Jesse D. Roberts[2] ((505) 284-2710; jdrober@sandia.gov)

Scott C. James[3] ((505) 845-7227; scjames@sandia.gov)

[1]Sandia National Laboratories, Mechanical Environments, P.O. Box 5800, Albuquerque, NM 87185-1135, United States

[2]Sandia National Laboratories, Carlsbad Programs, 4100 National Parks Highway, Carlsbad, NM 88220, United States

[3]Sandia National Laboratories, Geohydrology Department, P.O. Box 5800, Albuquerque, NM 87185-0735, United States

Soil and sediments play an important role in water management and water quality. Issues such as water turbidity, associated contaminants, reservoir sedimentation, undesirable erosion and scour, and aquatic habitat are all linked to sediment properties and behaviors. *In situ* analysis is necessary to develop an understanding of the erosion and transport of sediments. Sandia National Laboratories has recently patented the ASSET Flume that quantifies in situ erosion of a sediment core with depth while affording simultaneous examination of transport modes (bedload vs. suspended load) of the eroded material. Core erosion rates and ratios of bedload to suspended load transport of quartz sediments were studied with the ASSET Flume. The erosion and transport of a fine-grained natural cohesive sediment were also observed. Experiments using quartz sands revealed that the ratio of suspended load to bedload sediment transport is a function of grain diameter and shear stress at the sediment surface. Data collected from the ASSET Flume were used to formulate a novel empirical relation for predicting the ratio of bedload to suspended load as a function of shear stress and grain diameter for non-cohesive sediments.

H41E MCC: Level 2 Thursday 0830h

The Effects of Best Management Practices on Water Quality, Runoff Processes, and Sediment Transport II Posters *(joint with B, PA)*

Presiding: **D A Burns,** U.S. Geological Survey**; B McGlynn,** Montana State University

H41E-1043 0830h POSTER

Effectiveness of Vegetated Buffer Strips in Reducing Dormant Season Orthophosphate Pesticide Loading to Surface Waters in Glenn County, Northern California

Kristine D GIlbert[1] (530-898-4000; kdgilbert@animail.net)

David L Brown[1] (530-898-4035; dlbrown@csuchico.edu)

Lee Altier[2] (530-898-4137; laltier@csuchico.edu)

Michael N Oliver[3] (530-666-5476; mnoliver@ucdavis.edu)

[1]Dept. of Geological & Environmental Sciences, CSU, Chico, Chico, CA 95929-0205, United States

[2]College of Agriculture, CSU, Chico, Chico, CA 95929-0310, United States

[3]UC Cooperative Extension, UC Davis, Davis, CA 95616, United States

Riparian buffer strips are used in preventing nonpoint source contamination of agricultural runoff. The design and effectiveness of buffers varies widely under differing environmental conditions. Over the past two years, a project was implemented to evaluate the effectiveness of certain Best Management Practices in reducing organophosphate (OP) pesticide transport from almond orchards to local surface waters in Glenn County, northern California. Diazinon is a commonly-used OP pesticide applied during the dormant season in almond and stone-fruit orchards throughout the California Central Valley. Dormant season diazinon application coincides with the months of greatest rainfall and surface runoff in California. Three filter strip treatments were established: one planted with native vegetation, one with weedy resident vegetation, and the third with a bare soil surface. As a demonstration and reconnaissance project, replication of the treatments in this study was lacking (one plot of each vegetation type and two bare ground plots). Diazinon was applied in test orchard cells in January 2003. Surface runoff, shallow groundwater in the root zone, and deeper groundwater were monitored for the transport of diazinon during the three subsequent storm events. Composite surface water samples and flow volumes were obtained for each storm event using automated surface water collectors. Runoff and infiltration results indicate greater infiltration occurred in the vegetated plots as would be expected. Infiltration on bare ground plots was approximately 25%-50% less than on the vegetated plots. However, differences between the two vegetated plot treatments were less than 5%. Diazinon concentrations were reduced as surface runoff crossed the buffer strips for all three treatments. Detectable levels of diazinon were still present in runoff following the third storm, seven weeks after the pesticide application. Further replicated studies are currently being prepared for the coming dormant season and this study will continue over the next three years.

