales@swca.com

Sarah E. Beck, SWCA Environmental Consultants; sbeck@swca.com

Poster Abstract 12

SWCA Environmental Consultants have recently conducted investigations in floodplain habitats of the Middle Rio Grande near Los Lunas to document and define the importance of these habitats to the reproductive biology of the Rio Grande silvery minnow (*Hybognathus amarus*; silvery minnow). Hatch and others (2008) speculated that floodplain collections of young-of-year silvery minnow were attributable to the species adaptively and preferentially spawning in low water exchange lateral habitats, including most importantly backwater and other hydrologic retentive floodplain habitats, when possible to reduce downstream displacement of eggs and larvae. The collection of large numbers of spawning adult silvery minnow and their embryos in fyke nets that were set in low water exchange floodplain habitats near Los Lunas during May and June 2008 is evidence in support of this working hypothesis. Observations of silvery minnow in floodplain habitats along with covariate measures of environmental variables will help to reveal linkages of habitat patch occupancy to habitat patch characteristics. Only with this knowledge can a properly functioning nursery habitat reference state be defined to guide future habitat restoration efforts to enhance silvery minnow reproduction and recruitment.

Contact: Eric J. Gonzales, SWCA Environmental Consultants, egonzales@swca.com, 5647 Jefferson Street NE, Albuquerque, NM 87109, 505-254-1115, Fax 505-254-1116

DRAINAGE FIELD ASSESSMENT PROTOCOL

Sarah Williamson, Civil Engineering, NMSU, PO Box 3158, Las Cruces, NM 88003; shara@nmsu.edu; 505-692-0426

Adrian Hanson, Civil Engineering, NMSU, MSC 3CE, PO Box 30001, Las Cruces, NM 88003-8001; athanson@nmsu.edu; 575-646-3032

Poster Abstract 13

The valve and float mechanism designed is intended for use in measuring hydraulic loading rates for residential septic drainage fields. The mechanism regulates fluctuating water levels and maintains water level in drainage lines. The preliminary design and testing has been performed in a university laboratory with intent to test the mechanism in a previously established drainage field. A unique local residence with two drainage fields will be utilized in order to test the design. This residence has one failed drainage field that has been inactive for nearly a year and a half and one active system, which was implemented shortly after the first system failed. Hydraulic acceptance rates will be tested on the old system and compared to the new system. After the first opportunity to test the apparatus in the field, further lab work will likely be required to modify the design and analyze collected data.

Contact: Sarah Williamson, Civil Engineering, NMSU, shara@nmsu.edu, PO Box 3158, Las Cruces, NM 88003, 505-692-0426

PROGRESS REPORT ON DEVELOPMENT OF AN ANNOTATED BIBLIOGRAPHY FOR TRANSBOUNDARY AQUIFER SYSTEMS OF THE MESILLA BASIN-PASO DEL NORTE AREA, NEW MEXICO, TEXAS (USA), AND CHIHUAHUA (MEX)

John W. Hawley, NM Water Resources Research Institute, NMSU, Box 30001, MSC 3167, Las Cruces, NM 88003-8001; hgeomatters@qwestoffice.net; 505-255-4847

Alfredo Granados-Olivas, Universidad Autónoma de Ciudad Juárez, Ciudad Juárez, Chihuahua, México; agranados@uacj.mx

Poster Abstract 14

The 2007 United States-Mexico Transboundary Aquifer Assessment Act program's goal is to characterize, map, and model priority transboundary aquifers along the United States-Mexico border at a level of detail determined to be appropriate for the particular aquifer. Studies mandated by this program include an assessment of the Mesilla Basin aquifer system by New Mexico offices of the U.S. Geological Survey (USGS) and Water Resources Research Institute at NMSU (NMWRRI), with work done in cooperation with a binational group of state- and federal-level organizations. One of the initial tasks is to "compile extant information," including a bibliography of transboundary aquifers of the Mesilla Basin-Paso del Norte region of New Mexico, Texas, and Chihuahua. The NMWRRI leads this effort in collaboration with the Universidad Autónoma de Ciudad Juárez—Department of Civil and Environmental Engineering (CEE/UACJ), and the USGS. A draft reference list, with provisional alphanumeric cross-referencing codes for almost 400 items, has already been developed for the NM-TX-Chihuahua Transboundary region. Major topics include: bibliographies, biographies, and reviews; historical documents; environmental and geologic settings; basic hydrogeologic concepts; GIS/remote sensing and land-use planning; regional hydrogeology-geohydrology; basin/local-scale aquifer systems (hydrogeology, hydrochemistry, geophysics, and groundwater-flow models); and paleohydrology. Ultimately, short explanatory annotations (English/Spanish) will be created for specific references as needed, and EndNote® software will be used to facilitate bibliography, reference-list and footnote word processing. After peer review, the NMWRRI will create a bilingual (hardcopy and online) publication for joint release by NMWRRI and CEE/UACJ, which will be posted on appropriate internet sites.

Contact: John W. Hawley, NM WRRI, hgeomatters@qwestoffice.net, PO Box 4370, Albuquerque, NM 87196-4370, 505-255-4847, Fax 505-255-4847

NMDA AQUIFER SENSITIVITY: DRASTIC MODEL

Mark Smith, NM Water Resources Research Institute, NMSU, Box 30001, MSC 3167, Las Cruces, NM 88003-8001; smithmr@nmsu.edu; 702-204-7855

Poster Abstract 15

The purpose of this project is to show areas of vulnerability in aquifers that have the potential to contaminate groundwater with certain pesticides. This aquifer sensitivity is calculated using the DRASTIC model, which includes the following parameters: (D) depth to groundwater, (R) recharge rate of the aquifer, (A) aquifer media, (S) soil type, (T) topographic slope, (I) impact of the vadose zone, and (C) conductivity. Each parameter has an assigned weight determined by the amount of impact by the pesticide on the aquifer; the higher the weight, the more impact the parameter has on affecting the aquifer sensitivity and vice-versa.

