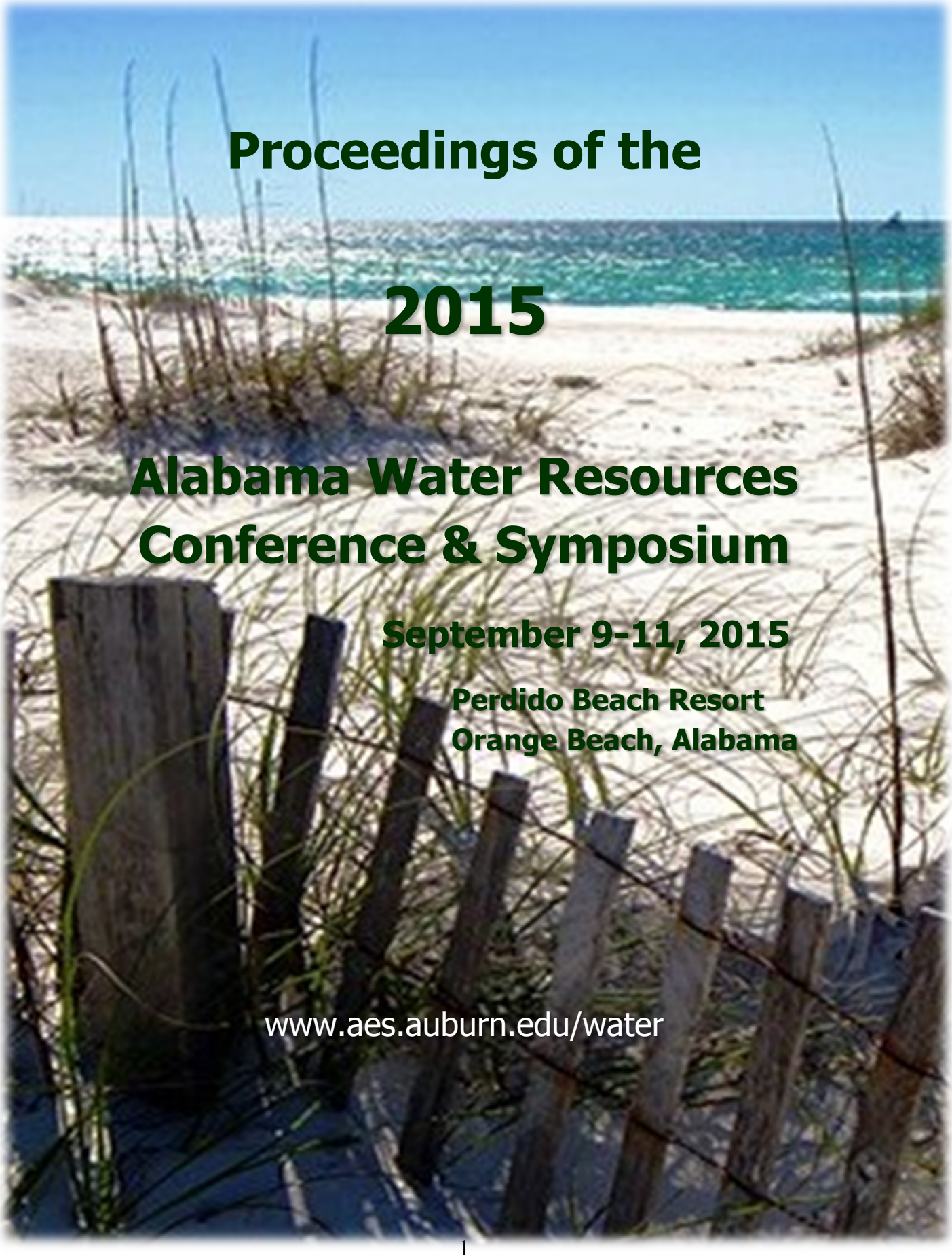

Proceedings of the

2015

Alabama Water Resources Conference & Symposium

September 9-11, 2015

Perdido Beach Resort
Orange Beach, Alabama

www.aes.auburn.edu/water

Symposium Program

Wednesday, September 9, 2015
Theme: Integrated Water Service Centers
Introduction & Welcome – (Salons E-H) Sam Fowler, President, AWRA Alabama Section
Symposium Introduction – (Salons E-H) Amanda Fleming, President Elect, AWRA Alabama Section
National Water Center: Initial Operating Capabilities and Collaborations
Introduction and Overview of 2014/2015 Activities and Plans for 2015/2016, CDR Nathan Hancock, NOAA ***NWC-focused funding opportunities during 2015/2016***, Sam Contorno, NOAA ***National Flood Interoperability Experiment (NFIE) Overview***, CDR Nathan Hancock, NOAA **NFIE Themes:** ***NFIE-Hydro***, Sagy Cohen, University of Alabama ***Field Experience/NFIE-River***, Sarah Praskievicz, University of Alabama ***NFIE-Response***, Joseph Gutenson, University of Alabama
Break (Ballroom Foyer)
Troy University Center for Water Resource Economics: Start Up Actions and Activities, Billy Turner, Director of the Troy Center for Water Resource Economics
The University of Alabama Water Policy and Law Institute: Bridging the Water Science-Policy-Law Interface, Bennett Bearden, Director of the Water Policy and Law Institute at the University of Alabama
Auburn University Water Resources Center: Current Activities and Vision for Sustainable Water Resources Management in Alabama, Puneet Srivastava, Director of the Auburn University Water Resources Center
USGS Water Resources Research Institute Program: A Federal-State Collaboration, Earl Greene, Coordinator of the National Institute of Water Resources Chief of External Research for USGS

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AU Center for Environmental Studies at the Urban Rural Interface	Samford University Masters of Science in Environmental Management
Balch & Bingham, LLP	Thompson Engineering
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Conference Program

Thursday, September 10, 2015

Keynote Address: ***Near-term Opportunities and Challenges in Southeast Water Resource Management,*** Steve McNulty, Director, USDA Southeast Regional Climate Hub, Raleigh, NC

Discovering Alabama "North River/ Lake Tuscaloosa Watershed" **(Salons E-H)**
Dr. Doug Phillips, Discovering Alabama

Session One (A): Water Policy/Law

"Alice In Groundwater Land": Adams v. Lang And "Nominal" Reasonable Use In Alabama Water Law And Policy, Bennett Bearden, Water Policy and Law Institute, University of Alabama

Alabama's Drought Planning – Policy Moving Forward, Tom Littlepage, Alabama Office of Water Resources
The Transition From Common-law To Statutory Regulation Of Water Resources: Lessons From Other States, Heather Elliott, University of Alabama School of Law

Session One (B): Aquatic Biology/Ecology I

Implications Of Land Use Change On Coastal Wetlands And Headwaters Of Alabama, Christopher Anderson, Auburn University
Ecosystem Engineers Alter Multi-trophic Species Diversity Across Spatial And Temporal Scales In Ponds, Jennifer Howeth, University of Alabama
Why So Different? Mercury Levels In Largemouth Bass (Micropterus Salmoides) In Two Adjacent Alabama Rivers, Robert Findlay, University of Alabama
Using Population Models To Evaluate Management Alternatives For Gulf-strain Striped Bass, Alex Aspinwall, Alabama Cooperative Fish and Wildlife Research Unit

Session One (C): Flood Issues

The Benefits Of A Well Managed Reservoir System Using As An Example The Tennessee Valley Authority's Management Of The Tennessee River Basin To Reduce Flooding, Daniel Saint, Tennessee Valley Authority
Hot Springs Flood Warning Information System, Joseph Fleming, USGS Lower Mississippi Gulf Coast Water Science Center
Flood Prediction Using Artificial Neural Networks: A Case Study Of Lower Tallapoosa, Alabama, Rajesh Sawant, Auburn University
Application Of SWMM Of Urban Flooding In A Coastal Alabama Watershed, Enis Baltaci, Auburn University

Session Two (A): Water Availability/Use

Water Use In Alabama, Michael Harper, Alabama Office of Water Resources

2015 Water-use Compilation: A National Perspective, Michael Bradley, U.S. Geological Survey

The Economic Impact Of Alabama's Navigable Waterways, J. Craig Stepan, Tennessee Tombigbee Waterway Development Council
Quantitative Estimation Of Land Use Land Cover Evolution Across The Middle Tennessee Elk Region Over The Past Four Decades, Mezemir Wagaw, Alabama Agricultural and Mechanical University

Session Two (B): Drought/Climate Issues

Artificial Neural Network Prediction Of Future Rainfall Intensity In The Southeastern United States, Ryan McGehee, Auburn University
Combined Effect Of Irrigation And Droughts On Surface And Baseflow Levels In The Lower Flint River Basin, Sarmistha Singh, Auburn University
Quantitative Study Of The Present-day Climate Of The Middle Tennessee Elk Watershed Area From Global And Regional Climate Model Simulation, Girma Kebede, Cooperative Extension System of Alabama
Developing A Multi-sector, Multi-basin Drought Decision Support System Incorporating Economic Consequence Assessment, Lian Zhu, University of Alabama

Session Two (C): Aquatic Biology/Ecology II

40 Years Of Biological Sampling In The Locust Fork Watershed: What Have We Learned?, Patrick O'Neil, Geological Survey of Alabama

The Shape Of Things To Come: Reverse-engineering Periphyton Colonization Processes Using 3D Printing, David Blersch, Auburn University

Microhabitat Preferences Of Federally Threatened Freshwater Mussel Species In Coastal Plain Streams, Jonathan Miller, Troy University
Acute Toxicity Of Mobile River Basin Endemic Freshwater Mollusks, Paul Stewart, Troy University

Session Three (A): Groundwater Availability

Hydrogeologic Characterization And Groundwater Source Development Assessment For Area 2, Southwestern Alabama, Gheorghe M. Ponta, Marlon Cook, and Steve Jennings, Geological Survey of Alabama
Simulation Of Groundwater Flow In The "1,500-foot" Sand And "2,000-foot" Sand, With Scenarios To Mitigate Saltwater Migration In The "2,000-foot" Sand Of The Baton Rouge Area, Louisiana, John Lovelace, U. S. Geological Survey
U.S. Geological Survey NAWQA Principal Aquifer Surveys In Alabama, Amy Gill, U.S. Geological Survey
Effect Of Irrigation Pumpage During Drought On Karst Aquifer Systems In Highly Agricultural Watersheds, Subhasis Mitra, Auburn University

Session Three (B): Water Quality I

Nutrient Concentration Trends In Surface Waters In Two Southeastern States, Lynn Sisk, TTL, Inc.
A Practical Tool For Modeling Wetland Nutrient Cycling, Latif Kalin, Auburn University
Evaluation of the Effectiveness of "No Dumping Signs" in Preventing Chemical Contamination of Inlet Stormwater (Preliminary Research), Dana Lackey, University of Alabama at Birmingham
Simulation Of Pollutant Transport In The Damietta And The Rosetta Branches Before And After Building The Ethiopian Dam, Mohamed Mostafa and Robert Peters , University of Alabama at Birmingham

Session Three (C): Restoration/Remediation

Monitoring And Restoration Of Alabama Coastal Streams, Marlon Cook, Geological Survey of AL
Supplemental Tools For Natural Channel Design In Urban Systems, William K. Barry, S&ME Inc.
Arlington Cove Living Shoreline - Partnership For Natural Infrastructure Design, Installation And Education, David Stejskal, CH2M
Proposed Metric For Measuring Shifts In Ecological Function Of Impaired Streams, Stacey Sloan-Blersch, SUNY at Buffalo

Session Four (A): Ecological Flows

"It's Hard To Fish In A Dried Up Stream": The Science And Policy Of Water Quality Standards For Flow Protection, Mitch Reid, Alabama Rivers Alliance
Streamflow Reconstruction Potential: Choctawhatchee River, Glenn Tootle, University of Alabama
Water Governance In The Southeast United States: Informing Decisions Regarding Water Allocation With Flow-ecology Data, Elise Irwin, U.S. Geological Survey, Alabama Cooperative Fish and Wildlife Research Unit
Connecting Water Level To Biological Health In Alabama Streams, Rodney Knight, USGS Lower Mississippi-Gulf Water Science Center