H41E-1044 0830h POSTER

Erosion Management of Construction Sites

Madhu Sudan Pudasaini[1] (612 9852 5776; m.pudasaini@uws.edu.au)

Surendra Prakash Shrestha[1] (612 9852 5733; s.shrestha@uws.edu.au)

[1]School of Engineering and Industrial Design, University of Western Sydney Locked Bag 1797, Penrith South DC, NSW 1797, Australia

Improvements in medical technology and improved lifestyles around the globe have resulted in the population growth trend we see today. The outcome is an ever-increasing demand in construction activities, be it for housing purposes or to provide for additional infrastructures to sustain the population growth and improved lifestyles. Indirect impact of this increase in construction activities is an increase in soil erosion from these (construction sites) activities, accelerating the global threat posed by massive soil erosion from human induced activities. While little, if any, can be done to stop the natural erosion process, timely actions can be taken to reduce erosion resulting from construction activities. The constraint, however, is to strike a balance between adverse economic impacts and associated environmental hazards. This is where effective use can be made of mathematical models specifically developed with aims of predicting soil erosion. For construction activities, these mathematical models can be used to compare adverse impacts of different management practices, with the objective of choosing the most appropriate (i.e. Best) Management Practice (BMP) for minimizing adverse environmental effects. With a plethora of erosion models available, with varied degree of data requirements and associated reliabilities, the dilemma planners and managers face in selecting a set of BMPs for reducing soil erosion from construction activities is the selection of a suitable model itself. This paper addresses this dilemma through selection of a simple yet reliable model that will assist the planners, developers and decision makers in comparing impacts of a range of management practices. The result is the selection of management practices that will meet the economic requirements without causing adverse environmental impacts.

H41E-1045 0830h POSTER

Managing Salinity of Seasonal Wetlands in the San Joaquin River Basin

Rebecca Leonardson[1] (510-642-3245; rebeccal@ce.berkeley.edu)

Nigel W.T. Quinn[2] (510-486-7056; nwquinn@lbl.gov)

John A. Dracup[1] (510-643-4306; dracup@ce.berkeley.edu)

[1]University of California, 533 Davis Hall Mail Code 1710, Berkeley, CA 94720-1710, United States

[2]Lawrence Berkeley Laboratory, 1 Cyclotron Road, 70A-3317H, Berkeley, CA 94720, United States

Management of seasonal wetlands (Refuges) for waterfowl in the San Joaquin Basin of California has been complicated by water quality requirements in the San Joaquin River, into which the wetlands drain. In particular, releases of salt and boron to the river are bound by a Total Maximum Daily Load requirement. At the same time, the US Bureau of Reclamation is exploring opportunities for conjunctive use of groundwater from beneath these wetland areas, which will likely yield pumped water of higher salinity than the surface water currently supplied to the Refuges. This study uses real-time data collection and adaptive management to encourage releases of saline water to coincide with periods of increased assimilative capacity in the river (i.e. elevated rainfall/runoff levels and timed releases from reservoirs upriver.) The wetland system is modeled using the Mike She and Mike 11 software packages, developed by the Danish Hydrologic Institute. The purpose of the model is the forecasting of assimilative capacity, estimation of response to wetland drainage, and simulation of migration of salinity in groundwater.