The final phase of the project will consist of ten interactive mapping services available online at: http://river.nmsu.edu/website/nmda/. The first map will display a generalized statewide aquifer sensitivity map. The other maps will display aquifer sensitivity for nine regions across the state of New Mexico. Additional layers in the final maps will include land use, land ownership, watershed regions, streams, highways, and many others that will enhance the detail of the regions. Functions of the online mapping service make the maps interactive. Users can pan and zoom around the map, buffer features, perform queries, measure distances, and print customized maps.

For more information about this project or the DRASTIC model, please refer to the website listed above.

Contact: Mark Smith, NM WRRI, smithmr@nmsu.edu, 702-204-7855

ONSITE WASTEWATER MANAGEMENT FOR NEW MEXICO TRIBAL LANDS

Angela Dreager, Civil Engineering, NMSU, PO Box 30001, MSC-3CE,
Las Cruces, NM 88003-8001; agregory@nmsu.edu; 575-805-5811

LeeAnn Demouche, Extension Plant Sciences, NMSU; ldemouch@nmsu.edu; 575-646-3973

Adrian Hanson, Civil Engineering, NMSU, PO Box 30001, MSC-3CE,
Las Cruces, NM 88003-8001; athanson@nmsu.edu; 575-646-3032

Poster Abstract 16

Since the early 1900s, sanitation on reservations has improved; however, the mission to improve health and technologies cannot continue without additional efforts to do so. In 1955, the age adjusted gastrointestinal disease death rate for all American and Alaskan Natives was 15.4 percent per 100,000 population, 4.3 times larger than all other races in the U.S. By 1985, the age adjusted gastrointestinal disease death rate had decreased to 2.2 percent per 100,000 population. To help Native American Tribes of New Mexico in these efforts, viable information regarding the treatment of decentralized wastewater was collected to develop a curriculum that would have positive repercussions on wastewater treatment technologies for future generations. NM Tribes are typically limited by location and rural conditions, and when such is the case, it is not feasible to make use of centralized wastewater treatment. Other limiting factors include high system failure rates, non-compliant systems, lack of inspection practices/programs, and too few computerized data collection systems for their wastewater systems. A great deal of Tribes are now building infrastructure such as schools and hospitals that will require more advanced treatment and larger treatment systems. To understand the needs of the Tribes, an assessment was developed and evaluated, finding that there was a need for lower septic failure rates, soils knowledge, treatment options, and regulations. Other materials researched and included in the development of the curriculum were management, history of development of sanitation practices, reuse, and advanced systems.

Contact: Leeann DeMouche, Extension Plant Sciences, NMSU, ldemouch@nmsu.edu, MSC 3169 NMSU, PO Box 30003, Las Cruces, NM 88003-8003, 575-646-3973, Fax 575-646-3808

IT'S GETTING CLEARER: HOW UNDERSTANDING THE TEMPORAL BEHAVIOR OF BIOMASS DENSITY MAY IMPROVE SECONDARY CLARIFIER PERFORMANCE IN CENTRAL NEW MEXICO WASTEWATER PLANTS

Patricia Jones, University of New Mexico, MSC01 1070, 1 University of New Mexico, Albuquerque, NM 87131-0001; mcpattij@unm.edu; 505-463-3546

Andrew Schuler, University of New Mexico, MSC01 1070, 1 University of New Mexico, Albuquerque, NM 87131-0001; schuler@unm.edu; 505-277-4556

Poster Abstract 17

Activated sludge sedimentation (secondary clarification) remains a critical and often problematic component of wastewater treatment processes in the U.S and around the world. The most common solids separation problem is "bulking" sludge, where flocculated biomass fails to settle efficiently and compress adequately for efficient clarifier operation, leading to diminished effluent quality, dilute solids streams in downstream treatment processes, increased operation costs, increased operator oversight, and decreased treatment capacity. Substantial research has been conducted evaluating the influences of filamentous bacteria and physical parameters, such as floc size and shape on solids separation.

Biomass density (the physical mass per volume of microbial cells) has been a long-neglected factor affecting biomass sedimentation, yet this property is the driving force of the settling process. Recent research in our laboratory has demonstrated that biomass density varies significantly across treatment plants, and this variability can have a large effect on sedimentation rates. Biomass density, therefore, appears to be a key "missing link" in our understanding and control of secondary clarification processes. Ongoing research in our laboratory seeks to evaluate temporal components of density effects on settleability, along with the contributions of filamentous organisms, across a range of wastewater treatment systems in central New Mexico. Over the course of five months of sampling, a negative correlation between SVI and density has been observed and a seasonal fluctuation in both SVI and density has been observed. Biomass density measurement is a simple, repeatable test that could be a useful tool in evaluating process conditions and making operation decisions. These results point to practical guidelines resulting from fundamental insights that may provide for improved effluent quality and system performance.