Session Four (B): Stormwater Management

We've Come A Long Way Baby: History Of Alabama's Erosion And Sediment Control Program For Construction, Earl Norton of AL Soil and Water Conservation Committee
"Tweak, Tweak, Tweak", The Latest Changes To The AL Handbook For Erosion And Sediment Control, Perry Oakes, Alabama Erosion Control Partnership
ALDOT MS4 IDDE Program-Uses Of Innovative Technology For Outfall Mapping And Screening, Richard Klinger, Alabama Department of Transportation and Brian Kane, Trimble
Creating A Clean Water Future, Christian Miller, Mobile Bay National Estuary Program, Ashley Campbell, City of Daphne, and Leslie Gahagan, City of Foley

Session Four (C): GIS in Water Management

Chattanooga WPA Program: Innovative Solutions To Infrastructure Assessment & Rehabilitation, Bradley Heilwagen, Amec Foster Wheeler
The Role Of Information Management In Coastal Hazard Analysis, Jeff Zanotti, Amec Foster Wheeler
Predicting Stream Channel Head Locations In The State Of Alabama, Burak Avcioglu, Auburn University
Updating Soil Hydraulic Properties Under Changing Land Use/ Land Cover For Improved Hydrologic Prediction, Guleser Sufraci, Auburn University

Friday, September 11, 2015

Keynote Address: ***A Geological History of Alabama's Rivers: Clues to the Ancient Origins of the State's Aquatic Biodiversity,*** Jim Lacefield, Ed.D., (Retired) Adjunct Professor of Biology and Earth Science at the University of North Alabama

Session Five (A): Coastal Issues

Restoration Of The Northern Tip Of Mon Louis Island - Surmounting Challenges To Project Implementation Through Teamwork, Tom Herder, Mobile Bay National Estuary Program
Influence Of Low-intensity Watershed Development On Small Coastal Alabama Streams, Brad Schneid, Auburn University
A Regional Holistic Approach To Watershed Management - To Protect And Enhance Ecosystem Services For Future Generations, Barbara Albrecht, Panhandle Watershed Alliance
Examining The Importance Of Submarine Groundwater Discharge (SGD) In A River Dominated Estuary: Example Of Mobile Bay, AL, Daniel Montiel, University of Alabama

Session Five (B): Watershed Management

Management Plan For The Choctawhatchee, Pea And Yellow Rivers Watersheds - A Roadmap For The Future Based On Sustainable Water Resource Management Planning, Barbara Gibson and Marlon Cook, Choctawhatchee, Pea and Yellow Rivers Watershed Management Authority and GSA
Apalachicola-Chattahoochee-Flint Stakeholders: Working Together To Share A Common Resource, Bradford Moore, ACFS
Promoting The Watershed Approach: Plan, Implement, Monitor, Respond, And Adapt, Christian Miller, Alabama Clean Water Partnership
Communicating Risk in a Short Attention Span World, Leslie Durham, ADECA Office of Water Resources

Session Five (C): Water Resource Education and Stewardship

Alabama Water Watch – Rising to Evolving Water Resource Management Challenges, Eric Reutebuch, Auburn University
Global Water Watch: An Update Of Watershed Stewardship Beyond Alabama, Sergio RuizCordova, Global Water Watch
Flashy And Trashy: Tale Of An Urban Stream, Alex James, Alabama Cooperative Extension System
Fight The Bite: How You Can Reduce The Risk Of West Nile Virus, Michelle Cole, Auburn University

Session Six (A): Water Quality II

Alabama's First Aquifer Storage And Recovery And Water Reuse Programs, Sarah Stokes, Southern Environmental Law Center
Sources of Escherichia coli In Lake Martin, Alabama, Brian Burnes, University of West Alabama
Bacteriological Sampling Of High-Use Sites On The Upper Cahaba River, Myra Crawford, Cahaba Riverkeeper
Effects Of Upstream Disturbances On Downstream Sediment Yield And Stream Channel Structure In An Actively Managed Forested Watershed, Ilkim Cavus, Auburn University

Session Six (B): Aquatic Biology/Ecology III

Exploring Past Velocity Conditions In Southeastern Streams Using USGS Flow Records, Fay Baird, Normandeau Associates, Inc.
Watershed Assessment Of The Big Canoe Creek System For The Recovery And Restoration Of Imperiled Aquatic Species, Anne Wynn, Geological Survey of Alabama
An Evaluative Tool For Prioritizing Removal Of Hazardous Debris To Improve The Watershed; A Final Review, Caitlin Wessel, University of South Alabama
The Use Of Biological Data To Achieve Compliance With The Final 316(b) Rule For Cooling Water Intakes, Paul Geoghegan, Normandeau Associates, Inc.

Session Six (C): Modeling in Water Management

Riverine Water, Sediment And Nutrient Flux Predictions: The Spatially And Temporally Explicit WBMsed Model, Sagy Cohen, University of Alabama
Small Sample Sizes, Collinear Predictors And Linear Modeling: A Simulation Study Comparing Alternative Methods For Landscape-Water Quality Research, Brad Schneid, Auburn University
Development Of A Procedure For Watershed Prioritization And Evaluation, Madhu Akasapu-Smith, Tetra Tech, Inc.
Data-driven Lake And Reservoir Monitoring Using Real-time 3-D Hydrodynamic And Water-quality Simulations, Reed Green, U.S. Geological Survey

ABSTRACTS (alphabetical order by author's last name):

Oral Presentations

Development of a Procedure for Watershed Prioritization and Evaluation

Akasapu-Smith, Madhu

ABSTRACT:
Georgia Environmental Protection Division (GAEPD) contracted Tetra Tech to develop a procedure to prioritize and evaluate watersheds and sub-watersheds using models and tools developed for the Georgia State-wide Water Management Plan's (GA State Water Plan) Water Quality Resource Assessment. The prioritization was done based on specific parameters, including Biological Oxygen Demand (BOD), Total Nitrogen (TN), Total Phosphorus (TP), and Total Suspended Solids (TSS). BOD served as an indicator for Dissolved Oxygen (DO) and TSS served as an indicator for fecal coliform (FC).

Watershed prioritization began with identifying the 12 digit Hydrologic Unit Code (HUC-12) sub-watersheds present in the watershed. The model outputs for wet, dry, normal years were processed to derive normalized stormflow and baseflow volumes, yearly mass loading, and average yearly concentrations for BOD, TN, TP, and TSS delivered to the stream. The highest priority sub-watersheds had the highest overall loading, concentration, and flow volumes that was associated with a 303 (d) impaired segment. Sub-watersheds that contained impaired waterbody segments listed for nutrients, DO, and/or FC were given higher priority rankings. Once all the HUC-12 sub-watersheds were prioritized (highest to lowest), the highest priority sub-watershed was analyzed in further detail to provide specific information about the various sources contributing to non-point/point source pollution of BOD, TN, TP and TSS.

A Regional Holistic Approach to Watershed Management - to Protect and Enhance Ecosystem Services for Future Generations

Albrecht, Barbara

ABSTRACT:
Alterations to the landscape by unbridled growth and development have been generally ignored in Northwest Florida. Coastal communities are known to be dynamic environments; these regions house ecosystems which have adapted to tropical weather in the form of heavy rain events, flooding, lightning induced fire, extreme temperature fluctuations, high humidity, etc.

Through growth and development, our landscape has become fragmented thus: altering biological community structure; altering hydrologic regimes; soil structure and chemistry; and thereby altering habitat structure, function and water quality. These shifts from a natural functioning landscapes to habitat conversion, destruction, and fragmentation have decreased the natural resiliency of the ecosystem by erosion, sedimentation, and sediment contamination. These rapid changes have also opened the Pandora's Box and contributed to the increase of invasive plants and animal species.

Today, the emphasis is more on protecting the infrastructure (roads, bridges, stormwater ponds, homes, etc.), than the ecosystem that affords the coastal community the resiliency to exist. Future land managers, business leaders and environmental stewards must be cross trained (cross pollinated) to understand the value and the importance of protecting these isolated wetlands, riparian zones, flood plains for future habitat and healthy water quality. Only then can the ecosystem function as designed.

Implications of Land Use Change on Coastal Wetlands and Headwaters of Alabama
Anderson, Christopher
ABSTRACT:
Starting in 2008, a series of studies were conducted to examine the influence of urban land use on the condition and function of coastal wetlands and headwater creeks in Baldwin County, Alabama. Over 35 headwater wetlands were selected across a range of surrounding land uses and examined for functional attributes such as contribution to local biodiversity, carbon cycling and water quality. Results from these studies emphasized the importance of minimizing land changes immediately adjacent to wetlands while maintaining hydrological conditions that approximate natural conditions. Changes in local drainage patterns and other hydrological alterations resulting from urban land use were shown to alter the functional capacity of these wetlands. Other research was conducted on low-order headwater creeks throughout the Wolf Bay basin. Water and invertebrate data collected at 13 wadeable creeks indicated that residential development typical of the region has influenced physiochemical and biotic conditions compared to reference creek sites. Finally, a comparison of six tidal creeks (3 surrounded by residential land use and 3 surrounded by forested lands) was conducted to examine seasonal use of resident fish and their associated habitats. Results showed that fringing salt marshes in urban settings had different marsh attributes that related to different assemblages of resident fish with reduced health measures. We discuss all of these results in the context of regional monitoring needs, the development of rapid assessment tools, and overall land use management in coastal Alabama.

Using Population Models to Evaluate Management Alternatives for Gulf-Strain Striped Bass
Aspinwall, Alex
ABSTRACT:
Interstate management of Gulf-strain Striped Bass (*Morone saxatilis*) has involved a thirty- year cooperative effort involving Federal and State agencies in Georgia, Florida and Alabama (Gulf Striped Bass Technical Committee). The Committee has recently focused on developing an adaptive framework for conserving and restoring Gulf striped bass in the Apalachicola, Chattahoochee, Flint River (ACF) system. To evaluate the consequences and tradeoffs among management activities, population models are being constructed to inform management decisions. We constructed a stochastic matrix model with varying recruitment, survival and stocking rates to simulate effects of management alternatives on Gulf Striped bass population objectives. We used an age-classified matrix model that incorporated stock fecundity estimates and survival estimates to project population growth rate. In addition, we evaluated how harvest rates in the fishery and Hydrilla (an exotic weed) density influenced population growth rate. Annual survival and mortality rates were estimated from catch curve analysis and fecundity was estimated and predicted using regression analysis of fish length versus total egg number from hatchery brood fish data. Stocking rates and stocked-fish survival rates were estimated from census data. Results of the model will be used to update data provided by the Committee for informing decisions related to selection of management alternatives. In addition, the results can be applied to other populations of Striped Bass in the Gulf Region.

Predicting Stream Channel Head Locations in the State of Alabama
Avcioglu, Burak
ABSTRACT:
Channel heads represents the beginning of a stream channel. Estimating stream channel head locations is an important task for managing water bodies since they play a significant role in sediment transport from hillslope to downstream. Even though identification of individual channel heads in the field is easy, channel heads are numerous across the landscape and field identifying all of them for mapping would be extremely time consuming. For this reason, several methods have been developed to estimate the location of channel

heads using digital elevation maps (DEM) and related data. However, the accuracy and the validity of those methods remains uncertain. The slope-area method (Montgomery and Dietrich 1989) has been widely used for this purpose and utilizes area:slope threshold relationships that are then used to estimate the position of channel heads from digital elevation models. The slope-area method originates from the inverse relationship between local slope at the channel head and drainage area that accumulates to form a channel head. The main goal of this project was to assess the utility of the slope-area method for predicting channel head locations in forested areas of Alabama under different physiographic regions. A total of 163 stream channel head locations across the three physiographic regions of Alabama, including Southwestern Appalachians (n=51), Piedmont (n=61), and Coastal Plains (n=51), were identified and mapped in the field using a GPS device. The field data collection was conducted in national forests corresponding to each physiographic region, namely William B. Bankhead National Forest, Talladega National Forest, and Conecuh National Forest of Alabama, to demonstrate least disturbed (i.e. reference) conditions. Local slope and drainage area for each mapped channel head was calculated using DEM with 10m resolution. The variables were then analyzed by regression analysis to evaluate potential relationships across regions. Initial results show that the drainage areas for channel heads among the physiographic regions differs significantly which supports that a single drainage area model to locate channel heads across the entire state is not a suitable method. The results demonstrated that channel head local slope and drainage area has an inverse and strong relationship in the Talladega National Forest ($r^2 = 0.71$) and the William B. Bankhead National Forest ($r^2 = 0.61$). Among three physiographic regions, the weakest relationship has been observed in the Conecuh National Forest ($r^2 = 0.45$). Potential application and improvement of the slope-area results will be provided.

