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Spring 2007 **Dr. Allen P. Davis, Director** **Dr. Phil Kearney, Assoc Director**

Extreme Water In Maryland A Successful Event

A one-day symposium entitled “Extreme Water in Maryland” was held Friday, October 27, 2006 at the University of Maryland, sponsored by the *Maryland Water Resources Research Center* and *Maryland Sea Grant*

Maryland has suffered severe damage in recent years from several extreme water events. There was keen interest in lessons learned from two past hurricanes and projected problems in the future. Over 75 participants from across the State attended the symposium.

Highlights

Below are some of the highlights presented by several speakers.

Gerry Galloway, CEE, University of Maryland, College Park, MD.

The US faces many water resource challenges including dealing with the consequences of extreme water events such as floods and droughts. Unfortunately the nation does not have any coherent policy that describes how these water challenges should be addressed. As a result the nation deals with hazards as well as other water issues on an ad-hoc basis. Water Professionals must become involved in educating the public about wise use of these resources and influence decision makers to deal with water on a comprehensive, sustainable basis.

Future Symposium

We are beginning to think about our next symposium for the Fall of 2007! These conferences take a great deal of advanced planning. Even though it is early February, as we get into the warm months a number of decisions will have to be made. At this stage in the planning process, selecting the topic of the next conference is our most important priority. We would be pleased to hear what ideas you have for a potential topic for the 2007 Symposium. Ideas can be sent to Phil Kearney at *kearneyp@umd.edu*.

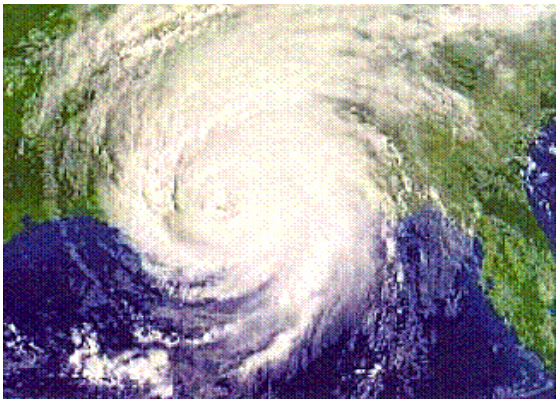
Inside the Newsletter

Wilson Shaffer, National Weather Service, Silver Spring, MD.

The National Weather Service (NWS) uses its Sea, Lake, and Overland Surges from Hurricanes (SLOSH) model for generating storm surge forecasts. This model is run in three modes – for simulation studies, for real-time, operational surge guidance, and for new, experimental probabilistic storm surge forecast guidance. For simulation studies to support hurricane evacuation planning, approximately 50,000 hypothetical hurricanes were run through the Chesapeake Bay. These hurricanes vary in track direction and landfall location, intensity, size, forward speed, size, and tide level. Composites depicting the possible flooding in the Bay were presented for various categories of hurricanes. As operational forecast guidance to NWS forecasters and emergency managers, SLOSH is run in a deterministic mode, beginning 24 hours before forecast landfall, based on the forecast track and hurricane parameters. The NWS has recently embarked on generating probabilities of storm surge exceeding various threshold levels.

Michael S. Scott, Salisbury University, Salisbury, MD.

To analyze the vulnerability of Maryland's environment to a 100-year flood we used the HAZUS-MH modeling software. Developed by FEMA, HAZUS-MH consists of several stochastic flood models operating within ArcGIS that create damage estimates from both coastal and riverine flooding. A generalized HAZUS-MH model was created for each county (and Baltimore City) in Maryland. Results from the study (available at www.esrgc.org/hazus.htm) show that Maryland has almost $8 billion in buildings potential exposed to a flood hazard.



In the event of a 100-year flood, the predicted building damage could equal over 109 million square feet. The direct economic losses from a 100-year flood could exceed $8.1 billion. Researchers are now examining identified vulnerable areas, like Ocean City, Maryland, in more detail in order to refine the results.

Kevin G. Sellner
Chesapeake Research Consortium, Edgewater, MD.