Contact: Patricia Jones, University of New Mexico, mcpattij@unm.edu, MSC01 1070, 1 University of New Mexico, Albuquerque, NM 87131-0001, 505-463-3546, Fax 505-277-1988

IMPROVING HABITAT FOR THE RIO GRANDE SILVERY MINNOW IN THE MIDDLE RIO GRANDE, NEW MEXICO

Grace M. Haggerty, NM Interstate Stream Commission, 121 Tijeras NE, Suite 2000, Albuquerque, NM 87102; grace.haggerty@state.nm.us; 505-765-2053

Anders Lundahl, NM Interstate Stream Commission, anders.lundahl@state.nm.us; 505-765-2054

Page Pegram, NM Interstate Stream Commission, page.pegram@state.nm.us; 505-764-3890

Peter Wilkinson, NM Interstate Stream Commission, peter.wilkinson@state.nm.us; 505-827-5801

Joseph Fluder, SWCA Environmental Consultants, 5647 Jefferson St. NE, Albuquerque, NM, 787109; jfluder@swca.com; 505-254-1115

Matt McMillan, SWCA Environmental Consultants

Poster Abstract 18

The creation of effective spawning and recruitment habitat for the endangered Rio Grande silvery minnow in the middle Rio Grande in the reach between the Angostura and Isleta diversion dams is the main focus of recent habitat restoration efforts by the New Mexico Interstate Stream Commission to address Endangered Species Act (ESA) requirements. In this reach in particular, the construction of Cochiti dam in addition to earlier placement of jetty jacks and levees has resulted in river channelization and the disconnection of the active river channel from the floodplain. In light of evidence that Rio Grande silvery minnow, a pelagic-spawning fish, show population increases in years when spring runoff inundates extensive areas on the floodplain, the emphasis of restoration activities has been to utilize and monitor various techniques that would create overbank habitat for egg retention, spawning, and early life stages. Two phases of habitat restoration have been implemented with funding from the State of New Mexico and the Middle Rio Grande Endangered Species Collaborative Program with construction of over 100 acres of aquatic habitat that function over a range of discharges. Examples of techniques include bankline destabilization, non-native vegetation removal and lowering of channel disconnected islands and attached bars, creation of side channels and backwaters within the floodplain, and placement of large woody debris. Post-construction monitoring included topographic, vegetation, and fish surveys to determine the effectiveness of the restoration techniques. While additional monitoring is needed, preliminary evaluation indicates that many of the techniques are functioning well to increase habitat.

Contact: Grace Haggerty, NM Interstate Stream Commission, grace.haggerty@state.nm.us, 121 Tijeras, NE, Suite 2000, Albuquerque, NM 87102, 505-765-2053, Fax 505-764-3893

FOULING OF RO MEMBRANES TREATING EFFLUENT FROM BIOLOGICAL WASTEWATER TREATMENT PROCESSES

Elizabeth Field, Civil Engineering, UNM; elfield@unm.edu; 505-277-2722

Rochelle Jim, Civil Engineering, UNM; rlnjim@unm.edu; 505-277-2722

Bruce Thomson, Water Resources, UNM; bthomson@unm.edu; 505-277-4729

Kerry Howe, Civil Engineering, UNM; howe@unm.edu; 505-277-2702

Poster Abstract 19

Rapid growth in the southwestern U.S. is placing increasing demands on limited water resources. Several communities in New Mexico are constructing or planning projects to use treated wastewater to augment their drinking water supplies, a process known as indirect potable reuse. These systems will treat wastewater using the membrane bioreactor (MBR) process, followed by Reverse Osmosis (RO). The treated water will be stored in either surface reservoirs or underlying aquifers, then blended with native ground water, given additional treatment, and introduced to the distribution system.

While there is extensive literature on both the MBR and RO processes, there is little understanding of the interactions between them. Of particular interest is the potential for fouling as effluent from the MBR process contains high concentrations (i.e., > 5 mg/L) of dissolved organic matter (DOM) as well as high concentrations of scale-forming constituents, including calcium, magnesium, and silica. Fouling depends on the degree of wastewater treatment plant as well as the wastewater chemistry.

A series of field scale pilot studies was conducted to determine the characteristics of DOM from variations of biological wastewater treatment processes and determine the impact on fouling of RO membranes. A small (7,000 gal/d) RO plant was used to treat effluent from different types of biological wastewater treatment plants including an aerated lagoon, conventional activated sludge, and using the MBR process. Methods used to characterize the treated wastewater included measurement of specific UV absorbance (SUVA), dissolved organic carbon (DOC), carbohydrates, proteins, and UV fluorescence. The fouling rate of RO membranes treating different types of wastewater was compared to that when treating tap water.

Contact: Bruce Thomson, Water Resources, UNM, bthomson@unm.edu, MSC05-3110, University of New Mexico, Albuquerque, NM 87131, 505-277-4729, Fax 505-277-1988

COLORIMETRIC FLOW INJECTION ANALYSIS OF IRON(II) IN NATURAL WATERS AT THE NANOMOLAR LEVEL

Andrea Higdon, Chemistry, New Mexico Tech, 801 Leroy Place, Box 2529, Socorro, NM 87801; higdona@nmt.edu; 575-517-0549

Eric Osantowski, Chemistry, New Mexico Tech, 801 Leroy Place, Socorro, NM 87801; eosantow@nmt.edu

Michael J. Pullin, Chemistry, New Mexico Tech, 801 Leroy Place, Socorro, NM 87801; mpullin@nmt.edu

Poster Abstract 20

Iron analysis in aqueous solutions is important for water quality control and for understanding redox processes in the environment. Current methods of iron analysis can determine iron(II) and total iron in water samples down to micromolar concentrations. However, in some environments researchers desire to analyze iron at nanomolar concentrations, such as in areas of the ocean where iron is a limiting nutrient. This work details the development and performance of an automated colorimetric analysis method (flow injection analysis) for low iron (II) concentrations in natural waters. This method uses a liquid waveguide flow cell with a 1 meter pathlength to increase the sensitivity of the method. However, increasing the pathlength of the colorimetric analysis method also increases the noise in the analysis, degrading the method's signal to noise ratio and its sensitivity. This work will detail the various sources of noise in this analysis and our efforts to minimize each of them. Overall, this iron(II) analysis method is capable of analyzing iron(II) down to concentrations as low as 4 nM.