The New Clean Water Rule and Identification of Jurisdictional Waters of the US

Baird, Fay

ABSTRACT:
On May 27th 2015, the US Environmental Protection Agency which possesses major oversight capacity for the Clean Water Act issued a new rule to further clarify the understanding of the extent of jurisdiction of the federal government on "waters of the US, including wetlands". This new rule has been dubbed the "Clean Water Rule" and was developed after careful legal and extensive scientific considerations. In January of 2015 the USEPA produced a document on which this new rule is based, entitled, "Connectivity of Streams and Wetlands to Downstream Waters: A Review and Synthesis of the Scientific Evidence (Final Report)". This presentation will review the highlights of the USEPA report, and the Clean Water Rule. We will present the essential aspects of water features that cause them to be considered under regulatory jurisdiction, including, definitions of watersheds, how groundwater affects jurisdiction, when floodplains are regulated and when they are not, how regulatory boundaries of wetlands, streams, lakes, oceans and rivers are identified using Ordinary High Water Marks (OHWM), how to determine spring tide or mean tide, and what legal decisions resulted in the need for USEPA to clarify current definitions used every day to ensure compliance with the Clean Water Act. We will also discuss some important aspects of definitions and authorities that have or have not changed since the rule was issued.

Application of SWMM of Urban Flooding in a Coastal Alabama Watershed

BALTACI, ENIS

ABSTRACT:
The locals living in the Toulmins Spring Branch Watershed (TSBW) (7.88 km^2) in the northern suburbs of the city of Mobile have frequently been complaining about chronic flooding. The increased frequency in floods has also caused significant increase in money spent for infrastructure repairs. In this Mobile Bay National Estuary Program (MBNEP) funded study we explored the causes of increased flood frequencies in this small community through field monitoring and watershed modeling and also searched for solutions to

help mitigate the flooding problems in the TSBW. Water levels and streamflow were monitored at various sites within the TSBW. Drainages, stormwater outfalls and their characteristics (e.g. material, diameters, etc.) were identified and mapped in GIS after intense field reconnaissance. Areas sensitive to flooding as well as areas that contribute to downstream flooding were identified through the use of the Storm Water Management Model (SWMM). Several low impact design (LID) options were evaluated for flood control including bio-retention, rain barrel, and permeable pavements. The model was calibrated and validated for water levels and discharge using data obtained from 5 sites. Floodplain maps were generated for various return period storm events, including 10, 50 and 100-yr periods, and flood generating areas were determined using the calibrated and validated model. The most downstream site is significantly influenced by tidal effect which was treated as a lower boundary condition in the SWMM. At the most downstream site, the model simulated water levels with an acceptable level of accuracy compared to the observed data; however, it overestimated water levels at upstream sites. Using the developed model, various LID practices were experimented at the flood-generating areas to help reduce future flooding at the flood-prone areas of the TSBW. This study intends to help Mobile County and the city planners make science-based decisions for infrastructure maintenance and to improve the future land use development plans

Supplemental Tools for Natural Channel Design in Urban Systems

Barry, William K.

ABSTRACT:
This presentation highlights the application of continuous simulation modeling (CSM) and 2-dimensional (2D) hydraulic modeling techniques to supplement the Natural Channel Design (NCD) approach in urban settings. The NCD approach promoted by the U.S. Environmental Protection Agency and others is strongly dependent on the quantification of the bank full flow rate and associated channel geometries of a given stream. In an urban setting, the determination of bank full flows is often a difficult prospect given the complex nature of urban hydrology, the highly modified morphology and hydrology of urban streams, and the often subjective indicators of bank full stage that can be observed in the field. This presentation will describe the application of CSM to supplement bank full flow interpretations on urban streams. CSM involves application of a continuous record of historical precipitation data to hydrologic and hydraulic models for a given watershed. This technique is useful for the estimation of the frequency of flows of a given magnitude, such as the bank full flow as well as the evaluation of the potential impact of future hydromodification within a watershed. Another difficulty that arises in the application of the NCD approach in urban settings is the need for reference reach data. Reference reach data is intended in part, as a means to evaluate the long term dynamic stability of the restored reach. This data is also used as a surrogate for analyses of the suitability of the hydraulic habitat in the restored reach for anticipated transient and resident fish species. Given the degree of anthropogenic impacts to urban watersheds and their receiving streams, a suitable reference reach may be difficult to identify. This presentation addresses the application of 2D modeling techniques to supplement the use of any available reference reach data for 1) the evaluation of potential failure modes and locations in stream designs and 2) evaluation of the hydraulic suitability of the stream design for the anticipated transient and resident fish species.

"Alice in Groundwater Land": Adams v. Lang and "Nominal" Reasonable Use in Alabama Water Law and Policy

Bearden, Bennett

ABSTRACT:
Alabama's courts traditionally have applied the "reasonable use" theory in analyses of surface water cases, but seemingly interpret groundwater law with a hodgepodge approach, mixing reasonable use with absolute ownership and nuisance law. In the seminal case of Adams v. Lang, 553 So. 2d 89 (Ala. 1989), the Supreme

Court of Alabama applied the reasonable use theory in name only, finding that, since water in the instant case was for beneficial use on the land, as opposed to use incidental to the land, the use was per se reasonable. The Adams rule, as it has come to be known, essentially is that beneficial use of groundwater on overlying land is reasonable per se. Noteworthy, is that the court did not balance the uses as traditionally required under application of the reasonable use theory, thereby making the actual rule applied in Adams tantamount to the absolute ownership theory or English rule. As stated in Corpus Juris Secundum "[i]n some states, the rule of common law followed in early decisions has given way to the doctrine of reasonable use limiting the right of a landowner to percolating water in his land to such an amount of water as may be necessary for some useful or beneficial purpose in connection with the land from which it is taken, not restricting his right to use the water for any useful purpose on his own land, and not restricting his right to use it elsewhere in absence of proof of injury to adjoining landowners."

Later in Martin v. City of Linden, 667 So. 2d 732 (Ala. 1995), the Supreme Court of Alabama, left the nominal reasonable use theory in place, but further stated that the withdrawal of groundwater for use on land not overlying the aquifer is unreasonable per se. The Martin court maintained the Adams rule, but the Martin opinion also had other far-reaching policy implications. In Martin, the City of Linden's principal water supply became contaminated by saltwater and consequently, the City purchased land adjacent to Judy Martin's farm and proposed to divert and pipe away up to 500,000 gallons per day back to Linden, 15 miles from the proposed well site. Martin successfully sued the City over whether it could use the groundwater off the lands from which it is taken. The court held that the proposed use of water was not permissible under the so-called reasonable use rule and the City did not have the right to transfer the water back to Linden.

Alabama courts need to clarify the nominal reasonable use rule for groundwater at the next available opportunity. Additionally, the Martin case exemplifies the policy and legal issues for municipalities where use of groundwater that is pumped from a well site, transferred off of the land from which it is taken, and piped away for water supply, may be unreasonable per se. This "Alice in Groundwater Land" approach to groundwater law in Alabama suggests that a more comprehensive policy may be advantageous to the State.

The Shape of Things to Come: Reverse-engineering Periphyton Colonization Processes using 3D Printing

Blersch, David

ABSTRACT:
Although periphyton communities form an important part in stream ecosystems, little is conclusively known about the process of colonization of new or bare substrata surfaces. Additive manufacturing technologies such as 3D printing provide a new research tool for reverse engineering this relationship. The objective of this research is to understand the micro-topographical surface characteristics that control species recruitment and growth from a mixed indigenous algal community. Our approach is to employ high-resolution polyjet 3-D printing to produce substratum surfaces with varying roughness morphologies, and expose them to growth conditions in Alabama streams, thereby determining the qualities of the periphyton community that colonizes particular surface topographies. Two experiments were designed to test the selective colonization of a mixed algal biofilm community on various printed surface designs. Preliminary results demonstrate the feasibility of using printed material as experimental substrata for algal growth, and show a direct effect of surface roughness on algal cell recruitment, colonization, and growth rates. Continuing work focuses on species-specific dynamics of recruitment from local streams. The results of this work have implications for understanding periphyton colonization dynamics in natural waterways, and inform applications to algal cultivation reactors for aquatic pollutant recovery and biomass production.

2015 Water-Use Compilation: A National Perspective

Bradley, Michael

ABSTRACT:

The U. S. Geological Survey through its National Water-Use Information Program compiles and reports on water use across the United States. The U. S. Geological Survey relies on water-use data compiled and provided by State agencies to produce the National compilation. Disseminated every 5 years since 1950, the National water-use compilation works with State, local, and Federal partners to consolidate dozens of disparate data sets and to create comprehensive reports of water use in the United States. The U.S. Geological Survey is the only Federal agency that explicitly collects water-use data as a part of the agency mission.

The 2015 water-use compilation will again rely on Federal, State, and local agencies for the water use data. Data will be compiled for public-water supply, self-supplied industry, self-supplied domestic, and irrigation from state agencies. The National program will provide nationally consistent water use data sets for irrigation, thermoelectric power, aquaculture, and mining to aid in the compilation. Water consumption at thermoelectric power plants will be included in the 2015 compilation as the agency begins to look again at water consumption in addition to water withdrawals.

The U.S. Geological Survey, as part of the SECURE Water Act, is also administering a grant program to State water-resource agencies to support activities related to data collection, methods research and development at the State level. The USGS Water Use Data and Research program will provide financial assistance, through cooperative agreements with State water resource agencies, to improve the availability, quality, compatibility and delivery of water-use data that is collected and/or estimated by States. The total authorized funding for the Water Use Data and Research program is $12.5 million over a period of five years. The maximum funding available in Federal fiscal year 2016 will be $1.5 million, depending upon Congressional approval. The program funds, beginning in FY2016 will be competitively awarded to State programs to address research, data collection, and data improvement in order to better define and understand water use in the United States.

Sources of Escherichia coli in Lake Martin, Alabama

Burnes, Brian

ABSTRACT:

Lake Martin, Alabama is a 44,000-acre (178 km²) hydroelectric reservoir built in 1926. Periodic high E. coli counts from Lake Martin waters have raised the question of whether animals or humans may be responsible, in some part, for the bacterial contamination. The lake has become highly developed in areas and in summer months is frequented by numerous recreational boaters and swimmers. Additionally, animals inhabit the watershed, including wild geese, cattle, horses, deer, dogs, and cats. In this study, 295 E. coli isolates from various animals around Lake Martin were analyzed by antibiotic resistance analysis to investigate their population structure and determine their potential use in identifying sources of bacterial contamination. The correct classification rate approached 100% for isolates from humans, geese, deer/horse, cattle, and a laboratory reference strain 25922, with cats/dogs following close behind. Isolates collected from sites in Lake Martin are currently being analyzed.

Effects of Upstream Disturbances on Downstream Sediment Yield and Stream Channel Structure in an Actively Managed Forested Watershed

Cavus, Ilkim

ABSTRACT:

Attaining high quality water has always been a big concern for humankind since life cannot exist in the absence of water. Forests are unique for water supply, quality and quantity. However, conversion of forested lands to agricultural and/or urban use, as well as disturbances created in forested watersheds lead to degradation and deterioration of our water resources. To minimize the disturbance impacts on water quality various best management practices (BMPs) such as streamside management zones (SMZs) are implemented in managed forested watersheds. On the contrary, any upstream urban and agricultural activities where BMPs are not present or are inadequate can negatively impact downstream water quality regardless of the presence of downstream BMPs. In a recent study two small paired watersheds located near Auburn, Alabama were examined for streamflow and sediment yield in 2009 and 2010 to evaluate the efficacy of SMZs at trapping sediment yield from a clearcut area. Recent urban activities upstream of the study watersheds and poorly designed BMPs around these activities provided us an opportunity to observe and document the impacts of upstream disturbances on downstream stream water quality and morphology. Six monitoring stations were established to observe flow and sediment yield. Sediment data have been collected since January 2014. In addition to sediment concentration measurements, cross-sections of the channels have also been surveyed at several locations across the streams, following each significant storm events in order to assess the effects on channel morphology. Although a full spectrum of data is not ready to reach to an overarching conclusion, data collected so far show substantial increase in sediment load. Sediment concentrations are up to two orders of magnate higher compared to the levels from the previous study where sediment concentrations were monitored following a clearcutting. Furthermore, channel morphology is altered visibly following almost every significant rain event (>1"). Our study clearly suggest that assessment of watersheds as a whole is needed in order to define the origin of problems and mitigate them more effectively.

