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The bi-national HABSOS

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The Harmful Algal Blooms Observing System (HABSOS) is a regional coalition of U.S. and Mexican Federal and State agencies working together to study algal bloom events within the Gulf of Mexico Ecosystem. Algal toxins introduced into the ecosystem affect the health of humans and marine life, and disrupt social and economic activities.

The coastal zone manager is challenged to monitor, assess, and forecast bloom events to minimize societal impact. A bilingual (Spanish/English) HABSOS web site and Internet tools have been developed to support this effort. Data entered into the system are available for display and analysis in the HABSOS Internet Map Service (www.ncddc.noaa.gov/interactivemaps/harmful-algal-blooms-observing-system-habsos).

The HABSOS and Bi-National were developed and supported by U.S. Environmental Protection Agency (EPA) Office of Research and Development, EPA Gulf of Mexico Program, and the NOAA National Coastal Data Development Center (NCDDC).
Assessing water quality and phytoplankton in streams of the leaf river and black creek watersheds

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Physicochemical and phytoplankton data has been collected since 1998 at 26 permanent monitoring stations located in streams draining into the Leaf River and Black Creek in South Mississippi. These streams are fast flowing and originate within the boundary of the Camp Shelby Training Site. Bacteria, nutrients, and physical characteristics are measured quarterly. The measurements are designed to detect acute changes in water quality. A small discharge of pollutants can result in major stream impairment within the boundaries. The danger for contamination of these small streams is that a small point source could cause a large influence in the water quality downstream because there is little water for dilution. This paper summarizes the results of water quality in the period of 2002-2007. Influences outside of the camp area were more pronounced than the military uses within the boundaries. The study shows that there has not been environmental deterioration caused by the land uses at Camp Shelby. The phytoplankton was dominated by diatoms in numeric abundance. However, the Chlorophyta, although widespread in occurrence, included the largest number of genera. Other algae divisions were minor component of the plankton community. Water temperature, flow, and phosphate availability were statistically important factors affecting and controlling phytoplankton abundance and algal richness over time.

Keywords: water quality, streams, phytoplankton, surface water
Long-term performance of a pump and treat system at a wood treating site

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A wood treating facility in South Mississippi was the site of a twelve year, pump and treat remediation. Two sixty-five thousand liter batch reactors treated approximately 250,000 liters of creosote and penta contaminated groundwater per day. Four liters of penta and creosote degrading bacterial culture and 5 kg of triple thirteen fertilizer were added to the reactors on a weekly basis. The approximate residence time in reactors was 12 hours. Samples were taken on bi-weekly basis for Total Suspended Solids (TSS), selected priority pollutant creosote constituents/polycyclic aromatic hydrocarbons (PAHs), Penta and Tetrachlorohenol (PCP&TCP), Biological Oxygen Demand (BOD), and microbial counts. Reduction of PAHs, PCP/TCP, BOD, and TSS were 82%, 55%, and 61% respectively; viable bacterial populations over (700,000 colonies/mL) were present in effluent samples during a twelve year period.
Land application of poultry litter is an economical and environmentally viable use of this manure by-product. However, the recent concern associated with fresh produce and pathogenic bacterial contamination has led to increased scrutiny regarding land applied manures. Runoff following a rain event is one possible source of environmental contamination resulting from manure application. In this second part of a two-part study, a series of treatments involving litter (two rates), inorganic fertilizer, and no fertilizer controls were added to bermudagrass plots held on the Mississippi State south farm to simulate “real-world” conditions and extend the baseline data gathered during the greenhouse trials previously conducted. A rainfall simulator was used to simulate precipitation events and following each rain event, runoff samples were collected for microbial analyses. Total Heterotrophic Plate Count (HPC) bacteria, antibiotic resistant bacteria (ARB), thermal-tolerant coliforms, enterococci, staphylococci, and Clostridium perfringens were investigated. Over a period of 60 days, 5 rain events were simulated using a portable rain applicator and results indicated that staphylococci, enterococci, and clostridia correlated well with manure application, corroborating the previous greenhouse study. Analysis of runoff concentration means demonstrated that in most cases litter application increased the presence of indicator microorganisms in runoff water. Traditional indicators such as thermal-tolerant and total coliforms performed poorly as fecal indicators relative to the other bacteria assayed in this study. No “frank” pathogens such as Salmonella or Campylobacter were detected in the applied litter or runoff. Chi square analysis of ARB indicated that litter application influenced the overall presence of antibiotic resistant bacteria, particularly with respect to polymixin B and aminoglycoside resistance. This study indicated that poultry litter land application can contribute to microbial runoff, however proper land and agronomic management practices can mitigate this.