Contact: Andrea Higdon, Chemistry, New Mexico Tech, higdona@nmt.edu, mpullin@nmt.edu, 801 Leroy Place, Box 2529, Socorro, NM 87801, 575-517-0549

STAGE-DISCHARGE RATING CURVE DEVELOPMENT OF THE GALLINAS RIVER AND ACEQUIAS IN THE LAS VEGAS, NEW MEXICO, AREA

Bildad Eyong, Natural Sciences, New Mexico Highlands University, Box 9000, Las Vegas, NM 87701; bildad_ee@yahoo.com; 443-983-9117

William Jaremko-Wright, Natural Sciences, New Mexico Highlands University, Box 9000, Las Vegas, NM 87701

Michael Meyer, Natural Sciences, New Mexico Highlands University, Box 9000, Las Vegas, NM 87701; mlmeyer@nmhu.edu

Chemanji Shu-Nyamboli, Natural Sciences, New Mexico Highlands University, Box 9000, Las Vegas, NM 87701

Luis Aguirre, New Mexico Office of the State Engineer

Alan Cuddy, New Mexico Office of the State Engineer

Poster Abstract 21

The Office of the State Engineer (OSE) initiated a stage-discharge rating curve development study of the Gallinas River, irrigation ditches, and acequias with the assistance of New Mexico Highlands University (NMHU) in the Las Vegas, New Mexico, area in the spring of 2008. Staff gauges were installed in the river, ditches, and acequias at approximately 20 locations extending from the El Porvenir, through the City of Las Vegas, and to San Augustine. Three NMHU students measured discharge and gauge height at one week intervals during the spring snow melt in May to the end of June 2008. Initial results indicate that rating curves were relatively stable and easy to develop at sites with stable cross-sectional geometry and a wide range in discharge. These sites provided the best R^2 fits to regression analysis. Sites with silt bottoms, unstable cross-sectional geometry, and the potential for the intrusion of plants exhibited rating curves with lower R^2 values. Further studies will assist the OSE in developing management scenarios for water usage in the Gallinas River watershed.

Contact: Bildad Eyong, Natural Sciences, New Mexico Highlands University, bildad_ee@yahoo.com, Box 9000, Las Vegas, NM 87701, 443-983-9117, Fax 505-425-3103

A COST-BENEFIT ANALYSIS OF WATER DISTRIBUTION SYSTEM LEAK DETECTION AND THE POTENTIAL FOR REAL WATER SAVINGS FOR WATER SYSTEMS IN NEW MEXICO

Shawn Hardeman, NM Environmental Finance Center, New Mexico Tech; rakashawn@earthlink.net

Heather Himmelberger, NM Environmental Finance Center, New Mexico Tech; Heatherh@iera.nmt.edu; 505-924-7028

Bruce Thomson, Water Resources, UNM; bthomson@unm.edu; 505-277-4729

Janie Chermak, Economics, UNM; jchermak@unm.edu

Poster Abstract 22

As the competition for new water sources increases, water systems must take a hard look at how water is used and lost in their distribution systems. Water loss due to leaks from drinking water distribution systems are costly and can affect a community's ability to provide water to its customers. There are a number of leak detection methods and strategies available for water systems to choose from. However, leak detection is a costly process and only identifies some fraction of the real water loss, thus there is a tradeoff between the benefit of reduced real water loss and the cost of leak detection. This project developed a process for determining the optimal allocation of resources to leak detection activities known as the Economic Leakage Level, which is based on the value of the water lost, the faction of real losses recovered using leak detection, and the cost of leak detection method. The process was illustrated by applying it to selected community water systems in New Mexico.

Contact: Bruce Thomson, Water Resources, University of New Mexico, bthomson@unm.edu, MSC05-3110, Albuquerque, NM 87131, 505-277-4729, Fax 505-277-1988

IDENTIFICATION OF WATER EFFICIENT BIODIESEL CROPS FOR EASTERN NEW MEXICO

Sangu Angadi, Agricultural Science Center at Clovis, NM 88101; angadis@nmsu.edu; 575-985-2292

Calvin Trostle, Texas AgriLife Extension, Lubbock, TX

Sultan Begna, Agricultural Science Center at Clovis, NM 88101

K. Annadurai, Agricultural Science Center at Clovis, NM 88101

Wahby Hassany, Agricultural Science Center at Clovis, NM 88101

Poster Abstract 23

Interest in biodiesel crops in eastern New Mexico is increasing with construction of a biodiesel plant in Clovis. However, decreasing water resources necessitate identifying water efficient biodiesel crops for the region. Field studies were conducted at the Agricultural Science Center at Clovis during the summer of 2007 to develop irrigation water application and seed yield relationships for sunflower and spring canola. The trials were conducted with a surface drip irrigation system. Water meters were used to measure the amount of irrigation. The treatments ranged from no irrigation after establishment to 12" of irrigation equally distributed during the season, while timing of irrigation also focused on a few treatments. In spite of good rainfall early in the season both crops responded to irrigation amounts. Plant height and seed yield of sunflower responded to water management, but oil content remained the same. Canola seed yield also varied with water management. The preliminary observations indicate that canola and sunflower will respond to irrigation water management. Multiple year data from this study can be used to develop a regression model that farmers can use to target their crop and yield goals based on the availability of irrigation water.