Hurricanes have impacted the mid-Atlantic region for recorded time and recent storms have resulted in tremendous losses of property, human and animal life, and staggering economic consequences. Hurricane Agnes of 1972 and Hurricane Isabel of 2003 are examples of differences in impacts associated with storms traveling up the east and western sides of the Bay, respectively. Agnes devastated Bay residents, land and the Susquehanna Basin. Impacts were largely a function of rains with river discharge and associated flooding damage in most of the tributaries flowing to the south into the Bay. Huge losses occurred in PA and NY State. Sediments and nutrient deliveries were huge, eliminating many submerged grasses and some benthos in the Bay. Excessive discharges displaced fish populations and their prey in freshwater rivers and creeks. Nutrient levels lead to elevated algal production and in the following year, high summer productive from nutrients remineralized from the loads and algal production form Agnes. Isabel on the other hand had its major impacts through storm surges mediated through counter-clockwise winds blowing northwards up the Bay, thereby piling up more saline coastal or southern bay waters up the estuary and tributaries. Rains and discharge were modest relative to Agnes impacts. This surge, coupled with wind waves and tides resulted in massive coastal damage in low-lying areas along the Bay. Even with considerable ‘forecasts of surges in the region. The northward flowing, more oceanic waters brought in coastal species, increasing some fish populations and larvae higher than seen in non-storm conditions. Some SAV were lost in tidal waters. The differences between the storm tracks, relative to the axis of the Bay and Susquehanna, indicate that future hurricane forecasts and potential emergency responses must account for storm location.

2007 Funded Summer Research Fellowships

Three University of Maryland graduate students will receive summer water research fellowships. These fellowships are worth $4600. The Center is proud to support several of the brightest research students at Maryland.

Developing Permeable Sorptive Barriers for Petroleum Contaminant Removal from Groundwater Using High Carbon Content Fly Ash

Mehmet M. Demirkan, Department of Civil and Environmental Engineering, University of Maryland.

In order to evaluate the potential use of the high carbon content (HCC) Maryland fly ashes as part of a permeable sorptive barrier, an experimental study has been undertaken. Geotechnical performance and environmental suitability of petroleum contaminated soils stabilized with fly ash were evaluated. A series of batch adsorption tests were conducted with two petroleum hydrocarbons and seven Maryland fly ashes. The results of the batch-scale adsorption tests conducted on the fly ash revealed that the ash had very good naphthalene and o-xylene sorption properties due to the presence of high carbon content in its structure, which indicates HCC fly ash as an ideal candidate for sorptive barrier applications. Even though numerous studies have been conducted in the past on alternate barrier materials (i.e., peat, wood chips, foundry sand, ground rubber), there is a lack of information on sorption and reaction properties of CCBs, particularly on Class F fly ash.

Hydraulic Consequences of Riparian Vegetation on Bank Roughness in Urban Stream Corridors

Erik Hankin, Department of Geology, University of Maryland.

The purpose of this project is to determine what effect native grasses have on the capacity of the Anacostia River channel to convey flood discharges using the hypothesis that native grass and herb plantings will decrease flow resistance and increase the flood carrying capacity of the channels at high flows. The study shall provide a detailed assessment of weather the plantings of native grasses and herbs on the banks of rip-rap protected channel affects flow resistance and the carrying capacity of the channel and detailed guidance on how to determine the changes in flow resistance (expressed as Mannings n) of the channel banks due to re-vegetation.

Sublethal Reproductive and Developmental Responses in the Fathead Minnow (*Pimephales promelas*) Exposed to Endocrine Disruptors in Poultry Litter

Sara Pollack, Doctoral Candidate, MEES Program, University of Maryland.

The overuse of poultry litter as a fertilizer has become a topic of regional concern. Agricultural run-off carrying unknown contaminant mixtures enter lotic and lentic systems that feed into the Chesapeake Bay. The significance of this research proposal is aimed toward elucidating the observed reproductive responses of an aquatic species exposed to EDCs. Results will aid in the assessment of sub-lethal response mechanisms to determine impacts on aquatic animal health in the Chesapeake Bay.