Riverine Water, Sediment and Nutrient Flux Predictions: the Spatially and Temporally Explicit WBMsed Model

Cohen, Sagy

ABSTRACT:

During the last several decades, many rivers have undergone considerable alterations in response to anthropogenic and climatic changes. These changes have affected water, sediment, nutrient and carbon fluxes along river networks, with considerable consequences to infrastructure, agriculture, water security, ecology and geomorphology, in many locations worldwide. The degree of change of river material fluxes, and their spatial and temporal characteristics are largely unknown. This is to a large degree due to the lack of continuous and long-term monitoring of river fluxes in the vast majority of global rivers. In part to address these shortcomings, we developed a spatially and temporally explicit global-scale riverine flux model, termed WBMsed, that predicts daily water, sediment and nutrient flux at relatively high spatial resolution. In this talk I will present the model's conceptual framework, recent applications, and future research and development directions.

Fight the Bite: How You can Reduce the Risk of West Nile Virus

Cole, Michelle

ABSTRACT:

Over the last couple of years the Center for Environmental Studies at the Urban Rural Interface has focused and did research on the West Nile Virus. The US Forest Service and Georgia Department of Community Health are two organizations that collaborated with us during the course of this project. The Georgia Department of Community Health provided the key WNV data that are fundamental to this project. In addition, we interacted with specialists with the Center for Disease Control (CDC) in Atlanta during the course of the study. Many Auburn University researchers and graduate students were involved. We will transfer our findings to K-12 students, the general public, teachers, and managers in order to increase awareness of forests' role in disease protection and reduce the risk of West Nile Virus incidence. The proposed work will link with two existing national distribution networks - urbanforestrysouth.org and interfacesouth.org - where we will post all research findings, PowerPoint presentations, fact sheets and newsletters. We will synthesize information for facts sheet (English and Spanish) specifically focused on different user groups including urban forest managers, policy makers, health officials, and the general public. Fact sheets will be distributed electronically to all urban forest coordinators for their use and distribution. Fact sheets will be supplemented by providing text material on the progress and findings to "Leaves of Change", a national newsletter through interfacesouth.org. and other water resource groups. Finally, we will work with urbanforestrysouth.org and water organizations on creating and presenting webinars on research findings and management opportunities. For the health officials, we will be working closely with CDC and will be posting our research findings on their websites and in their newsletters. Project Learning Tree will do a case study of West Nile and the finding will be distributed national wide.

Monitoring and Restoration of Alabama Coastal Streams

Cook, Marlon

ABSTRACT:

Baldwin and Mobile Counties are at a crossroads related to stream health, biological sustainability and quality of life for a growing population. Parts of these counties are undergoing widespread transitions in land use from forest and agriculture to commercial and residential as the pace of population growth is ever increasing. Land-use change can have tremendous deleterious impacts on water quality and biological habitat of streams. This is particularly true along the eastern shore of Baldwin County where complex geology has influenced topography, highly erodible soils, and surface-water runoff and in Mobile where urbanization has profoundly impacted coastal streams and Mobile Bay.

An initiative lead by the Mobile Bay National Estuary Program and funded by fines and penalties from the Deep Water Horizon Oil Spill is investigating stream and estuary health, formulating watershed management plans, and implementing remedial strategies for improving water quality and habitats in Baldwin and Mobile Counties. Water quality impacts are being investigated by the Geological Survey of Alabama (GSA) in cooperation with the Mobile Bay National Estuary Program, Alabama Department of Conservation and Natural Resources State Lands Division, Alabama Department of Environmental Management, and municipalities. Currently, investigations of the geologic, hydrologic, and geochemical character and land-use impacts in five watersheds in Baldwin and Mobile Counties have been completed. These data, which include stream flow, various field parameters, sediment transport rates, and nutrient and metals concentrations, are used to formulate environmental management plans and to design remediation strategies. Currently, evaluations of Bon Secour and Magnolia Rivers, and D'Olive Creek in Baldwin County and Dog and Fowl Rivers in Mobile County have been completed. Water quality data, remedial efforts, funding, and future assessments will be discussed during the presentation.

Bacteriological Sampling of High-Use Sites on the Upper Cahaba River

Crawford, Myra

ABSTRACT:

Timely data on the state of pathogens in the Cahaba River are often not accessible, especially to the general public. Inquiries often come to the office of the Cahaba Riverkeeper asking: Is it safe to swim at (fill in the blank with some site on the river). In summer 2014, the Cahaba Riverkeeper initiated a study to answer those questions by measuring the amount of *E. coli* and other bacteria present at eight high-use sites in the Upper Cahaba. For eight weeks, the sites were sampled, using EPA-approved methods (Alabama Water Watch protocol). *E. coli* counts that exceeded 200, the lower level of the cautionary rating system, were found in six of the eight sites during two or more samplings. One site produced *E. coli* counts that were either in the cautionary or unsafe ranges all eight weeks. Sampling results were reported via social media each week in time for weekend recreational activities. Additional bacteriological sampling is being conducted at the same sites in summer 2015 and will provide comparison data that can be examined by time series analysis and other data analysis methods.

Communicating Risk in a Short Attention Span World

Durham, Leslie

ABSTRACT:

Awareness of risk alone is not enough to motivate people to take action, especially when we are not in imminent risk of danger. Social research confirms that people must be aware of their risk and be concerned about their risk before they will change their behavior. How do you begin to change the conversation about flood risk from whether a community or stakeholder is "in or out of a flood zone" to "how much is at risk" by linking that risk to issues they already care about like economic development, property values and sustainability (to name a few)? If we empower key stakeholders at the community level to begin talking about these risks and how the benefits of taking action can outweigh the costs, we will be in a better position to elicit change.

Themes of this presentation would be how do you communicate risk in a way that it will motivate change, how easily people forget their risks when there is no constant reminder (no hurricanes in a decade), and strategies for influencing change.

The Transition from Common-Law to Statutory Regulation of Water Resources: Lessons from Other States

Elliott, Heather

ABSTRACT:

A variety of government officials, policy analysts, and non-governmental actors have called on the State of Alabama to adopt a comprehensive water-resources statute to replace its current and largely common-law approach to water management. Such transitions have already occurred in a number of other states east of the Mississippi, which have adopted regulated- riparian statutes to manage state water resources and/or have entered into interstate compacts that closely regulate regional water resources. What can Alabama learn from those states' experiences? In this paper, we investigate the political interests, social processes, and resource pressures that led the regulated-riparian states to adopt these statutes. We also identify the interest groups that were key players in each state's transition, and we highlight the successes and failures of each state's regulatory scheme. Our hope is that this research can inform any move in Alabama toward a regulated-riparian statute.

Why So Different? Mercury Levels in Largemouth Bass (Micropterus salmoides) in Two Adjacent Alabama Rivers

Findlay, Robert

ABSTRACT:
Methyl mercury is a significant environmental toxin with consumption of wild caught fish being a main route of human exposure. A recent study found that largemouth bass populations in regulated and unregulated rivers differed significantly in methyl mercury concentration suggesting that trophic dynamics strongly influence pollutant body load. To examine this possibility, we sampled largemouth bass from two adjacent rivers, one regulated and one unregulated, and applied a suite of biochemical and stable isotope assays to determine the trophic dynamics of each population. Largemouth bass from the unregulated Sipsey River (Elrod, AL, USA) averaged 0.87 mg total mercury kg-1 wet weight skinless fillet while bass from the regulated Black Warrior River (Demopolis, AL, USA) averaged 0.19 mg kg-1 wet weight skinless fillet. For both populations, fish age, weight, and length were positively correlated with muscle Hg concentration. Compound specific analysis of ÃŽÂ´15N of amino acids indicated both populations occupy comparable trophic positions. Triglyceride fatty acid profiles of Sipsey River bass, compared to Demopolis Reservoir bass, were enriched in fatty acids associated with terrestrial detritus, fatty acids typical of sulfate: reducing bacteria, omega 6 fatty acids, and 13C indicating the food web was subsidized by allochthonous detritus and was benthic in nature while the Demopolis Reservoir bass relied more on a pelagic food web. The close proximity of the rivers makes differences in atmospheric deposition unlikely and our findings indicate that food web dynamics strongly influence mercury concentration in fish.

Hot Springs Flood Warning Information System

Fleming, Joseph

ABSTRACT:
The City of Hot Springs is identified by its sharp topography, exposed bedrock, and thermo heated springs. These characteristics along with the likelihood of receiving frequent precipitation events in the form of microburst can turn the City's small urban creeks into torrents, destroying property and endangering lives. Along with this propensity for flash flooding, the City's heavily travelled historical district lies atop an aging tunnel structure that can quickly become inundated by flood waters during larger than normal precipitation events. In 2008 the city of Hot Springs came into an agreement with the USGS (Arkansas Water Science Center) to monitor two creeks upstream and one downstream of the historical district. This system consisted of four stream gages and two precipitation gages in the upper reach of the two watersheds of concern. Each gage's primary job was to alert emergency officials by a voice phone message when an alert threshold was met during a storm event. The Secondary function for each gage was to collect stream flow data and relay this information by GOES for data display and for future model analysis to better forecast city inundation.

The flood information system was activated a number of times over a five year period with some success and failures. During these events, parties involved were able to better understand these failures and also understand what characteristics were needed to have a more innovative system that can meet the communication needs to serve the city of Hot Springs better. In 2013 a new agreement was signed with the intention to meet and surpass these new goals for a more complete flood warning system. First order of action was to equip existing stream-gages and precipitation-gages with new communication equipment that would add the abilities of two minute data retrieval, the ability for two way communication with each gage, and the capacity for text message notifications. A more concise website was created that displayed data in verity methods with a two minute replication cycle for real-time event monitoring. This webpage quickly became the primary vehicle for data display, and alert information for the city. For viewing flood debris entering the tunnel system, two real-time PTZ web cameras were installed on creeks just upstream of the city. In addition to upgrading existing gages two new stream-gages were installed on a creek east of the city

center. This now brings the flood warning information system to total of six stream-gages and two precipitation-gages with a new precipitation-gage to be installed in 2015. The system has been activated ten times since the upgrade to the network. The improvement in data retrieval, network coverage growth, and system reliability has been the biggest success story for the new system renovation. Most importantly as weather patterns change for the worse, the new improvements will allow for the network to be more dynamic and adapt to future requirements.

The Use of Biological Data to Achieve Compliance with the Final 316(b) Rule for Cooling Water Intakes
Geoghegan, Paul
ABSTRACT:
Section 316(b) of the Clean Water Act (CWA) requires the USEPA to issue regulations on the design and operation of cooling water intake structures to limit potential adverse impacts to the aquatic ecosystem. Biological data forms the basis for compliance with §316(b) of the CWA. This section of the Act requires that the location, design construction and capacity of cooling water intake structures reflect the best available technology for minimizing adverse impacts. These adverse impacts usually take the form of impingement of adult and juvenile fish against the cooling water intake screens of power plants or the entrainment of fish eggs and larvae through the cooling water system. The flow of information to reach compliance with §316(b) starts with the collection of biological impingement and entrainment estimates and proceeds through technology selection and optimization, and benefit evaluation analyses. The design of sampling programs and sampling locations must ensure that annual, seasonal, and diel variation is adequately described. Sample collection methods for entrainment, either nets or pumps, must collect samples that are representative of potential impacts. Once samples are analyzed in the lab, strict quality control procedures are used to ensure the collection of high quality data. The final rule implementing §316(b) has the underlying assumption that reductions in cooling water flow will reduce impingement and entrainment (I&E). However, environmental factors and year class strength are also important factors in affecting I&E that will not be mediated by reductions in cooling water flow. Biological modeling procedures such as adult equivalency and production foregone can be used to show that I&E results in relatively small losses to the environment. Multi-million dollar decisions rest on the design and implementation of biological monitoring programs and technology evaluations that are informed by biological data. The biological data are also input to the benefits evaluation analyses required by the rule. Therefore, a thorough and scientifically sound strategy for collection of biological data forms the basis for compliance with §316(b).