Contact: Sangu Angadi, New Mexico State University, angadis@nmsu.edu, Agricultural Science Center at Clovis, 2346 SR 288, Clovis, NM 88101, 575-985-2292

THE ALUMINUM INTERFERENCE IN FLOURIDE DETERMINATIONS IN ACIDIC MINE DRAINAGE WATERS BY ION SELECTIVE ELECTRODE

Rachel Fry, Chemistry, New Mexico Tech, 801 Leroy Place, Socorro, NM 87801; rfry@nmt.edu; 575-835-6185

Michael J. Pullin, Chemistry, New Mexico Tech, 801 Leroy Place, Socorro, NM 87801; mpullin@nmt.edu; 575-835-6185

Poster Abstract 24

Flouride is often found at appreciable concentrations in natural waters impacted by acidic mine drainage (AMD). The standard method for determining the fluoride concentration in aqueous solutions is by a fluoride ion selective electrode (ISE). However, the high concentration of aluminum in AMD waters is known to interfere in the determination of fluoride by ISE. Equilibrium calculations and experiments suggest that this interference is not entirely due to the commonly assumed reason, the formation of aluminum-fluoride complex ions. Instead, the formation of aluminum-containing colloids that scavenge fluoride from solution appears to be the main reason for this interference. This work proposes a new sample preparation procedure that eliminates the interference of aluminum in the determination of fluoride by ISE in these samples.

Contact: Rachel Fry, Chemistry, New Mexico Tech, rfry@nmt.edu, mpullin@nmt.edu, New Mexico Tech, 801 Leroy Place, Socorro, NM 87801, 575-835-6185, Fax 575-835-5364

FLUX MEASUREMENTS AT ELEPHANT BUTTE RESERVOIR, NEW MEXICO

Jimmy Moreno, Civil Engineering, NMSU, MSC 3CE, Las Cruces, NM 88003; jimoreno@nmsu.edu
A. Salim Bawazir, Civil Engineering, NMSU, MSC 3CE, Las Cruces, NM 88003; abawazir@nmsu.edu
J. Phillip King, Civil Engineering, NMSU, MSC 3CE, Las Cruces, NM 88003; jpking@nmsu.edu
Zohrab Samani, Civil Engineering, NMSU, MSC 3CE, Las Cruces, NM 88003; zsamani@nmsu.edu
Nabil G. Shafike, NM Interstate Stream Commission; nabil.shafike@state.nm.us

Poster Abstract 25

The Elephant Butte Reservoir (EBR) plays a major role in the management and distribution of water to southern New Mexico, Texas, and Mexico. Official evaporation from EBR is currently estimated from a single Class-A evaporation pan placed on a hill southeast of the reservoir that does not represent the same meteorological conditions as EBR. A pan coefficient of 0.7 is used to compute lake evaporation from pan evaporation measurements. Stage-surface-area tables developed from periodic hydrographic surveys are used to relate the depth measurement of evaporation to the volume of water lost from the reservoir. Pan coefficients are highly variable and depend on climate, season, and local conditions. This study measured flux above EBR using the eddy covariance technique with an objective to improve evaporation estimates for better management.

A yearly pan coefficient of 0.41 was found when pan evaporation was compared to the eddy covariance method. Total evaporation (extrapolated over missing data) was found to be 1.09 meters for the eddy covariance method and 1.23 meters for the bulk aerodynamic method in 2006. The pan method was found to overestimate evaporation when compared to eddy covariance and bulk aerodynamic methods. Wind velocity and vapor pressure was found to have a greater influence on evaporation of EBR than net radiation in contrast to land based evapotranspiration towers.

Contact: Jimmy Moreno, Civil Engineering, New Mexico State University, jimoreno@nmsu.edu, PO Box 35, Mesilla Park, NM 88047, 575-646-6103, Fax 575-646-6049

AN INTEGRATED ASSESSMENT MODEL FOR UNDERSTANDING THE IMPACTS OF CO_2 EMISSION REDUCTION POLICIES ON WATER, AGRICULTURE, AND ECONOMICS

Donatella Pasqualini, LANL, Los Alamos, NM; dondy@lanl.gov; 505-667-0701

Paolo Patelli, University of Trento, via Inama 1, Trento, Italy; paolo@santafe.edu; 505-955-1411

Poster Abstract 26

CO_2 emissions are the result of several coupled processes. The coupling among these different processes leads to a complex nonlinear system. In particular, to reduce CO_2 emissions the understanding of the interrelationships among climate, water, agriculture, green house gas emissions, population, and economic systems is crucial.

We developed an integrated assessment model to understand the dynamic behavior of this global system. Our research focus is the investigation of CO_2 emission reduction policies specifically on water infrastructures, agriculture, and economics. As a modeling approach, we used the system dynamics approach, which is well suited to study rich and complex interrelations among different components. The nature of the model is not predictive but prognostic, helping to unravel the most important feedbacks in the system.