MWRRC ON HOLD!

Federal Agencies are currently operating on a Congressional Continuing Resolution. Since we are funded by the Department of the Interior, U.S. Geological Survey, we are also affected by this budgetary constraint. MWRRC hopes this situation will be resolved in the near future so our projects can be funded.

2007 Funded Research

The MWRRC will fund two new research projects this year. One continues our string of funding research related to impacts of road salt application to the water environment. The second will quantify ecological impacts related to salinity changes resulting from sea level rise.

ASSESSING THE ROLE OF ROAD SALT RUN-OFF ON THE CRITICAL ECOLOGICAL INTERACTIONS THAT REGULATE CARBON PROCESSING IN SMALL, HEADWATER STREAMS IN THE CHESAPEAKE BAY WATERSHED

Christopher Swan, Assistant Professor, University of Maryland, Baltimore County

Small streams constitute a large majority of the stream miles in a drainage basin, accentuating the link these reaches have to the landscape. As such, the ecological condition of streams and rivers reflect human disturbance in the watershed. The consequence for society is the degradation of water quality as habitat is modified, reducing the capacity of the biota to properly mediate natural rates of nutrient cycling (e.g., carbon mineralization, denitrification). Recently, researchers have discovered that streams draining human-dominated landscapes can experience enhanced loading of road salt deicer. Elevated levels of chloride are reported to increase with impervious surface cover, reaching levels toxic to freshwater life. The potential for anthropogenic salinization to alter ecosystem processes performed by streams, specifically carbon processing, is largely unknown. Biological processing of the seasonal input of detritus from riparian forests may very well suffer from chloride loading. There exist strong microbial and invertebrate contributions to the decay of this material, and experimentation has demonstrated that inhibiting these components of the community results in drastic changes to export of both carbon and nitrogen downstream. Thus, any abiotic factor altering either the microbial or invertebrate community is likely to disrupt decomposition of organic matter and carbon processing in these systems. I propose a series of experiments to learn how an increase in road deicer, specifically NaCl, alters water quality. Given the energetic reliance of forested stream food webs on riparian-derived detritus (e.g., senesced leaf litter, wood), and the subsequent feed-back the microbial and invertebrate community has on mineralization of this material, I will focus on the effects of rising salt levels on carbon processing in small, headwater streams.

RESPONSES OF SPECIES-RICH LOW-SALINITY TIDAL MARSHES TO SEA LEVEL RISE: A MESOCOSM STUDY

Andrew Baldwin Associate Professor, Environmental Science & Technology, University of Maryland

Coastal wetlands in the Chesapeake Bay and elsewhere are at risk of loss or alteration due to increases in water level and salinity from sea level rise. For example, extensive brackish wetlands at Blackwater National Wildlife Refuge on Maryland's eastern shore have converted to open water during the last century due to the combined effects of background water level rise and land subsidence. To date the majority of research on effects of sea level rise on coastal wetlands has focused on salt and brackish marshes; little research exists on effects of sea level rise on tidal freshwater and "intermediate" marshes in the upper reaches of Atlantic coast estuaries (collectively referred to here as low-salinity tidal marshes). The lack of research on these systems is surprising given that they have considerably higher plant diversity than brackish and salt marshes, support myriad wildlife species, and are critical nursery habitat for commercially important species such as rockfish. Sea level rise is likely to result in increases in salinity and soil waterlogging in low-salinity marshes, causing stress or mortality of salt-intolerant species and altering vegetation diversity and species composition. While this broad prediction is possible based on current knowledge, little is known about the responses of plant diversity to specific changes in salinity and waterlogging regimes. Information allowing prediction of how low-salinity marsh vegetation will respond to increases in salinity, water level, or both is critical to developing mitigation strategies and designing wetland restoration or enhancement projects in the face of sea level rise.