Management Plan for the Choctawhatchee, Pea and Yellow Rivers Watersheds - A Roadmap for the Future Based on Sustainable Water Resource Management Planning
Gibson, Barbara
ABSTRACT:
For over 23 years, the only watershed management authority existing as a state agency in Alabama has commissioned numerous studies to evaluate critical natural systems including water quality, water quantity, flooding, drought, and biological resources in southeast Alabama. Addressing these water resource issues is the cornerstone of the Choctawhatchee, Pea and Yellow Rivers Watershed Management Authority (CPYRWMA) mandated responsibilities. The CPYRWMA has taken on the task, along with state and federal partners, of developing a comprehensive Watershed Management Plan for its watersheds. The Plan contains basic watershed geographic and cultural information; scientific data; summaries of all past water resource assessments; and information including water availability and use, water quality, biological and forest resources, flood control, climate and economic impacts, and conservation education. It also contains numerous recommendations and options for policy development to more effectively manage and protect

vital natural resources into the future. The CPYRWMA Watershed Management Plan is a comprehensive reference document containing detailed data from more than 300 references covering 32 major watershed topics. Information in the Plan creates a framework for the CPYRWMA to assist federal, state, and local officials and agencies, and local stakeholders in protecting and conserving the natural resources in the region. The recommendations and policy options included in the document provide strategies for interstate and intrastate planning for sustainable natural resource management. The document will be distributed to all CPYRWMA state and local partners and will become an essential tool for education, natural resource protection, along with water quality and habitat protection.

U.S. Geological Survey NAWQA Principal Aquifer Surveys in Alabama

Gill, Amy

ABSTRACT:
The National Water-Quality Assessment (NAWQA) Program of the U. S. Geological Survey is designed to collect and interpret water-quality data to describe the status of our nation's water resources. Recent and ongoing NAWQA groundwater studies are exploring the status of water quality in multistate principal aquifers. By October 2015, groundwater samples will have been collected and analyzed from representative wells within six Principal Aquifer Surveys (PAS)
in Alabama. Samples have been collected from public-supply wells completed in the Coastal Lowlands, Southeastern Coastal Plain, Valley and Ridge/Piedmont carbonate rock, Piedmont/Blue Ridge crystalline rock, Mississippi Embayment and Texas Coastal Uplands, and Floridan aquifer systems. Samples were analyzed for a variety of water-quality characteristics and constituents, including temperature, dissolved oxygen, specific conductance, pH, major inorganics, trace elements, nutrients, radionuclides, pesticides, volatile organic compounds, and microbial indicators. In addition, samples were analyzed for chemical indicators of groundwater age. Preliminary data from these studies will be summarized by principal aquifer, and differences among the water- quality characteristics of the principal aquifers will be discussed.

Data-Driven Lake and Reservoir Monitoring Using Real-Time 3-D Hydrodynamic and Water-Quality Simulations

Green, Reed

ABSTRACT:
Recent advances in sensor technology and data telemetry allow a range of surface meteorological and vertical water-column data to be collected simultaneously, in real time, for lakes and reservoirs. With recent advancements in computer technology, three-dimensional lake and reservoir models can be run in much shorter time frames, allowing for near real-time simulations of hydrodynamics and water quality. Together, these advances allow for the development of quasi-real-time decision-support systems for water-quality management of individual lakes and reservoir systems. Using real-time instrumentation, the models can "learn" from the data and continuously check their predictive capabilities. Near real-time model simulations will provide necessary information for "data-driven" monitoring schemes designed to examine current physical, chemical, and biological conditions that impair the water quality of a lake or reservoir, like algal blooms. For example, real-time model simulations and resultant animations of algal patch development (functional groups like nitrogen-fixing cyanobacteria or even species like Cylindrospermopsis), which may be responsible for taste and odor or toxin problems in drinking water, will provide up-to-date information that can be used by monitoring teams to cost-effectively target data-collection to specific locations in the lake or reservoir and collect data throughout the growth phase and subsequent crash of the algal population. Most often, recognition of an algal bloom in a lake or reservoir does not happen until after the bloom peaked or crashed, and then it is too late to collect information about the conditions that propagated the bloom.

Water Use in Alabama
Harper, Michael
ABSTRACT:
The Alabama Office of Water Resources was established, in part, to help educate Alabama's citizens about how and where the State's water resources are being used.
OWR partnered with the U.S. Geological Survey (USGS) to publish the 2005 Water Use in Alabama report, which at the time, was the most comprehensive assessment of water withdrawals in Alabama ever produced. Earlier this year, the update to that report, based on 2010 data, was released in both a report format as well as an interactive web site.

This effort is being conducted in coordination with the USGS National Water Census program which is mandated to develop state by state summaries of water use every five years. This year is the next year in that census cycle and OWR has begun the process to work with numerous state and federal partners and to collect and assess the data that will be needed.
This presentation will provide an overview of how Alabama collects, assesses, and summarizes water use data, especially as it relates to the 2015 USGS Water Census process. The presentation will also provide some of the lessons learned from previous efforts as well as describing how data is being developed for geographic information system (GIS) and web based users. This capability will provide website visitors with improved data visualization tools that should allow for a better understanding of water use in individual sectors or a specific county or watershed.

Chattanooga WPA Program: Innovative Solutions to Infrastructure Assessment & Rehabilitation
Heilwagen, Bradley
ABSTRACT:
Between the years of 1936 and 1941, the Works Progress Administration (WPA) constructed a system of concrete-bottom rock-lined ditches within ten major neighborhoods in the City of Chattanooga: St. Elmo, South East Lake, East Lake, Highland Park, Orchard Knob, Bushtown, Avondale, East Chattanooga, Brainerd, and North Chattanooga. In the 70-plus years since these ditches were constructed, they have been slowly degraded by elements both natural and anthropogenic. Grass, weeds, bushes, and trees have grown relatively unchecked through the cracks in the joints, and storm water from routine rainfall events and major flooding events has eroded the grout between the rock linings and undermined the concrete bottom. In 1975, attempts were made to rehabilitate these ditches by covering most in a two-inch thick layer of new concrete, but this started to deteriorate over time. Since 1975, there has not been a comprehensive inventory and assessment of the integrity of the WPA drainage ditches.

Beginning in 2013, the City of Chattanooga and Amec Foster Wheeler began a WPA Ditch program to prepare a Condition Assessment Report, Ranking System, and Rehabilitation Plan for the WPA Ditch system. The system has been assessed using innovative mobile data collection methods and hydrologic and hydraulic modeling, which can be seamlessly integrated into the City of Chattanooga's existing GIS datasets. Based on the condition assessment, a three pronged scoring system was developed to provide objective information for the City to rank WPA ditches for rehabilitation projects. The three pronged scoring system is based on flood risk, ditch deterioration, and ecological conditions. The scores will be used to develop of suite of rehabilitation alternatives tailored to each WPA ditch ranging from restoration to natural conditions to off-channel storage to resurfacing. This presentation will provide a brief overview of the overall Chattanooga WPA Program, including its motivation and goals. It will describe the innovative techniques that Amec Foster Wheeler and the City of Chattanooga have used to make the data collection and condition assessments that will support the comprehensive rehabilitation plan as cost-effective as possible. It will present lessons learned since the beginning of the program that can be applied to infrastructure rehabilitation projects in municipalities throughout Alabama.

Restoration of the Northern Tip of Mon Louis Island - Surmounting Challenges to Project Implementation through Teamwork

Herder, Tom

ABSTRACT:

The erosion-impacted northern tip of Mon Louis Island in southern Mobile County, AL, is south of and adjacent to the mouth of East Fowl River. Owned by a consortium of cooperative interests, this wetlands-covered, approximately eight-acre peninsula underwent a 2005 wetlands restoration that successfully provided diverse native vegetation, tidal creeks, and regular flushing from its river (western) side. But the rate of erosion along the Mobile Bay (eastern) shore greatly exceeds that of more southern MLI shorelines and leaves this area particularly vulnerable to storm-related breaching across and into a lee-side embayment that serves as a harbor for commercial fishing interests. A breach would result in significant wetlands loss, diminished hazard mitigation due to river mouth expansion, and increased sedimentation caused by wetlands and uplands destruction and intensified river bank erosion upstream.

Mobile Bay National Estuary Program secured funding through the National Fish and Wildlife Foundation Gulf Environmental Benefit Fund to address restoration. Thompson Engineering was contracted to provide an engineering design with goals to stabilize the shoreline along the Bay side of the northern tip of MLI and to create or enhance aquatic, wetland, and upland habitats to the extent possible. The design target is restoration to the shoreline's 1997 footprint with creation of an additional four acres of wetland habitat beneficially using dredged material from the Fowl River Channel, an innovative plan was developed. Thompson Vibracore samples confirmed USACOE assertions that suitable material was available at the existing and permitted USACOE Fowl River disposal site, also in reasonable proximity. Material would be hydraulically dredged from there to backfill behind the breakwater for marsh creation. With equipment already in place, avoiding additional mobilization/demobilization costs, contractors would subsequently dredge the Fowl River navigation channel and use that material to replace sediment borrowed from the disposal site to bring it up to grade. With permit applications submitted to the USACOE and State, the project will is targeted to go to bid in early fall with construction set for fall, 2015.

Ecosystem Engineers alter Multi-trophic Species Diversity Across Spatial and Temporal Scales in Ponds

Howeth, Jennifer

ABSTRACT:

Ecologically important species that strongly structure diversity, including dominant, engineering, foundation, and keystone species, can influence local community composition and ecosystem function. As ecosystem engineers, beavers (*Castor canadensis*) modify local stream ecosystems through dam building thereby yielding a pond mosaic in the landscape. The effects of beavers in structuring species diversity across trophic levels and at multiple spatial and temporal scales through differences in the time since pond formation (habitat age), however, are unknown. Here, we evaluate the effects of beaver pond age on the spatial and temporal diversity of crayfish, fish, and zooplankton communities in 15 ponds located within a shared landscape. We also measure the response of pond ecosystem properties. We find that species diversity differs as a function of pond age, but the sensitivity varies by taxonomic group. Several pond ecosystem variables respond linearly to the age gradient, including maximum depth, dissolved organic carbon, and temperature, indicating that these variables likely contribute to age-dependent community structure. The results suggest that ecosystem engineers may play an even larger ecological role at both local and landscape scales than historically assumed, and thus should be acknowledged in conservation planning and management efforts. The maintenance of ponds of multiple age classes in the landscape may be necessary to maximize diversity of the regional species pool.

Water governance in the Southeast United States: Informing Decisions Regarding Water Allocation with Flow-ecology Data

Irwin, Elise

ABSTRACT:

The Southeastern United States is a global center of freshwater biodiversity that boasts the richest fish diversity and highest number of endemic fishes in any region of North America north of Mexico. The natural patterns of seasonal flows in streams and rivers are the drivers for many of the ecosystem functions and processes on which riverine and coastal natural and human economies rely. Alteration of natural flows by increased human demands for water and global climate change have been identified as priority threats to the health of southern rivers. Despite the fact that water resources are 'plentiful' compared to other regions, water allocation issues almost always involve multiple-competing users with different values and objectives. Science-based frameworks (e.g., Ecological Limits of Hydrologic Alteration; ELOHA) that incorporate the needs and values of decision makers are available to assist with decision making; however, there is no well-developed process for incorporating this into a broader social and political process of making flow allocation decisions. To address this problem, water resource managers and governance entities require science-based resources, tools, and information to support the development and testing of sound instream flow management and practices .Instream flow assessments that incorporate deliberative analytic tools have been case-by-case and although examples are becoming more prevalent, broader scale delivery is warranted. This paper will describe application of structured decision making methods to instream flow management on multiple spatial scales, with specific attention to structural uncertainty. The approach involves defining the problem, decision space, alternatives and appropriate decision analytic tools. Ultimately the framework can incorporate existing data on flow-ecology relations in a way that explicitly links potential water allocation strategies and management scenarios to expected outcomes. The approach will build the capacity of decision-makers in the region to apply data in a socio-ecological context by providing a scientific framework for assessing trade-offs between social values, management needs, and environmental outcomes.