H41E-1046 0830h POSTER

Telluride, Tom Cruise, and Land Use Codes: Science, Policy, and Community Response

Kim S Raby[1,3] (303-492-5546; rabyk@colorado.edu)

Mark W Williams[1,2] (303-492-8830; markw@snobear.colorado.edu)

[1]Institute of Arctic and Alpine Research, 1560 30th Street, Campus Box 450, Boulder, CO 80309

[2]Department of Geography, University of Colorado at Boulder, Boulder, CO 80309

[3]Department of Environmental Studies, University of Colorado at Boulder, Boulder, CO 80309

Mountain areas throughout the western US have experienced a surge in popularity in the last decade, resulting in degradation of the resources that drew people to the area in the first place. Traditional economic interests, recreational users, and environmentalists all have opposing priorities. Thus, resource managers and planners face increasingly critical and controversial decisions regarding development and protection of watersheds. Best Management Practices (BMPs) are generally an attempt to improve land and water quality after degradation. Here we report on our work with local stakeholders in the San Miguel River drainagehome of Telluride Ski Area and Hollywood moguls such as Tom Cruiseto prevent degradation of headwater catchments while providing for reasonable economic and recreational activities. We developed new tools for resource managers by mapping landscape types and associated water quality parameters so as to develop sensitivity criteria that are displayed visually using GIS maps. Using these results, San Miguel County Commissioners adopted land use codes to restrict development, including an 800-sqft building footprint, and bans on septic systems and winter plowing. This case study lays the foundation for science-based policy at the catchment scale, but is dependent on local culture and politics. Preliminary fieldwork was conducted in the summer of 2003 as the first steps toward similar work in adjacent San Juan County, which has a strong mining heritage. The San Juan County Planning Commission identified priority basins for study, and extensive physical field surveys were conducted in these drainages to map spatial distribution and aerial extent of numerous landscape types. Again, water quality parameters will be associated with different land covers to enable alpine sensitivity analysis at the landscape unit scale. Results will be provided to the San Juan Planning Commission to augment current planning tools. However, because of the different political and cultural climates of the two counties, we show that policy outcomes that ensue in San Juan County will likely differ from those achieved in San Miguel County.

H41E-1047 0830h POSTER

Sediment Yield From First Order Streams in Managed Redwood Forests: Effects of Recent Harvests and Legacy Management Practices

Hobie Perry[1] (707.826.5622; chp1@humboldt.edu)

Matt O'Connor[2] (707.431.2810; matto@oe-i.com)

William McDavitt[2] (707.442.7533; billm@oe-i.com)

[1]Humboldt State University, 1 Harpst Street, Arcata, CA 95521, United States

[2]O'Connor Environmental, Inc., PO Box 794, Healdsburg, CA 95448, United States

First order streams in the Van Duzen River and lower Eel River watersheds owned by Pacific Lumber Company (Palco) in Humboldt County, California, were surveyed and small sedimentation basins were installed to develop quantitative estimates of sediment yield. A random study design was developed to investigate the potential effects of different geologic substrates and forest management on sediment yield. The drainage area for these streams was about 5 to 10 ha where fluvial characteristics were expressed. The erosion processes within the scope of this investigation included surface erosion from hillslopes and harvest units, rill and gully erosion that may occur in relation to skid trails (recently used or abandoned), and stream channel erosion, including bank erosion and small-scale mass wasting. Temporary sedimentation basins were installed in 30 randomly chosen channels to quantify relative amounts of sediment yield from watersheds with different management conditions (treatment sites) and second-growth stands not recently entered (control sites). Most treatment sites were clearcut harvests. Two classes of treated sites were sampled: sites harvested under stricter regulations of a Habitat Conservation Plan (HCP) and sites harvested prior to implementation of the HCP. Channel surveys were also conducted to characterize conditions and identify existing evidence of channel erosion and surface erosion

in areas adjacent to the channel. Results from winter 2001/02 suggested that there may be differences in sediment yield among geologic substrates, with the Wildcat having relatively low sediment yield values. Treatment effects were significantly different (ANOVA, $p < 0.05$) when two large landslides were removed from the control sites; the HCP sites had significantly lower sediment yield. There was also a significant interaction between treatment and geologic substrates (ANOVA, $p < 0.05$). Control sites had sediment yield comparable to the pre-HCP treatment sites. The apparent treatment effect on sediment yield may be influenced by the fact that the HCP treatment sites have experienced only one or two post-harvest winters, while the pre-HCP treatment sites experienced relatively severe winters over a longer post-harvest period. In addition, the fact that the control sites tended to have higher sediment yield than the HCP treatment sites suggests that legacy effects of management may also be an important factor.