Objectives: The broad goal of this proposed research is to understand how increases in salinity and water level will influence plant diversity and ecosystem function of tidal low-salinity marshes. Specific objectives are to:
1) Create experimental wetland mesocosms containing species from tidal oligohaline and freshwater marshes
2) Expose mesocosm plant communities to a factorial arrangement of salinity and inundation treatments
3) Relate changes in plant communities and indices of ecosystem function to potential changes in water level and salinity predicted under various sea level rise scenarios

Distinguished Lecture – March 8

"Where are we going? Where have we come from? Assessing sewage impacts in a coastal environment"

Dr Joan Rose has been selected to present the 2007 *Association of Environmental Engineering and Science Professors'* Lecture. We are pleased that the University of Maryland will be one of her stops on the lecture circuit. This lecture is sponsored by the *Water Resources Research Center, the Department of Civil and Environmental Engineering, Howard University, The Johns Hopkins University, the University of Maryland, Baltimore County and the Washington Suburban Sanitary Commission*. Dr. Rose serves as the Homer Nowlin Chair in Water Research at Michigan State University, the Co-Director of the Center for Advancing Microbial Risk Assessment and the Director of the Center for Water Sciences.

MICHIGAN STATE UNIVERSITY

Dr. Rose's professional experience includes environmental virology, environmental parasitology, drinking water treatment and disinfection, microbial risk assessment, wastewater treatment and reuse, water pollution microbiology, mycology and food microbiology. The Lecture will be presented on Thursday March 8, 2007 at 3:30 pm in **Chemistry Room 0115**. A reception will follow the lecture.

Maryland Water Resources Research Center/Agriculture Research Service Cooperation

The University of Maryland has had a long standing cooperative research program with the Henry A. Wallace Beltsville Agricultural Research Center, USDA. The Center and the University are located three miles apart. Our water center has cooperated on a number of projects, including examining the sources of sediments in the Anacostia River, evaluating the aerial movement of pesticides into the Chesapeake Bay and a survey of endocrine disruptors in the Back River. In addition to cooperation, USDA scientists have given lectures on subjects of common interest and have served as part of PhD committees. The Maryland Water Resources Research Center looks forward to a continuing cooperation on water issues of mutual interest**.**

Featured Scientist

Dr. Bruce James

Dr. Bruce James is a Professor of Soil Chemistry in the newly-formed Department of Environmental Science and Technology. He also is Director of the Environmental Science and Policy undergraduate major (ENSP) and the living-learning Environmental Studies Program of College Park Scholars for freshmen and sophomores (CPS-ES). He began research and teaching in Soil Chemistry in College Park in 1986 as an Assistant Professor after a post-doctoral appointment at Cornell University where he conducted research on the soil chemistry of aluminum in forest soils and its relationship to acid precipitation. He completed his M.S. and Ph.D. degrees in soil chemistry at the University of Vermont in 1981, and his research focused on the oxidation-reduction chemistry of chromium and its relevance to waste disposal issues surrounding sewage sludge disposal on land and on water quality issues as affected by industrial waste transformations. He earned a B.S. degree at Williams College in Chemistry and Environmental Studies in 1973, where he developed a strong interest in cross-disciplinary approaches to environmental issues. His interest in the environment and water was hatched during multi-year, severe droughts in his home state of New Hampshire during the early 1960's when having enough water for human, plant, animal needs was not assured during several parched summers.

At the University of Maryland, his teaching comprises undergraduate and graduate courses in Soil Chemistry, ENSP, and CPS-ES. He teaches the introductory course in Environmental Science for ENSP majors, CPS-ES students, and as a CORE course. He teaches the senior, interdisciplinary Capstone course for ENSP, with a focus on innovative ways to address emerging, international issues surrounding freshwater resources and related to the transition to the post-petroleum era. He developed and teaches annually a course entitled “Crops, Soils, and Civilization,” in which he explores with the students in an interdisciplinary context the roles of water and soil management as influences on the rise and decline of ancient civilizations.