Flashy and Trashy: Tale of An Urban Stream

James, Alex

ABSTRACT:

The Mill Creek Restoration Project is a multi-year, multi-agency collaborative effort towards the removal of Mill Creek from the CWA S. 303(d) List of Impaired Waters. The Mill Creek Watershed in Alabama is comprised of Mill Creek and Holland Creek and drains an area of approximately 24.8 square miles. The headwaters of Mill Creek originate within the City of Smiths Station (Lee County) and then flow through an increasingly urbanized area of Phenix City (Russell County) where it finally discharges into the Chattahoochee River at the Alabama-Georgia state line. Mill Creek in its entirety (9.93 linear miles) is impaired by low dissolved oxygen developing from organic enrichment triggered by urban development. Much of the watershed is increasingly urbanizing which results in recurrent flashy stormwater runoff flows in the creek; thus, contributing to eroding streambanks, lack of floodplain connection, minimal native riparian vegetation, invasive species, and aggraded stream channels. Completion of this project results in the implementation of 3 stream projects spanning approximately 2,000 linear feet of stream, 16 BMPs including 5 LID/green infrastructure practices, 5 water quality community outreach and education workshops as well as water quality education and training of over 2,000 elementary school children and 60 teachers from over 20 schools and 3 universities. Implementation of this project is dependent on the collaborative efforts of its partners. Partners include ADEM, ACES, City of Phenix City, City of Smiths Station, Chattahoochee-Chipola Clean Water Partnership, Lee and Russell County Commissions, Smiths Water and Sewer Authority, Alabama Water Watch, Phenix City Beautiful, Consolidated Resources, Phenix City Public Schools, and Lee County Board of Education.

A Practical Tool for Modeling Wetland Nutrient Cycling

Kalin, Latif

ABSTRACT:

Graphical user interfaces (GUIs) provide point-and-click control of software applications, eliminating the need to learn a language or type commands in order to run the application. WetQual is a process based model for nitrogen, phosphorus and carbon retention, cycling, and removal in flooded wetlands. This paper presents the recently developed GUI for WetQual model. The GUI allows the users run WetQual in a deterministic or stochastic fashion. Using the median values of WetQual model parameters, the deterministic mode provides one simulation of WetQual model. In the stochastic mode, model parameters are generated randomly based on user selected three probability distribution functions (pdfs) which are uniform, log-normal and triangular pdfs. The GUI then performs Monte Carlo Simulations to generate ensemble of outputs. Users can pick among the simulation numbers to visualize the time series of various WetQual outputs for a particular parameter set. To run the model user needs to provide fixed parameters, hydrologic parameters, water quality (including initial concentration and time-dependent parameters) prior to output generation. User can provide them in a text file format or enter them manually. In terms of hydrology, if observed data is available user can provide them as time series input. Alternatively, the model can do hydrologic flow routing (third order Runge-Kutta) to compute flow output and wetland depth/area/volume. WetQual GUI will enable users with a basic knowledge of hydrology and water quality to easily apply this model to their wetland sites and the related projects. The WetQual model, its source code, and the GUI will be publicly available through EPA for download once it is thoroughly tested and approved for release.

Quantitative Study of the Present -day Climate of the Middle Tennessee Elk Watershed Area from Global and Regional Climate Model Simulation

Kebede, Girma

ABSTRACT:

Quantitative estimation the climate and better understanding of the fresh water balance over the Middle Tennessee Elk watershed is one of corner stones of sustainable economic growth over the coming decades. As part of a wider hydroclimatic modeling research, we studied the spatial and temporal variability of precipitation and temperature over the Middle Tennessee Elk watershed and its environs using regional climate model simulations. Three sets of simulations with the Hadley Center's regional climate model (PRECIS) were carried out for the present day climate (1980-2010) at a resolution of 25km covering the southeastern U.S. These three sets simulations are driven by lateral boundary conditions taken from ERA-Interim reanalysis, and two global climate models (HadCM3 and ECHAM5) respectively. For validation, high resolution observed daily data sets from North American Land-Data Assimilation System (NLDAS) are used.

Preliminary results show that the spatial distribution of the present-day seasonal mean rainfall and temperature, simulated by PRECIS, are not only consistent with NLDAS but also captured fine scale spatial structures that are missing in the global model simulations due to their coarse resolution. In addition, the annual cycle and interannual variability, particularly that of temperature, are reasonably well reproduced by the PRECIS. When comparing the PRECIS simulations with the driving GCMs, PRECIS is sensitive to the choice of the driving GCM, suggesting a careful selection of driving GCM based on the current climate performance for the use of future climate impact assessment.

ALDOT MS4 IDDE Program-Uses of Innovative Technology for Outfall Mapping and Screening

Klinger, Richard,
Kane, Brian

ABSTRACT:
On 1 April 2013, the Alabama Department of Transportation (ALDOT) was issued a new permit under the National Pollutant Discharge Elimination System (NPDES) for their Municipal Separate Storm Sewer System (MS4) program. A major program element is the Illicit Discharge Detection and Elimination (IDDE) program, requiring ALDOT to map and screen outfalls located on transportation and support facilities statewide within the five year permit cycle. While a daunting task, ALDOT has developed a program using GIS analysis, efficient data collection, and in field screening to meet permit requirements.

ALDOT outfalls are located at transportation facilities (ALDOT roadways) or ALDOT support facilities. Transportation facility outfalls are present where ALDOT right-of-way (ROW) for roadways intersects Waters of the State within established MS4 areas. Support facility outfalls are located where ALDOT facility property is in close proximity to Waters of the State. Using GIS analysis, ALDOT initially listed 1,827 general locations requiring field investigation in the Storm Water Management Program Plan (SWMPP).

ALDOT's Maintenance Bureau was tasked with physically investigating and mapping these locations to establish ALDOT's Outfall Reconnaissance Inventory (ORI). The Maintenance Bureau recognized the need for securing external manpower and developing a paperless data collection process. The Bureau decided Trimble® could help provide both in coordination with additional consultants as needed. Trimble® performed pilot studies in the Dothan, Auburn, and Columbus, GA MS4 urbanized areas for developing and fine-tuning a new proprietary application – Trimble Unity™ Outfall Mapper – for ALDOT's ORI.

Trimble Unity™ Outfall Mapper is an application which can be used on GPS-enabled devices to assign work orders to field crews, collect required outfall data, link directly to a cloud-based system, and view progress in real time if needed online from the office. Project managers can assign one or several of the 1,827 identified locations to specific field crews without overlapping work. Field crews can capture the required data at each outfall within the location, including dimensions, photographs, GPS location, description, inspector information, date and time, major or minor outfall determination, and suspect illicit discharge information.

This application is also used during a Quality Assurance / Quality Control post-processing, ensuring completeness and accuracy. With Graphical User Interface software, project administrators may view outfall information as soon as field crews sync devices with the cloud. This enables faster recognition of illicit discharges, prompting sampling within the permit's 72-hour period, if required. It can also direct crews to missing locations while still in the field, saving possible extra trips. Eliminating paper forms also eliminates the time and staff required for data input, and allows for a more GIS-friendly file for ALDOT's Roadmap system.

Since outfall screening and illicit discharge reporting are required by the permit, Trimble Unity™ Outfall Inspector can also record indicator parameter sampling, illicit discharge source tracing and documentation, and almost immediate notification to selected authorities. Field crews can also carry small indicator parameter testing kits for illicit discharge sampling and testing for helping determine sources of pollutants.

ALDOT is presently continuing its field work for the ORI and screening processes and expanding the use of the IDDE applications to other areas of MS4 programs to help better manage large amounts of data.

Connecting water level to biological health in Alabama streams

Knight, Rodney

ABSTRACT:

Water is critical to the survival of aquatic biota, but little has been done to quantify the minimum water level in a stream that provides adequate support for aquatic biological communities. Most research in this field has focused either on connections between various streamflow measures and aquatic habitat, linkages between aquatic habitat and the biological health of streams, or using the annual or monthly 7Q10 or other low-flow measures to establish minimum flows. Resource managers need a better understanding of the interaction and linkages between streamflow, water level, channel morphology, physical habitat availability (streambed), and biological health to establish scientifically- defensible flow requirements.

The proposed analysis will be based on existing streamflow, channel morphology, physical habitat availability, and biological health (richness, diversity, or IBI score) data at each site. The analysis will include, but is not limited to daily value streamflow time series, streamflow measurement data (cross-section data), game and non-game fish community data, available habitat data, and stream cross-sectional surveys. Existing data from 15 to 20 streams indifferent physiographic regions of Alabama will then be used to answer the following questions:

- Is physical habitat quantity maximized at low, yet consistent streamflow?
- Is the streamflow associated with maximized physical habitat predictable and does it vary regionally according to published geologic and physiographic boundaries?
- Does biological health of fish communities appear to be correlated with the amount of time? streamflow is lower than that associated with the maximized physical habitat?

Evaluation of the Effectiveness of "No Dumping Signs" in Preventing Chemical Contamination of Inlet Stormwater (Preliminary Research)

Lackey, Dana

ABSTRACT:

In the summer of 2010, three graduate students from the University of Alabama at Birmingham (UAB), including the main author, undertook a project, together with the Occupational Health and Safety Department, to determine whether or not hazards existed on the UAB campus concerning influx of chemical contaminants into storm drains. This was accomplished via a risk assessment of every storm drain in two very different strategic areas: the main academic side of campus, and the medical side. During these risk assessments, the proximity of potential sources of contamination such as trash cans, dumpsters, roadways, parking spaces, etc., was taken into account. The purpose of this early study was to determine which inlets would be most suitable for new "No Dumping" warning signs based on three different budgetary levels. Those signs were installed in the fall of 2012 on only the lowest budgetary level, that covers the inlets that were determined in the risk assessment to have the highest potential level of contamination.

So as a continuation of that project, it is logical to evaluate the effectiveness of those "No Dumping" signs in preventing measurable chemical contamination. This will be accomplished by using chemical sensors and cameras which may be developed specifically for this operation. Laboratory experiments will reveal background concentrations and blank concentrations of different contaminants, and the sensors' and cameras' effectiveness will be tested extensively in the laboratory prior to their use in the field, most likely beginning in Spring 2016. This presentation will contain a discussion of the preliminary research which led to the promulgation of the warning signs in the first place, as well as research plans for laboratory analysis and sampling of the storm drains, which is likely to take place later this fall. If any results of this newest phase of the project are available, they will be presented as well.

Alabama's Drought Planning - Policy Moving Forward
Littlepage, Tom
ABSTRACT:
In the 2014 legislative session, the Alabama Drought Planning and Response Act (Act 2014-400) was passed and signed into law. Since that time, the Alabama Office of Water Resources has begun working with the Alabama Water Resources Commission, the Alabama Monitoring and Impact Group, stakeholders, and others to develop the specific policies, procedures, regulations and other tools to fully implement the Act. All these efforts support the primary goal of ensuring there is relevant, accurate, and consistent information concerning drought conditions, impacts and forecasts around the state.

The next step in this effort will be the promulgation of regulations and a revision to the Alabama Drought Management Plan that will provide specific guidelines and criteria for both state level activities as well as local public water system compliance with the Act. This presentation will provide an overview of the process to date as well as an update on the status of regulations being developed in support of the Alabama Drought Planning and Response Act and the upcoming revision to the Alabama Drought Plan.

Simulation of Groundwater Flow in the "1,500-Foot" Sand and "2,000-Foot" Sand, with Scenarios to Mitigate Saltwater Migration in the "2,000-Foot" Sand of the Baton Rouge Area, Louisiana
Lovelace, John
ABSTRACT:
Groundwater withdrawals have caused saltwater to encroach into freshwater- bearing aquifers beneath Baton Rouge, Louisiana. Groundwater investigations in the 1960s identified a freshwater-saltwater interface located at the Baton Rouge Fault, across which abrupt changes in water levels occur. Aquifers south of the fault generally contain saltwater, and aquifers north of the fault contain freshwater, though limited saltwater encroachment has been detected within 7 of the 10 aquifers north of the fault. The 10 aquifers beneath the Baton Rouge area, which includes East and West Baton Rouge Parishes, Pointe Coupee Parish, and East and West Feliciana Parishes, provided about 167 million gallons per day (621 million liters per day) for public supply and industrial use in 2010. Groundwater withdrawals from the "2,000-foot" sand in East Baton Rouge Parish have caused water-level drawdown as great as 356 feet (108 meters) and induced saltwater movement northward across the fault. Saltwater encroachment threatens industrial wells that are located about 3 miles north of the fault. Constant and variable-density groundwater models were developed with the MODFLOW and SEAWAT groundwater modeling codes to evaluate strategies to control saltwater migration, including changes in the distribution of groundwater withdrawals and installation of "scavenger" wells to intercept saltwater before it reaches existing production wells.