H41F MCC: Level 2 Thursday 0830h

Nitrogen Sources and Cycling in Aquatic Systems I Posters *(joint with B, OS)*

Presiding: **C Kendall,** U.S. Geological Survey**; R B Alexander,** U.S. Geological Survey**; E W Boyer,** State University of New York

H41F-1048 0830h POSTER

Water-Quality Trends in the Neuse River Basin, North Carolina, 1974-2003

Douglas A. Harned (919-571-4024; daharned@usgs.gov)

U.S.Geological Survey, 3916 Sunset Ridge Road, Raleigh, NC 27607, United States

Data from two U.S. Geological Survey (USGS) sites in the Neuse River basin were reviewed for trends in major ions, sediment, nutrients, and pesticides during the period 1974-2003. In 1997, the North Carolina Division of Water Quality implemented management rules to reduce nitrogen loading to the Neuse River by 30 percent by 2003. Therefore, the 1997-2003 period was reviewed for trends associated with the management changes. The Neuse River at Kinston basin (2,695 square miles) includes much of Raleigh, N.C., with 8-percent urban and 30-percent agricultural land use (1992 data). The Contentnea Creek basin (734 square miles), a Neuse River tributary, is 42-percent agricultural and 3-percent urban. Agricultural land uses in the Contentnea Creek basin have changed over the last decade from predominantly corn, soybean, and tobacco row crops to corn, soybeans, and cotton, with reduced tobacco acreages, and development of the hog industry. Data for this analysis were collected by the USGS for the National Stream Quality Accounting Network and National Water-Quality Assessment Program. Data were examined for trends using the Seasonal Kendall trend test or Tobit regression. The Seasonal Kendall test, which accounts for seasonal variability and adjusts for effects of streamflow on concentration with residuals from LOWESS (LOcally Weighted Sum of Squares) curves, was used to analyze trends in major ions, nutrients, and sediment. The Tobit test, appropriate for examining values with reporting limits, was used for the pesticide analysis. Monotonic trends are considered significant at the alpha < 0.05 probability level. Long-term (1974-2003) decreasing trends in the Neuse River at Kinston were detected for dissolved oxygen, silica, and sediment concentrations; increasing trends were detected for potassium, alkalinity, and chloride. Decreasing trends in Contentnea Creek were detected for silica, sulfate, and sediment concentrations during 1979-2003; increasing trends were detected for pH, hardness, and alkalinity. A pattern of increase until 1990 followed by little change or decline was observed for specific conductance, dissolved solids, hardness, and sulfate in the Neuse River and for potassium in Contentnea Creek. No significant recent (1997-2003) trends were detected for dissolved oxygen, pH, specific conductance, hardness, dissolved solids, or major ions. The Neuse River data indicated a recent declining trend in sediment concentration. Nitrogen concentrations in the form of ammonia, total ammonia and organic nitrogen, and nitrite plus nitrate have declined in both the Neuse River and Contentnea Creek. Total nitrogen concentrations increased in the Neuse River until about 1990 and then declined, primarily because of declines in nitrate. Recent declines are evident in nitrite plus nitrate in the Neuse River and in ammonia concentrations in Contentnea Creek. The data also show a reduction in variation of extreme values after 1990 in Contentnea Creek. Both observations suggest that the 1997 Neuse River management rules have had a detectable effect on nitrogen concentrations. Concentrations of dissolved and total phosphorus and orthophosphate reduced in a step trend in 1988 at both locations. This reflects the 1988 phosphate detergent ban in North Carolina. Orthophosphate concentrations have continued a recent decline in Contentnea Creek. Contentnea Creek has sufficient period of record (1994-2003) of concentrations of atrazine, deethyl atrazine, alachlor, carbaryl, diazinon, and prometon to test for trends. Both alachlor and prometon concentrations showed significant declines. Recent changes in agricultural practices coupled with a 5-year drought probably have affected pesticide use and transport to surface waters.