Keywords: Agriculture, Water Quality, Surface Water, Management and Planning
Sensitivity analysis of simultaneous nitrification-denitrification process by simulation with activated sludge model number one

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Nitrogen removal by Simultaneous Nitrification-Denitrification (SND) has invited much attention in recent years due to possible reduction in capital and operating costs associated with wastewater treatment. The potential of biological nitrogen removal through this process and optimization of its operating parameters were investigated by simulations using Activated Sludge Model No. 1 (ASM1). Adopting typical properties of domestic sewage, simulations of SND process were performed in three sequential phases to optimize the operating parameters and assess reliability of the SND process over variation in the kinetic and stoichiometric parameters. Since dissolved oxygen (DO) concentration and solids retention time (SRT) were considered to have the most significant impact on nitrogen removal, the first set of simulations was aimed at identifying an applicable operating window for these parameters. Simulation results indicated that optimum nitrogen removal occurred at a DO concentration of 0.3 mg/L coupled with a SRT of 15 days. A second set of process simulations was run using this combination of operating DO and SRT to examine the effect of other process parameters; specifically the ratio of biodegradable COD to total Kjeldahl nitrogen (BCOD:TKN) in the influent, hydraulic residence time (HRT), and recycle ratio (R) on total nitrogen removal. The influent BCOD:TKN ratio significantly affected overall nitrogen removal, since availability of electron donor is essential to drive denitrification, with optimal nitrogen removal observed at a BCOD:TKN ratio of 11. Neither HRT nor R had a significant effect on nitrogen removal. The third set of simulations considered the natural variability of the kinetic and stoichiometric parameters of ASM1. Monte Carlo analysis was performed to evaluate the performance of an SND system operated at a DO of 0.3 mg/l and an SRT of 15 d using probability density functions developed by Cox (2004) for the model parameters. Results of these simulations were used to assess the potential reliability of an SND process designed using “typical” model parameter values. A sensitivity analysis was also performed to identify the model parameters that had most significant effect of nitrogen removal.

Key words: Models, Treatment, Wastewater, Water Quality

student presenter
Primary productivity, hydro period, and nutrient cycling in four flood-plain forest communities on a blackwater river

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A characterization of a blackwater river floodplain forest in South Carolina was conducted to 1) provide a reference for better management and restoration of this forest type, 2) test the subsidy stress hypothesis, 3) relate variations in hydroperiod to primary productivity and nutrient cycling among years and communities, 4) identify ecological processes potentially responsible for differences in productivity among communities and years, 5) identify mechanisms that contribute to water quality improvement by these forests, and 6) identify potential limiting nutrients on the site. The forest communities exhibited the classic subsidy stress curves of productivity along a flooding gradient over a period which included a wide range of moisture conditions. Greatest productivity occurred on the community occupying middle elevations. Also in that community, amplitude in productivity increased when flooding returned after several dry years, and this was attributed to luxury consumption of P during dry years and a fertilization effect by N subsidies arriving with subsequent floods. Several mechanisms of N sequestration were identified, including uptake by trees with induced N deficiencies through luxury P uptake, and there was evidence of a N limitation of productivity in this nutrient rich and productive floodplain forest. Because eutrophication of marine systems is related to N runoff from terrestrial sources, these forests may be important to sustainable water quality on the coast.

Key words: Water Quality, Bottomland Hardwoods, Nitrogen, Phosphorus, Productivity
Interactions between ground water and surface water in the Bogue Phalia near Leland, Mississippi, Summer 2007

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Ground-water discharge is a key control on streamflow quality and quantity and associated aquatic ecosystems; however, factors that affect the spatial and temporal distribution of water flux across stream beds remain poorly understood. The objective of this study is to characterize ground-water and surface-water interaction in the Bogue Phalia, which drains an agricultural area in northwestern Mississippi. Study sites are located near the Bogue Phalia gaging station near Leland, MS. At the study sites, the Bogue Phalia is about 35 meters wide with a maximum depth at low flow of 1.2 meters and a discharge of 78 cubic feet per second during the study period (June – August 2007). Ground-water discharge was measured with pan and bag seepage meters fitted with extensions for deployment in deep (>1 meter) water. Five arrays were measured across the width of the river, with an average of 10 meters between each array and at least 5 meters per array. Seepage data were supplemented with measurements of head gradient, hydraulic conductivity, bed sediment grain size, and temperature in order to better understand interactions between ground water and surface water. Drought conditions in the area were temporarily relieved by storms in late June and early July when flow in the river reached a maximum of 5,120 cubic feet per second. Measurements were made both before the storms and after flow in the river returned to base conditions in order to evaluate the effects of flooding on ground-water discharge.