Artificial Neural Network Prediction of Future Rainfall Intensity in the Southeastern United States
McGehee, Ryan
ABSTRACT:
Climate change projections from the National Climate Assessment (NCA) predict a sobering future for the United States. Current climate trends are predicting an increasingly more vigorous hydrologic cycle, which can be characterized by increasing precipitation amounts, consecutive dry days, and temperatures. There are a number of environmental processes that will be affected by climate change, but soil loss mechanisms, especially in the southeastern US, are susceptible to instability due to highly erosive rainfall. Erosion prediction technologies such as WEPP and RUSLE2 can be used to estimate soil loss under a changing climate regime. These models require rainfall intensity data that can be derived from direct regional climate model outputs through the use of an artificial nueral network (ANN) without the use of additional temporal or spatial downscaling.

3-hourly, 50km x 50km gridded data from multiple GCM-RCM combinations are used to train, validate, and test an ANN to target data, which in this case is observed past rainfall intensity data. The ANN is subsequently used to predict future rainfall intensity based on projected climate data. This will enable the next step towards erosion prediction technologies that can anticipate the response of soil loss and sediment yield from a hillslope to changing climate.

Promoting the Watershed Approach: Plan, Implement, Monitor, Respond, and Adapt

Miller, Christian

ABSTRACT:
The Mobile Bay Watershed is over 43,600 square miles and drains most of Alabama and parts of three other states. It comprises many subwatersheds classified numerically by the USGS into Hydrologic Unit Codes, or HUCs. For planning purposes, the EPA prefers a scale of 12-digit HUCs, the smallest scale used by USGS. There are ninety-eight 12-digit HUCs in Alabama's two coastal counties draining into receiving waters like Fowl River, Magnolia River and many others.

Towards developing a five-year ecosystem restoration strategy, MBNEP's Project Implementation Committee (PIC) adopted a protocol of watershed management planning at the 12-digit HUC level to guide science-based project implementation. The PIC sought community input to prioritize coastal watersheds to pursue planning and project implementation and then worked to develop an inventory of resources and needs for each of the prioritized watersheds to guide project implementation. Additionally, the PIC agreed to include any other 12-digit HUC with direct tidal influence on the priority watersheds list because they have a demonstrable nexus to the resources potentially injured during the Deepwater Horizon incident, elevating their priority for possible settlement funds.

Currently, the MBNEP has secured funding through the National Fish and Wildlife Foundation's Gulf Environmental Benefit Fund (GEBF) to develop comprehensive watershed management plans (WMPs) for eight coastal basins: Fowl River, Dog River, Bayou La Batre, West Fowl River, Tensaw-Apalachee, Fish River, Bon Secour River, and Wolf Bay. Once completed, these plans will comprise twenty 12-digit HUCs and provide a roadmap for restoring and conserving watersheds and improving water and habitat quality in areas where resources may have been damaged by the Deepwater Horizon incident. This planning process, guided by the PIC and watershed stakeholders, charts a conceptual course for improving and protecting the things people most value about living along the Alabama coast. In addition to meeting the requirements for watershed planning specified by the EPA's Nine Key Elements, these plans also encompass issues related to environmental health and resiliency, culture and heritage, public access, and critical coastal habitats identified by the MBNEP's Science Advisory Committee as most threatened by anthropogenic stressors (freshwater wetlands; streams, rivers and riparian buffers; and intertidal marshes and flats).

To date, development of WMPs is underway for Fowl River, Bayou LaBatre, Dog River, and Bon Secour River, with the rest to follow in succession. Key projects identified by the WMPs will feed into the upcoming Coastal Alabama Restoration Plan. This effort is focused on improving the quality of the water entering Mobile Bay, as well as the Gulf of Mexico, and increasing the amount of nursery habitat necessary for sustaining a healthy fishery. This plan will include an inventory of restoration and conservation opportunities to guide future GEBF requests. Improving water quality and maintaining healthy populations of fish and shellfish are at the base of ensuring what is most important to people living along the Gulf coast: access to Gulf waters; abundant fish and shellfish; protection of heritage; environmental health and resilience; and water that is fishable, drinkable, and swimmable.

Creating a Clean Water Future

Miller, Christian

ABSTRACT:

On the Gulf Coast, water quality equates to quality of life. The Mobile Bay National Estuary Program along with numerous partners developed the Create a Clean Water Future campaign. The campaign is a public education and outreach program to bring awareness to stormwater pollution. The partners in development as well as implementation includes federal and state agencies, county and municipal governments, environmental groups and nonprofits, and the business community. Step up for what you can do to address stormwater issues. Speak up so your voice can be heard on the issues. Follow up by contacting regulatory officials and spreading the word. The campaign includes a website with numerous resources and logo to be used freely by all partners. Commercials educating on stormwater pollution introduced the campaign to the Gulf Coast. Ideas to spread the word has also led to the success of the campaign. Create a Clean Water Future is a simple outreach program that has been embraced by the community to address the serious impacts from stormwater.

Microhabitat Preferences of Federally Threatened Freshwater Mussel Species in Coastal Plain Streams

Miller, Jonathan

ABSTRACT:

Alabama contains the richest aquatic biodiversity of any state in the U.S. and hosts the greatest diversity of freshwater mussels, snails, fish, and crayfish. Freshwater mussels of the United States are the second most endangered fauna, closely following freshwater gastropods (snails). Freshwater mussel populations and diversity have been declining throughout Alabama for over a century. Habitat alteration and degradation are the leading cause for such declines. In 2010, eight species in the Escambia, Yellow, and Choctawhatchee basins were listed under the Endangered Species Act. Prior to federal listing, this study was implemented to 1) determine if microhabitat associations (water depth, current velocity, and sediment particle size and compaction) existed among mussel species, 2) determine if instream habitat (leaf pack, root mat, root wad, woody debris, and log) associations existed among mussel species, and 3) examine species associations regarding sediment stability. This study included three sites in the Choctawhatchee River watershed where habitat data were collected for individuals of three federally threatened mussel species, *Pleurobema strodeanum* (263), *Fusconaia burkei* (117), and *Hamiota australis* (25), and a common species, *Elliptio pullata* (94). Mussels were sampled by visual and tactile search, and the exact location of each individual mussel found was flagged. Within five centimeters of each mussel, water depth, flow, sediment particle size, sediment compaction, and habitat structure were recorded. Statistical results of all sites indicated that one variable or more among depth, current velocity, and compaction was significantly lower for *E. pullata* than the threatened mussel species sampled ($p < 0.05$). At all sites, the threatened species were associated with woody debris or log habitats, whereas *E. pullata* was often associated with leaf pack. Except for *H. australis* at a single site, threatened species were found in areas with higher relative shear stress than *E. pullata*. In conclusion, federally threatened species were associated with deeper and faster flowing water with more compacted sediments, and greater woody debris and log when compared to the common species (*E. pullata*). Anthropogenic influences in Coastal Plain river habitats have generally resulted in habitat homogenization (e.g., loose sand dominated and shallower streams) and eliminated habitats for listed species preferring deeper and faster flowing water and more compact sediments.

Effect of Irrigation Pumpage during Drought on Karst Aquifer Systems in Highly Agricultural Watersheds

Mitra, Subhasis

ABSTRACT:
Rapid population growth and increased irrigated-agriculture are threatening the availability of freshwater resources around the world. This scenario plays out very well in the Apalachicola-Chattahoochee-Flint (ACF) River Basin in Alabama, Georgia, and Florida where population growth in the city of Atlanta and increased groundwater withdrawal for irrigation in southwest Georgia are greatly affecting the supply of freshwater to aquatic ecosystems of the basin and the Apalachicola Bay. Since 1990s, Alabama, Georgia, and Florida have fought over the allocation of ACF River Basin's water and the conflict heats up every time there is drought in the basin. This study was conducted to understand and quantify the effect of irrigation pumpage on karst aquifer systems (Upper Floridan Aquifer) and stream-aquifer interactions in the lower ACF River Basin in southwest Georgia, USA. The groundwater model MODular Finite-Element Model (MODFE) developed by USGS was used for this study. The effect of two drought years, a moderate drought year and a severe drought year, were simulated to understand the effect of irrigation pumpage during droughts. The comparison of the results of the irrigated and non-irrigated scenarios showed that stream-aquifer flux is a major source of discharge from the aquifer to streams, and irrigation can cause as much as 10% change in stream-aquifer flux. The results also show that storage loss, recharge and discharge from upper semi-confining unit and stream-aquifer flux are the major water sources contributing towards irrigation pumpage in the study area. Similar scenario plays out in many river basins throughout the world, especially in the basins

Examining the Importance of Submarine Groundwater Discharge (SGD) in a River Dominated Estuary: Example of Mobile Bay, AL

Montiel, Daniel

ABSTRACT:
In a recent publication, Liefer et al. 2009 hypothesized that harmful algae blooms (HABs) occurring along the Alabama coastline may be initiated and sustained by nutrients delivered by submarine groundwater discharge (SGD) to impacted marine sites. The main argument is that nutrients concentrations in groundwater are typically several orders of magnitude higher than that of surface water, consequently, nutrient fluxes delivered to the coastline could be comparable to river-derived nutrient fluxes, playing an important role during low river flow regime sustaining HABs. The main goal of this study is to evaluate the magnitude of SGD-related nutrients delivered to the Alabama coastline and compare it to river fluxes in order to assess the significance of SGD for the nutrient balance of the Bay. We used a suite of tracers, both radioactive (222Rn, 226Ra, 224Ra and 223Ra) and stable (2H, 18O and 15N) isotopes to understand nutrients and water budgets and contributions from different sources. We performed continuous 222Rn measurements along Mobile Bay coastline in a marine survey mode, which indicated several "hot-spots" of SGD in the east side of the Bay. These were confirmed by two 24-hour time series that were deployed at both sides (Mobile and Baldwin County) to estimate total SGD. The average seepage rates at the west side (Mobile County) were 10.58 cm/day whereas the radon mass balance indicated higher discharge of 17.6 cm/day on the east side (Baldwin County). Discreet samples were also collected during the survey for 226Ra, 224Ra and 223Ra in order to calculate water residence time within Mobile Bay and assess water flow circulation within the Bay. Younger water (av. 3 days) was detected on the western shore of Mobile Bay compared to the eastern (7 days). The two 24h-time series deployed at both eastern and western shores show an average SGD of 17.6 cm/day (ranging between 0 and 108.45 cm/day) in Baldwin County, and 10.58 cm/day (ranged between 0 and 58.56 cm/day) in Mobile County, which is in agreement with activities found on the survey and water flow circulation.

Apalachicola-Chattahoochee-Flint Stakeholders: Working Together to Share a Common Resource
Moore, Bradford
ABSTRACT:
The Apalachicola-Chattahoochee-Flint watershed begins in Georgia, with the headwaters of the Chattahoochee near Unicoi and the headwaters of the Flint near Atlanta Hartsfield Airport. These rivers flow south to join at Lake Seminole, forming the Apalachicola, which flows south through Florida towards the Apalachicola Bay in the Gulf of Mexico. With over 48 inches of average annual rainfall, the basin has historically had significant water resources to support many uses. However, with the rapid population growth in the basin, particularly in the last two decades, as well as the implementation of agricultural irrigation beginning in the 1970s, combined with several significant drought events, stress on available water resources has been observed.

Water use in the basin has been litigated for more than two decades. Recognizing that litigation and politics have been unable to resolve the issues, a grassroots effort was launched by the individuals and groups most impacted by the situation: the stakeholders themselves. The ACF Stakeholders brought together a diverse group representing all water use sectors, organized by geographical basin caucuses.