His research at the University of Maryland addresses questions surrounding remediation of heavy metal-contaminated soils (particularly chromium), oxidation-reduction phenomena of natural waters and soils, and the effects of soil chemical reactions on ground and surface water chemical composition. This research couples theoretical and experimental work in the laboratory and the field to address thermodynamic and kinetic controls on electron transfer processes in soils. Practical applications of his research are in the development of remediation practices for and the management of natural and artificial wetlands, tidal marshes, riparian zones; as well as in agricultural and forest soils. The research has resulted in two patents on the remediation-by-reduction of chromium-contaminated soils using ascorbic acid. His research on chromium in soils has generated continuing controversy about whether or not nontoxic, relatively-insoluble Cr(III) can be oxidized to the toxic, soluble Cr(VI); and whether or not the reduction of Cr(VI) to Cr(III) can be considered a safe and permanent remediation-by-reduction strategy. He often is asked to explain the nuances of soil redox chemistry to environmental engineers, toxicologists, government regulators, environmental lawyers, hydrologists, and the lay public in ways that may assist in formulating policies for soil clean-up based on sound soil chemical research results.

His current research with M.S. student, Dominic Brose, is addressing how drainage catenas (topohydrosequences of soils on the landscape) influence the microbial and chemical reduction of Cr(VI) and oxidation of Cr(III) in Maryland soil landscapes and in soils contaminated with chromite ore processing residue. This work is at the nexus of pedology, soil chemistry, and soil microbial ecology.

In his life as a professor at the University of Maryland, he has found great satisfaction in working with students in the classroom, the laboratory, and the field. In addition to the oft-observed influence that research has on teaching, he finds remarkable and keen insights in students in his classes that shape his research and thinking about what soils are really like and how they are linked to the chemistry of natural waters. Teaching students in the ENSP and CPS-ES programs has provided many opportunities to develop and implement new ideas that link environmental

science, policy, history, and ethics. Dr. James has received several awards for his research and teaching. He was a Distinguished Scholar-Teacher in 2004-2005, received a Lilly Foundation Teaching Fellowship in 1993-1994; and he has been recognized regionally, nationally, and internationally for his fundamental work on redox processes in soils and its applications to environmental issues. He was a Visiting Scientist at the Swiss Federal Institute for Aquatic Science and Technology (EAWAG) where he spent a year-long sabbatical leave conducting research on the photochemistry and free radical chemistry of chromium in natural waters and soils.

2007 Smart and Sustainable Campuses Conference here at Maryland

On April 17-19, 2007, the National Association of College and University Business Officers (NACUBO) will join with the Environmental Protection Agency (EPA), the Association for the Advancement of Sustainability in Higher Education (AASHE), the Association of Higher Education Facilities Officers (APPA), the Campus Safety, Health, and Environmental Management Association (CSHEMA), the Campus Consortium for Environmental Excellence (C2E2), the Society for College and University Planning (SCUP), and the University of Maryland College Park to deliver a comprehensive symposium on smart growth and sustainable practices that serve the economy, the community, and the environment. Sessions and workshops will be offered in the areas of campus planning, engaging the campus in sustainability, facility construction and operations, and assessment and measurement. The conference will be held at the University of Maryland Inn and Conference Center.

Student Scholarships: NACUBO is accepting applications from college students interested in receiving a complimentary registration to attend the conference. Thirty scholarships are available.

See www.nacubo.org/x8593.xml for details.

Recent USGS Publications

The U.S. Geological Survey MD-DE-DC Water Science Center has recently published several new reports. They are only available online; no paper versions of these reports will be distributed.

Selected Streamflow Statistics for Streamgaging Stations in Northeastern Maryland, 2006, by Kernell Ries.
http://md.water.usgs.gov/publications/ofr-2006-1335

Pesticides in Ground Water of the Maryland Coastal Plain, by Judith Denver and Scott Ator.
http://md.water.usgs.gov/publications/fs-2006-3119

The National Streamflow Statistics Program: A Computer Program for Estimating Streamflow Statistics at Ungaged Sites, by Kernell Ries and others.
http://md.water.usgs.gov/publications/tm-4-a6/

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