We also designed a web-based user-interface that allows stakeholders to use the model and explore potential future scenarios and mitigation policies. The model was developed and calibrated using data and information for Sonoma County in California.

The model is integrated in the web-portal developed for the Sonoma Project initiative, whose general goal is to inform and promote public discussion about energy and water resilience and carbon neutrality. This project will be summarized in a different contribution at this symposium (Keating et al.).

Contact: Donatella Pasqualini, Los Alamos National Laboratory, dondy@lanl.gov, Los Alamos, NM, 505-667-0701, Fax 505-667-1628

URANIUM AND HEAVY METALS IN MACROINVERTEBRATES IN THE SANTA FE RIVER ON THE COCHITI RESERVATION

Carlos R. Herrera, Natural Resource Management, New Mexico Highlands University, Box 9000, Las Vegas, NM; cherrer7@student.nmhu.edu; 505-426-2243

Michael L. Meyer, Natural Science, New Mexico Highlands University, Box 9000, Las Vegas, NM; mlmeyer@nmhu.edu; 505-426-2267

Poster Abstract 27

Benthic macroinvertebrates provide useful spatial and temporal patterns of contamination not easily obtained using conventional surface water or groundwater measures. This project is designed to analyze the effect of the retired La Bajada uranium/copper mine on aquatic macroinvertebrates' uranium and heavy metal concentrations in the Santa Fe River located on the Cochiti Reservation. This project focuses on the accumulation and biomagnification of uranium and selected heavy metals within macroinvertebrate feeding guilds to assess the effect of uranium mining on macroinvertebrate feed groups. Four sampling sites were selected in the Santa Fe River to reflect different habitats within the stream environment. At the four sites, macroinvertebrates, sediment, and water samples were collected following EPA and USGS protocol. A total of 65 invertebrate samples, 22 sediment samples, and 15 water samples were analyzed by ICP-MS. The wide variety of metals reported using ICP-MS provides us a wide variety of metals to compare and analyze. Preliminary results suggest uranium is present at very low levels in invertebrates, water, and sediment. Upon further analysis of data we hope to establish a correlation between the concentrations of heavy metals in the water, sediment, and invertebrates. Study results will be disseminated to the Pueblo of Cochiti as well as other interested parties, including NMED, US Forest Service, Bureau of Land Management, USGS, and the City of Santa Fe.

Contact: Carlos Herrera, New Mexico Highlands University, cherrer7@student.nmhu.edu, Box 9000, Las Vegas, New Mexico, 505-426-2243, Fax 505-454-3263

IDENTIFICATION OF MATURE PECAN MOISTURE UPTAKE FROM OBSERVED WATER CONTENT FLUCTUATIONS

Yi Liu, Texas AgriLife Research at El Paso, TAMU, 1380 A&M Circle, El Paso, TX 79927; yiliu@ag.tamu.edu; 915-859-9111

Zhuping Sheng, Texas AgriLife Research at El Paso, TAMU, z-sheng@tamu.edu
Frank Reyes, Texas AgriLife Research at El Paso, TAMU

Poster Abstract 28

Pecan moisture root-uptake can be identified through an elaborate analysis of observed moisture fluctuations. The moisture data for the analysis was collected from July 2006 to February 2008 in a pecan field using ECH2O System, with an interval of 15 minutes at different depths down to 3 ft. During pecan hibernation (without moisture uptake by pecan), soil moisture at any point of the vadose zone below evaporation extinction tends to stabilize at its field capacity in response to the water table through drainage or capillary rise. This supports an assumption that gravitational drainage ceases when the moisture value is equal to or less than the field capacity, while capillary water is rising. The daily moisture increase driven by capillary rise is close to a constant of 0.003 inches based on the field data. When moisture is less than the field capacity during pecan growing, daily pecan moisture uptake is supposed to be the combination of observed daily moisture decrease and the capillary rise. Water uptake is assumed to be zero when soil is saturated, and capillary rise is also considered to be zero when moisture is higher than the field capacity. Daily water uptakes of mature pecan were interpreted from the above observed moisture fluctuations by applying these assumptions. The results are consistent with pecan evapotranspiration values measured using the OPEC system and neutron probe. With insights into pecan moisture root-uptake, guidelines can be developed for irrigation scheduling to conserve water.

Contact: Yi Liu, Texas AgriLife Research at El Paso, TAMU, yiliu@ag.tamu.edu, 1380 A&M Circle, El Paso, TX 79927, 915-859-9111

ESTIMATING A PECAN WATER PRODUCTION FUNCTION USING REMOTE SENSING TECHNIQUES

Rhonda Skaggs, Agricultural Economics, NMSU; rskaggs@nmsu.edu; 575-646-2401

Zohrab Samani, Civil Engineering, NMSU; zsamani@nmsu.edu; 575-646-2904

A. Salim Bawazir, Civil Engineering, NMSU; abawazir@nmsu.edu; 575-646-6044

Max Bleiweiss, Entomology, Plant Pathology, and Weed Science; mbleiwei@nmsu.edu; 575-646-3225

Poster Abstract 29

Pecans are a major agricultural crop in New Mexico. As of 2008, there are approximately 11,000 hectares of pecans in the Elephant Butte Irrigation District, consuming more than one third of the annual diversion. The research presented here provides previously unavailable broad-scale estimates of pecan ET, the extent of deficit irrigation of pecans, and the relationship between pecan yield and ET in southern New Mexico. The data that form the foundation of this paper were generated using the Regional ET Estimation Model (REEM) developed at New Mexico State University for agricultural and riparian vegetation (Samani et al. 2005, 2006, 2007). REEM uses remotely sensed satellite data to calculate ET as a residual of the energy balance. This research extends the results of REEM to an analysis of crop yield response under deficit irrigation. Results indicate that pecan yield response to ET is best expressed as a curvilinear function and that the yield costs (and thus economic costs) of deficit irrigation in the region are high. This research illustrates the linkages that can be made between remote sensing technology, farm-level water management, and yield outcomes.