Preliminary results indicate that the highest ground-water discharge fluxes occurred along the central axis of the Bogue Phalia; whereas, the lowest fluxes occurred along the banks. The main channel was gaining at the study sites, although losing reaches were common in ditch-like tributaries. The average and (standard deviation) of vertical flux through the study area was 1.2 x 10^-6 meters per second (m/s) (6.3 x 10^-7 m/s), and ranged from a minimum of 3 x10^-8 m/s to a maximum of 5 x10^-6 m/s. Techniques for setting seepage meters in deeper water produced an average coefficient of variation (COV) of 0.5, which is greater than the typical value for shallow water application (COV = 0.3). The mean flux before the storms in late June and early July is statistically indistinguishable from the mean after the storms. Although the maximum flux increased slightly from 4.2 x10^-6 m/s (2.7 x 10^-6 m/s) to 5.6 x10^-6 m/s (1.8 x 10^-6cm/s) and shifted position by approximately 30 m upstream following the storm. The highest fluxes always occurred in areas where the stream bed was composed of medium- to coarse-grained sand, whereas the lowest fluxes occurred where the bed sediment was fine-grained, primarily along the banks and particularly downstream of a tributary. Seepage-meter studies elsewhere in the Southeastern United States have shown average ground water discharge fluxes of approximately an order of magnitude greater than those at the Bogue Phalia, an effect that could be due to either ground-water pumping or drought conditions.

Keywords: Agriculture, Water Quality, Surface Water, Management and Planning

student presenter
The National Weather Service (NWS) is responsible for issuing river and flood forecasts and warnings to mitigate the loss of life and property. Current NWS text-based products are utilized by emergency managers (EMs). One of the most often requested product from EMs is flood inundation mapping to show the areal extent of flooding. Flood inundation maps would translate the forecasted stages into inundation areas, making it easier for EMs to take action and alert the public. They would also prove invaluable to EMs in their outreach, mitigation, and educational efforts.

By partnering with the Federal Emergency Management Agency (FEMA) and local communities, the NWS is developing flood inundation maps for their forecast locations. When a community performs flood studies to update FEMA Flood Insurance Rate Maps (FIRMs), much of the necessary data are available to develop flood inundation maps. For a small incremental cost above the cost to develop FIRMs, flood inundation maps at various stages above the NWS-established flood stage are being developed. This collection of maps will form a flood inundation map library that can be served up to the public via the Internet.

The NWS has partnered with FEMA and developed flood inundation map libraries at about 15 locations across the country. Currently, work is ongoing to produce these maps for an additional 30 sites in the states that border the Gulf of Mexico. The NWS has established a website and web structure to serve this data up to the public.

Keywords: Floods, Hydrology, Management and Planning, Models
Potential for recharge in agricultural soils of the Mississippi Delta

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Ground water models predict that 5 percent or less of precipitation in the Mississippi Delta region recharges the heavily-used alluvial aquifer; however high concentrations of agricultural chemicals in ground water suggest more substantial recharge. In a preliminary assessment of the potential for aerial recharge through the agricultural soils of the Bogue Phalia basin in the Mississippi Delta, we applied a method for rapidly measuring field-saturated hydraulic conductivity \( K_{fs} \) in 26 locations in cotton and soybean fields. The technique makes use of a portable falling-head, small-diameter, single-ring infiltrometer and an analytical formula for \( K_{fs} \) that compensates both for falling head and for subsurface radial spreading. Soil samples were also collected at the surface and at about 6 cm depth at each location for particle size analysis. \( K_{fs} \) values are generally higher than anticipated and vary over more than three orders of magnitude from \( 1 \times 10^{-2} \) to \( 5 \times 10^{-6} \) cm/s. There is also a correlation between \( K_{fs} \) and mean particle size which may prove useful in generalizing recharge rates over larger areas. A 2-m ring infiltration test is planned that will include the use of tracers and subsurface instruments for measuring water content and matric potential from the near surface to about 5 m to evaluate flow and transport below the root zone.