H41F-1049 0830h POSTER

Submarine Groundwater Discharge and Associated Nitrogen Flux in Coral Reef Lagoons of Mauritius

Meagan Eagle[1] (akeagle@stanfordalumni.org)

Adina Paytan[1] (650-724-4073; apaytan@pangea.stanford.edu)

Roshan T. Ramessur[2] (ramessur@uom.ac.mu)

[1]Stanford University, Department of Geological and Environmental Sciences Braun Hall, BLDG 320, Stanford, CA 94305-2115, United States

[2]University of Mauritius, Department of Chemistry, Reduit 00000, Mauritius

Recent eutrophication in several coral reef lagoons along the Indian Ocean island nation of Mauritius (20°S, 57°E) has highlighted the need for a greater understanding of nutrient sources to these lagoon waters. Submarine groundwater discharge (SGD) into the coastal environment is one possible transport mechanism for excess terrestrial nutrients to coral reef lagoons, since groundwater nitrate levels are an order of magnitude greater than coastal nitrate levels (330 and 30 μM respectively). However, the direct discharge of groundwater into the sea has been difficult to measure, because fluxes may be episodic and patchy in distribution. Here we utilize radium isotopes (224Ra and 223Ra), which desorbs from aquifer sediments when fresh water and salt water interact within the coastal aquifer, as naturally occurring SGD tracers. Given the positive correlations between radium activities, salinity and nitrate concentrations found in the lagoon waters of Mauritius, it is apparent that SGD is a source of nitrate to the coastal lagoons. Based on mass balance of 223Ra activities, submarine groundwater flux per meter of coastline is 116 m3/m along the west coast and more than twice as great on the east coast (323 m3/m). The nitrogen loading associated with SGD in the east coast lagoon (0.28 g N/m3) is likewise twice that in the west coast (0.14 g N/m3). Regions of the east coast lagoon have recently experienced eutrophication, while the west coast has not experienced significant algal blooms, suggesting that the nitrogen loading along the east coast may be negatively impacting the health of the coral reef lagoon. Given the sensitivity of the marine environment to excess nutrients and the potential groundwater transport of such nutrients far from their source, there is a clear need for greater understanding of groundwater nutrient transport to the lagoons of Mauritius.

H41F-1050 0830h POSTER

Tracing Nitrate Contributions to Streams During Varying Flow Regimes at the Sleepers River Research Watershed, Vermont, USA

Stephen D Sebestyen[1] (315 470 6988; sdsebest@syr.edu); James B Shanley[2] (802 828 4466; jshanley@usgs.gov); Elizabeth W Boyer[1] (315 470 4818; ewboyer@syr.edu); Nobuhito Ohte[3] (650 329 4649; nobuohte@usgs.gov); Daniel H Doctor[4] (650 329 4544; dhdoctor@usgs.gov); Carol Kendall[4] (650 329 4576; ckendall@usgs.gov)

[1]State University of NY College of Environmental Science and Forestry, 211 Marshall Hall, 1 Forestry Dr, Syracuse, NY 13210, United States

[2]US Geological Survey, PO Box 628, Montpelier, VT 05602, United States

[3]Kyoto University, Dept of Environmental Science and Technology, Kyoto 00000, Japan

[4]US Geological Survey, Bldg 15, McKelvey Building, Menlo Park, CA 94025, United States