Contact: Rhonda Skaggs, Agricultural Economics, NMSU, rskaggs@nmsu.edu, MSC 3169 Box 30003, Las Cruces, NM 88003, 575-646-2401, Fax 575-646-3808

ACCURACY OF MOISTURE SENSORS IN SALINE SOILS

Elena Sevostianova, Plant and Environmental Sciences, NMSU; esevosti@nmsu.edu

Bernd Leinauer, Extension Plant Sciences, NMSU, PO Box 30001, Las Cruces, NM 88003-8001; leinauer@nmsu.edu; 575-646-2546

Poster Abstract 30

One of the most challenging problems facing farmers and turfgrass managers in arid and semi-arid climate zones is the accumulation of salts in rootzones as a result of irrigation with low quality saline water and insufficient leaching through rainfall. In order to maintain adequate turf quality and agricultural production, continuous monitoring of soil salinity and moisture with soil sensors is necessary. The salinity level in soils, however, may affect moisture readings, just as moisture levels can affect salinity readings. In addition, the accuracy in measuring moisture and salinity can depend on the type of sensor as well as the soil type. A study was conducted at New Mexico State University to compare the accuracy of four soil moisture and salinity sensors in 2 soil types. We compared soil moisture readings of SDI-12 soil Moisture Transducer, Turf Guard TM Wireless Monitoring System, Watermark Soil Moisture Sensor, and Digital Sun Sensor in a saturated sandy loam (sandy skeletal mixed thermic Typic Torriorthents, volumetric soil moisture 36%) and a silty loam (Typic Torriorthents, volumetric soil moisture 50%) with salinity levels ranging from 2.5 to 15 dS/m for sandy loam and from 6 to 23 dS/m for silty loam. Our results indicate that salinity did not affect soil moisture readings in either soils under saturated conditions.

Contact: Elena Sevostianova, Plant and Environmental Sciences, New Mexico State University, esevosti@nmsu.edu

POTENTIAL IMPACTS OF CHANGES IN RAINFALL INTENSITY ON FLOOD CONTROL INFRASTRUCTURE IN THE LOWER RIO GRANDE OF NEW MEXICO

Susanna Glaze, NM Water Resources Research Institute, NMSU, Box 30001, MSC 3167, Las Cruces, NM 88003-8001; sglaze@wrri.nmsu.edu; 575-646-4337

Poster Abstract 31

Communities in the American Southwest are experiencing the effects of global climate change. These effects are not limited simply to warmer temperatures and drier climates, but also have effects on rainfall intensity. A study by Denault et al. in 2006 explored the impacts of future increases in rainfall intensity on the urban infrastructure and natural ecosystems in a watershed near Vancouver in British Columbia, Canada. Using the framework constructed by the authors, the impacts of potential changes in rainfall intensity in the Lower Rio Grande of New Mexico will be examined. Various statistical analyses will be used to determine if there are trends in rainfall intensity for several different rainfall time durations in the watershed. Any resulting trend lines of statistical significance will be used to extrapolate future rainfall intensities and the resulting runoff. The Storm Water Management Model (SWMM) will be used in conjunction with ArcGIS to model these possible changes in rainfall intensity and the resulting runoff on flood control infrastructure as well as on stream health by examining impervious surface area present. The results of the study will be useful in incorporating issues of climate change into community planning.

Contact: Susanna Glaze, NM WRRI, sglaze@wrri.nmsu.edu, MSC 3167, Las Cruces, NM 88003, 575-646-4337, Fax 575-646-6418

GROUNDWATER DEPTH AND AIR TEMPERATURE EFFECTS ON DISCHARGE AND RUNOFF GENERATION IN THE COLORADO FRONT RANGE

Hernan Moreno, Hydrology, New Mexico Tech, 801 Leroy Place, MSEC118; hmoreno@nmt.edu; 505-835-5457

Enrique Vivoni, Hydrology, New Mexico Tech, 801 Leroy Place, MSEC244; vivoni@nmt.edu; 505-835-5611

Poster Abstract 32

Historical data and projections of climatic forcing on the hydrologic systems in the western U.S. show an increase in air temperatures and drier soils as compared to the last decades. Since the climatic and hydrologic systems are strongly coupled, variations in one lead to non-linear changes in the other and vice-versa. This paper presents simplified quantifications of climatically-forced impacts on the total runoff volume and mechanisms on the Fish creek watershed (106 km^2), Colorado. The main question to be answered is: by how much will this hydrological system change its short-term summer runoff response to possible long-term climatic variations? Different long-term climate scenarios and effects on antecedent soil wetness will be assumed by imposing groundwater initial conditions and air temperature during the simulation period. Basin responses will be compared by the time to peak, peak flow, and runoff coefficient. Extreme cases combine: (1) increases in the soil wetness by increasing the water table elevation, which will be re-enforced by a lower air temperature scenario, and (2) decreases in the antecedent moisture in the soil by deepening of the groundwater table and progressively increasing air temperatures, which will be known as warm scenarios. Despite that results are constrained only by variations in two hydrologic variables, they offer insights on water availability and runoff mechanisms under simple climatic change forcings.