Keywords:
Environmental State agencies have been supporting the construction of Wastewater Treatment Plants (WTPs) in Colombia, South America. There is not much technical evaluation of the performance of these WTPs. The objective of this research was to evaluate the performance of an aerobic-anaerobic lagoon located in the rural area of Palmira City, Valle del Cauca. The lagoon was constructed around 1984 and was originally designed for 240 people. However, uncontrolled habitat growth in the study area has resulted in the treatment plant receiving wastewater from approximately 500 people. Water quality data were collected between September and November, 2006 on the influent and effluent of the system. In-situ water quality measurements (temperature, pH, and dissolved oxygen) were observed every hour for 24 hours during five different days. Composite samples of every day were analyzed in the laboratory for chemical oxygen demand, five-day biochemical oxygen demand, coliforms, solids, conductivity, acid, oil and grease, nitrogen, and phosphorus. The lagoon reached the efficiency values according to standards declared by the 1984 Colombian National Government Law of Permit Limits. There was no preliminary treatment of the wastewater prior to reaching the lagoon; therefore, the system was trapping a lot of sediments and the actual effective volume of the WTP decreased approximately 65% from its original design. The lagoon was mainly working under anaerobic conditions because observed dissolved oxygen values were very low. The effluent of the lagoon can be used for crop irrigation or be discharged into a water body.

Keywords: Treatment, wastewater, and water quality

Aerobic-anaerobic lagoon evaluation in a small rural community in Columbia, South America

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Student presenter
The Phytoplankton Monitoring Network (PMN) is a volunteer regional data management network to assist the Harmful Algal Bloom Observing System (HABSOS) effort. PMN is an education and outreach program developed by NOAA’s National Ocean Service to engage school and community volunteer groups in phytoplankton sampling and identification and to raise awareness of harmful algal blooms. The National Coastal Data Development Center (NCDDC) partnered with PMN to create an end-to-end data management system for the volunteers. Members are provided an on-line data entry tool to submit data, and are then able to visualize and analyze their own validated data as well as from Network peers in an Internet Geographic Information System (GIS) environment. Approved data is mapped to (www.ncddc.noaa.gov/website/SEPMN/viewer.htm). NCDDC has partnered with the newest NOAA Cooperative Research Institute, the Northern Gulf Institute (Mississippi State University, University of Southern Mississippi, Louisiana State University, Florida State University, and Dauphin Island Sea Lab) to train and equip the volunteer organizations.
The Big Sunflower River is listed on the EPA Section 303(d) list of Impaired Waterbodies of Mississippi. Contributing to the decline in conditions in this system are the substantial decreases in baseflow during the late summer and fall as groundwater levels decline. In an attempt to improve water quality and ecological conditions the Yazoo Mississippi Delta Joint Water Management District has begun supplementing flows during critical periods using groundwater for the past 2 years. To assess the impact of streamflow augmentation we evaluated water quality trends through the 2006-2008 pumping periods and assessments of the quality of the riparian plant community during the summers of 2006 and 2007. Measurements of water quality (Temperature, Dissolved Oxygen, pH, Specific Conductance and Turbidity) were made at 11 locations on the Sunflower River between Indianola and North Clarksdale, at one location associated with the augmentation pumps and 1 location along the channel used to funnel pumped water to the Sunflower River. In general, water quality continued to be better above Clarksdale, with improvements in dissolved oxygen concentrations associated with increased flows and decreased temperatures. The riparian plant community was analyzed over a more focused portion of the upstream drainage basin with 2 sites south of Clarksdale, 2 sites north of Clarksdale and 1 within the city itself. Clarksdale represented a clear break in plant composition with higher numbers of monocots, invasive species and weedy early succession species encountered upstream (North) of Clarksdale. Taken together, there is a strong indication that supplementing natural stream discharge can have beneficial impacts on water quality in the near term and on broader measures of ecosystem quality in the long term.

Keywords: Ecology, Surface Water, Water Quality, Wetlands
The U.S. Geological Survey, in cooperation with the Mississippi Department of Environmental Quality, U.S. Department of Agriculture Natural Resources Conservation Service, Mississippi Department of Transportation, U.S. Department of Agriculture Forest Service, and the Mississippi Automated Resource Information System developed a 1:24,000-scale Watershed Boundary Dataset for Mississippi including watershed and subwatershed boundaries, codes, names, and areas. The Watershed Boundary Dataset for Mississippi provides a standard geographical framework for water-resources and selected land-resources planning. The original 8-digit subbasins (Hydrologic Unit Codes) were further subdivided into 10-digit watersheds and 12-digit subwatersheds—the exceptions being the Delta part of Mississippi and the Mississippi River inside levees, which were subdivided into 10-digit watersheds only. Also, large water bodies in the Mississippi Sound along the coast were not delineated as small as a typical 12-digit subwatershed. All of the data—including watershed and subwatershed boundaries, subdivision codes and names, and drainage-area data—are stored in a Geographic Information System database.

Keywords: Hydrology, Surface Water, Management and Planning, Water Quantity, Water Supply