Quantifying sources and transformations of nitrate in headwater catchments is fundamental to understanding the movement of nitrogen to streams. At the Sleepers River Research Watershed in northeastern Vermont (USA), we are using multiple chemical tracer and mixing model approaches to quantify sources and transport of nitrate to streams under varying flow regimes. We sampled streams, lysimeters, and wells at nested locations from the headwaters to the outlet of the 41 ha W-9 watershed under the entire range of flow regimes observed throughout 2002-2003, including baseflow and multiple events (stormflow and snowmelt). Our results suggest that nitrogen sources, and consequently stream nitrate concentrations, are rapidly regenerated during several weeks of baseflow and nitrogen is flushed from the watershed by stormflow events that follow baseflow periods. Both basic chemistry data (anions, cations, & dissolved organic carbon) and isotopic data (nitrate, dissolved organic carbon, and dissolved inorganic carbon) indicate that nitrogen source contributions vary depending upon the extent of saturation in the watershed, the initiation of shallow subsurface water inputs, and other hydrological processes. Stream nitrate concentrations typically peak with discharge and are higher on the falling than the rising limb of the hydrograph. Our data also indicate the importance of terrestrial and aquatic biogeochemical processes, in addition to hydrological connectivity in controlling how nitrate moves from the terrestrial landscape to streams. Our detailed sampling data from multiple flow regimes are helping to identify and quantify the "hot spots" and "hot moments" of biogeochemical and hydrological processes that control nitrogen fluxes in streams.

H41F-1051 0830h POSTER

Septic Nitrate Contamination of Multiple Municipal Wells: Trends and Remedial Efforts

Dan Dragan[1] (1-775-954-4600; ddragan@mail.co.washoe.nv.us)

Christian A. Kropf[1] (1-775-954-4600; ckropf@mail.co.washoe.nv.us)

[1]Washoe County Department of Water Resources, 4930 Energy Way, Reno, NV 89502, United States

Fifteen years of groundwater quality monitoring in the Spanish Springs Valley, Nevada, have shown increasing levels of nitrate in municipal wells. Three of the six municipal wells have nitrate concentrations just under the U.S. EPA MCL of 10 mg/L. More than 2,000 homes on septic sewage disposal systems are located within a four square-mile area - with almost half of these systems within 2,000 feet of one or more of the municipal wells. A 1999 USGS study concluded that increasing nitrate levels can be linked to local septic systems. This study, completed in January 2003, is a preliminary step to define the lateral and vertical extent of nitrate contamination in the valley and identify the vertical mixing zone of the pollutant. The preliminary conceptual model of contaminant migration was confirmed by the study. Although a discontinuous clay aquitard is acting to slow vertical migration of contamination, the combination of numerous septic systems and their proximity to shallow-screened, high-volume municipal wells, leads to the present situation. Concentrations of nitrate in groundwater collected from all existing shallow monitor wells were above the MCL, with a maximum concentration greater than three times the MCL. In addition, concentrations of nitrate in groundwater collected from deeper wells within the assumed plume were elevated as compared to background concentrations.

H41F-1052 0830h POSTER

Nutrient Uptake and Cycles of Change: the Ventura River in Southern California

Al Leydecker[1] (805-569-1748; al.leydecker@cox.net)

Julie Simpson[2] (805-893-7398; simpson@lifesci.ucsb.edu)

Leigh Ann Grabowski[3] (lag@sbck.org)

[1]Marine Science Instutite, University of California, Santa Barbara, CA 93106, United States

[2]Dept. of Ecology, Evolution and Marine Biology, University of California, Santa Barbara, CA 93106, United States

[3]Santa Barbara Chanel Keeper, 714 Bond Street, Santa Barbara, CA 93103, United States

Watersheds in Mediterranean climates are characterized by extreme seasonal and inter-annual rainfall variability. This variability engenders cycles of sediment deposition and removal, algal growth, and the advance and retreat of riparian and aquatic vegetation. In turn, these changes dramatically alter the appearance and biological functioning of rivers and streams, regulating the uptake of nutrients. The Ventura River drains 580 sq. km of mountainous coastal watershed 100 km northwest of Los Angles, Ca. More than 90 % of the average annual rainfall of 500 mm falls between December and March with most of the annual runoff occurring within a few days. Since 1930, annual runoff has varied from 0.01 to 70 cm/ha, with a mean of 12 and median of 4 cm. We have been measuring dissolved nutrient concentrations at four locations on the lower 9 kilometers of the river for the past 3 years (annual runoff of 19, 0.6 and 14 cm, respectively) and quantifying the relative abundance of plants and