Contact: Hernan Moreno, Hydrology, New Mexico Tech, hmoreno@nmt.edu, 801 Leroy Place, PO Box 2254, 575-835-7660

WATER QUALITY ASSESSMENT IN THE EL PASO VALLEY

Omar Al-Qudah, **Nicole Kyger,** and **Zhuping Sheng**
Texas A&M University Agricultural Research and Extension Center, El Paso, Texas

Poster Abstract 33

The Rio Grande contributes approximately 97 percent of the water used in Texas' Lower Rio Grande Valley for municipal and industrial consumption, crop irrigation, support of riparian vegetation and wildlife, and recreation. In order to better understand El Paso Valley water quality, to track the water flowpath downstream to assess the distribution and dilution of the contaminants over distance, and to investigate the effect of land use and urban areas on the river basin, surface water samples were collected and analyzed from 110 different locations along the Rio Grande basin from El Paso Upper to Lower valley. Also, the geographic coordinates of the surface water points were collected using GPS and GIS technology and then imported into ArcMap to create a hydrological map of the drainage. Using the data derived from the correspondence analysis, the hydrological map shows the concentration and flow distribution of the contaminants. The results of the chemical analysis obtained through ICP, IC, and HORIBA water quality monitoring show that the values of the major ions and salinity exceed the surface water standard values in some points and increased downstream, and this was related to the land use conditions and the interfaces between the groundwater and the surface water in the lower valley.

Contact: Estrella Herrera, edherrera@ag.tamu.edu, Texas A&M University Agricultural Research and Extension Center, El Paso, Texas, 915-859-9111

THE USE OF RECLAIMED EFFLUENTS AND SALTY GROUNDWATER AS IRRIGATION SOURCES FOR COTTON CULTURE

Zhuping Sheng, **Girisha Ganjegunte**, **Estrella Herrera,** and **Yi Liu**
Texas Agrilife Research and Extension Center at El Paso, 1380 A&M Circle, El Paso, Texas

Poster Abstract 34

Rapid urbanization and economic growth along the Texas-Mexico border has resulted in a significant increase in freshwater demands for drinking and agricultural/urban landscape irrigation. Cotton growers will rely increasingly on alternative water sources for irrigation, such as graywater or reclaimed water as more freshwater is diverted for domestic and municipal uses. However, potential impacts of irrigation with these waters with elevated salinity on soil salinity and cotton performance needs to be evaluated before advocating their use on a large scale. This project is a three year study that emphasized both water and soil management to manage successfully salts in graywater irrigated soils used for cotton production. In this 2007 study, we evaluated the impacts of laundry water for cotton production and soil salinity by comparing with freshwater irrigation. Effects of mulch treatment of soil were also evaluated. The results indicate that changes in soil salinity and sodicity were more impacted by significant interactions between irrigation supply and soil conditioning (mulch). With soil conditioning, laundry water produced 80 percent (1053.536 kg/acre) more lint than those without mulch conditioning. With soil conditioning, freshwater produced 150 percent (1207.096 kg/acre) more cotton/lint than those with non conditioning. With soil conditioning, laundry water produced 10 percent (295.104 kg/acre) more seed cotton than freshwater. The results show promising potential for cotton production with laundry water irrigation. It is recommended that additional studies be conducted to verify long-term impacts of laundry water irrigation for cotton production.

Contact: Estrella Herrera, edherrera@ag.tamu.edu, Texas A&M University Agricultural Research and Extension Center, El Paso, Texas, 915-859-9111

RIO GRANDE BASIN INITIATIVE – NEW MEXICO INTERACTIVE STATEWIDE AND COUNTY MAPS ONLINE

Kristen Ronning, NM Water Resources Research Institute, NMSU, Box 30001, MSC 3167, Las Cruces, NM 88003-8001; kronning@nmsu.edu; 575-646-4337
Bobby Creel, NM Water Resources Research Institute, NMSU, Box 30001, MSC 3167, Las Cruces, NM 88003-8001; bcreel@wrri.nmsu.edu; 575-646-4337
Leeann DeMouche, Extension Plant Sciences, NMSU, PO Box 30003, MSC 3AE, Las Cruces, NM 88003-8001; ldemouch@nmsu.edu; 575-646-3973
Susanna Glaze, NM Water Resources Research Institute, NMSU, Box 30001, MSC 3167, Las Cruces, NM 88003-8001; sglaze@wrri.nmsu.edu; 575-646-4337

Poster Abstract 35

The Rio Grande Basin Initiative (RGBI) developed an internet map service that places extensive data from every county in New Mexico conveniently in the format of an interactive map accessible to anyone with an internet connection and requires no special software or training to use. It is available at the following website: http://water.nmsu.edu/website/RGBI/.
The project has been planned in two phases. Phase I, which included initial design and deployment and acquisition/incorporation of environmental and natural resources data into the service, is complete. Phase II is now underway and will complete the service with socio-economic and health related data and software upgrades. Software utilized by New Mexico Water Resources Research Institute (WRRI) for RGBI's development includes ESRI's ArcIMS and ArcSDE and Microsoft SQL Server. ArcServer has been slated to replace ArcIMS in the near future.

Contact: Krisen Ronning, k.ronning@gmail.com, NM Water Resources Research Institute, NMSU, PO Box 30001, MSC 3167, Las Cruces, NM 88003-8001, 575-646-4337