The ACF Stakeholders (ACFS) was incorporated as a 501(c)3 nonprofit in late 2009, and began working together to achieve a common goal: the development of a Sustainable Water Management Plan (SWMP). The ACFS's mission is to recommend equitable water-sharing solutions among stakeholders that balance economic, ecological and social values while ensuring sustainability for current and future generations. The ACFS has raised over $1.7 million dollars for the development of this historic plan through scientific modeling and a shared vision process.

After five years the ACFS has completed and unanimously approved a Sustainable Water Management Plan for equitably managing water in the Apalachicola, Chattahoochee and Flint River Basin, including its impact on the Apalachicola Bay. The Plan will be shared with the governors of Alabama, Florida and Georgia, as well as other relevant state offices and agencies. It will also be shared with the U.S. Army Corps of Engineers, which is responsible for managing the chain of reservoirs along the Chattahoochee River.

This stakeholder driven planning process is a unique example of empowerment of impacted water users seeking to develop consensus around water management priorities. The ACFS's collaborative approach is distinctly different from other efforts in the watershed, and it offers an unprecedented opportunity to reach a long-term solution. This oral presentation will provide an update from last year's presentation on the completed SWMP and the recommendations that the ACFS believes will lead to start solving the complex issues in the Apalachicola-Chattahoochee-Flint basin.

Simulation of Pollutant Transport in the Damietta and the Rosetta Branches Before and After Building the Ethiopian Dam
Mostafa, Mohamed
ABSTRACT:
This research was performed on the Damietta and the Rosetta branches of the Nile River, Egypt. These two branches receive pollutant loadings from domestic, industrial, and agricultural activities located along their paths. The primary objective of this research project involved comparing the water quality of the Damietta and the Rosetta branches before and after building the Ethiopian Dam.

This comparison was conducted by using the river pollutant (RP) modeling. RP modeling is a river water quality model used to estimate water quality parameters such as total organic carbon (TOC), chlorides (Cl-), biological oxygen demand (BOD),chemical oxygen demand (COD), total dissolved solids (TDS), total suspended solids (TSS), dissolved oxygen (DO), pH, and temperature. The results showed that constructing

the Ethiopian Dam will slightly increase pollutants concentrations in the Damietta branch and that this increase will cause a slight decrease in water quality. On the other hand, constructing of the dam will significantly increase pollutant concentrations in the Rosetta branch and that this increase will cause a significant decrease in water quality. The water quality at the Rosetta branch will be adversely affected by the dam due to the high concentration of pollutants and the existence of three major pollution sources along the branch, while the water quality at the Damietta branch will not be adversely affected by the dam due to the absence of major pollution sources along the branch.

We've Come a Long Way Baby: History of Alabama's Erosion and Sediment Control Program for Construction

Norton, Earl

ABSTRACT:
The development of The Alabama Handbook for Erosion Control, Sediment Control and Stormwater Management on Construction Sites and Urban Areas started out as a simple request in 1992 by the Jefferson County Soil and Water Conservation District to the Alabama Soil and Water Conservation Committee to develop a handbook similar to what other states like Virginia, North Carolina, and Georgia had prepared. The handbook was developed during 1992-93 by the Soil Conservation Service with little input from industry, researchers, regulators and others. The 1993 handbook, for years, was mostly a "shelf" document and not used extensively like it is today. A state-wide erosion and sediment control program for Alabama took off in 2001 when Clean Water Act 319 grant dollars were targeted to modernize the handbook and develop the program. The "Handbook", as it is often referred to, has undergone major updates in 2004, 2006, 2009, and 2014 and is one of the most modern and comprehensive documents of its kind in the country. An accompanying Field Guide was prepared in 2004 and revised earlier this summer.
Along with developing a Handbook and Field Guide, a strong program has grown in support of erosion and sediment control technology for construction sites under the leadership of the Alabama Soil and Water Conservation Committee. Ten entities have joined together and form the Alabama Erosion and Sediment Control

"Tweak, Tweak, Tweak", The Latest Changes to the AL Handbook for Erosion and Sediment Control

Oakes, Perry

ABSTRACT:
The Alabama Handbook for Erosion and Sediment Control was modernized in 2004, updated in 2006, 2009, and recently revised in 2014. Since 2009, needed changes to the Handbook have been tracked by its developers. In January of 2014 an Agreement was signed between the Alabama Chapter of the Soil and Water Conservation Society and Perry L. Oakes, PE, to provide coordination for the revision of the 2009 Handbook and other support to the Erosion and Sediment Control Program in AL. In February of 2014, requests were sent to active industry participants, regulators, researchers, and others for suggested changes. Most suggested changes were included in the 2014 Handbook by incorporating suggestions and further integrating the concepts of Low Impact Development to mesh with the new LID Handbook for Alabama prepared in 2014 by the Alabama Cooperative Extension System, Auburn University and ADEM. Some of the more significant changes to the 2014 Handbook include replacing exotic invasive species with native species in the Shrub, Vine and Groundcover Planting practice, modifying the specifications of the Class A Silt Fence in the Sediment Barrier practice, adding the practice Flocculant as a Sediment Control measure, and providing CAD drawings for several of the practices that were supported earlier with only figures. These along with other changes to the Handbook will be outlined in the presentation.

40 Years of Biological Sampling in The Locust Fork Watershed – What Have We Learned?
O'Neil, Patrick
ABSTRACT:
The Locust Fork in north central Alabama has been a working watershed for many decades supplying coal and timber to the region's industries and receiving the wastes of urban growth in the Birmingham-Jefferson County-Blount County area. The legacy of water quality degradation associated with development and urbanization still lingers in the watershed as evidenced by 6 stream reaches of the Locust Fork, totaling 94.4 river miles, on Alabama's current 2014 303(d) with siltation (habitat alteration) and nutrient pollutants listed as the causes of impairment. These impairments still linger in the aquatic biological communities with many species becoming rare or extirpated from the system, populations of more tolerant species increasing, and the distribution of invasive species increasing rapidly. Fish community structure can play a significant role in understanding watershed pollution and where to focus habitat and water quality restoration projects. Three comprehensive surveys of the Locust Fork fish communities have been completed in the past 45 years; 1969-70 (Barclay 1971), 1997-98 (Shepard and others 2004), and 2010-11 (O'Neil and others 2015). Results of these surveys have identified species in decline, species at risk of extirpation, areas of the Locust Fork where biology has improved, degraded, or remained unchanged, and how some rare fish species are subsisting in the system. A cumulative total of 91 species has been identified from the Locust Fork with 75 species reported from the 1969-70 sample period, 61 species from the 1997-98 period, and 59 species from the 2010-11 period. Biological assessments completed at 46 sites (20 main channel, 26 tributary) in sites, 10 had no change, 12 improved, and 4 declined in condition.

Hydrogeologic Characterization and Groundwater Source Development Assessment for Area 2, Southwestern Alabama
Ponta, Gheorghe M.
ABSTRACT:
Extreme droughts in recent years have highlighted the need to manage and protect the water resources of Alabama. The Groundwater Assessment Program (GAP) investigates the availability, and quality of the state's waters. The GAP works in cooperation with other state and federal agencies, local governments and water systems, industry, educational institutions, and citizens to address Alabama's water issues.
As part of the statewide comprehensive groundwater assessment initiated by Governor Robert Bentley, the state is divided into 8 areas that will be address separately. The initial groundwater assessment began in southeast Alabama (Area 1), and is being expanded into southwest Alabama (Area 2), and will continue in each county until the entire state of Alabama has been assessed.

The Area 2 of the GAP cover eleven counties of southwest Alabama. In order to understand the geology of the area, a series of hydrogeological cross sections were constructed depicting the stratigraphy and aquifers of the study area. The selection of the cross-section lines were based on their geographic location, preferences being given to wells having a greater total depth, with geophysical and sampling logs.
For each cross-section, a horizontal scale of one inch equals one mile and vertical scale of one inch equals 200 feet was chosen (vertical exaggeration 26.4x). These cross sections are used in planning the exploitation of the aquifers, and determining where deeper aquifers might be located.

"It's hard to fish in a dried up stream": The Science and Policy of Water Quality Standards for Flow Protection

Reid, Mitch

ABSTRACT:
"The quality of water in streams is closely related to the quantity and origin of water as a function of the timing, amount, and types of discharges and effluents from natural and man-made sources" (Instream Flow Council, 2004) Section 304(a)(1) of the Clean Water Act requires the development of criteria for water quality that accurately reflects the latest scientific knowledge and that are based solely on data and scientific judgments on pollutant concentrations and environmental or human health effects. Fundamental to the protection of water quality is ensuring that sufficient water is retained in rivers and lakes systems at all times to sustain fishery and aquatic wildlife resources and ecological processes. (IFC, 2004) It is also extremely difficult to swim in streams that have been dewatered due to overuse. Apart from using 7Q10 as a low flow parameter, Alabama's water quality standards do not currently account for water quantity nor protect stream flow. This presentation will look at the science behind instream flow protections, evaluate flow standards from other state programs, and provide recommendations for water quality standards for flow protection in Alabama.

Alabama Water Watch – Rising to Evolving Water Resource Management Challenges

Reutebuch, Eric

ABSTRACT:
Alabama Water Watch (AWW) has been collaborating with local, state and regional partners for the past two decades in many facets of water monitoring and watershed stewardship. As population and land use patterns change, water resources are being subjected to increasing pressures for a wide array of uses. AWW has been working with a broad spectrum of stakeholders throughout the state since its inception in 1992, empowering citizen volunteers in watershed stewardship management through conducting three types of workshops in water quality monitoring. Workshops in water chemistry monitoring, bacteriological monitoring (for E. coli) and stream biomonitoring via macroinvertebrate sampling have been the mainstays of AWW's statewide workshop efforts. As stresses on water resources intensify, the AWW Program continues to investigate new monitoring tools and techniques for the citizen volunteer monitor toolbox, as well as new and improved methods and tools for data dissemination and data interpretation to support the program's mission to improve both water quality and water policy through citizen monitoring and action.

Global Water Watch: An Update of Watershed Stewardship beyond Alabama

RuizCordova, Sergio S.

ABSTRACT:
Watershed stewardship evokes the sense of personal responsibility for ensuring that the environment and natural resources are carefully, responsible and sustainably managed for our own quality of life, and for future generations. It prompts for the managing of one's life, property, resources, and environment with regard for the rights and interests of others and for the benefit of the greater community. Forested watersheds provide clean water, irreplaceable habitat for wildlife, and supports our homes, farms, industries, and energy production. Secure, good-quality water from forests is vital to the world prosperity and it can be obtained only through effective, constructive community-based watershed stewardship. Citizen volunteer water monitoring is one of the most popular and effective forms of citizen science, and is increasing, as worldwide community groups' interest to collect scientifically valid data for the protection and restoration of their surface water and watersheds grows.

Global Water Watch (GWW) began in 1993 as an international extension of Alabama Water Watch and has been active in ten countries in response to interests of locals to become personally involved in water issues

and in the sustainability of watershed processes and services. GWW numerous cross- cultural experiences led to the inception of a global model for Community- Based, Science-Based Watershed Stewardship (CBWS); a participatory process of linking community groups to low-cost and reliable appropriate technologies to generate credible data for a better watershed understanding, protection and management. The focus of GWW CBWS is the development of standardized water monitoring of local surface water (rivers and lakes) and water supply. The purpose of this is to nurture awareness of water issues and natural resources, to engage citizens to exercise its rational use, considering its protection and sustainability, and facilitate activities to identify and tackle environmental problems. CBWS is a living, evolutionary process that must be a daily experience, linked to the development of new knowledge. A key objective of GWW CBWS is to develop long-term data sets that are useful for determining water quality conditions and trends, with the utmost goal of improving water quality, water policy and public health through citizen monitoring and action for a better quality of life.

GWW has received funding from USAID, Heifer International, ChildFund International, IUCN, the World Bank, and other NGOs and governmental organizations. GWW has successfully certified hundreds of citizens as water monitors, mobilizing them to collect valid data using EPA-approved QAQC plans. Volunteers have tested water from hundreds of sites and all information is publicly available for applications including education, protection/restoration, and policy. Particular approaches and outcomes, case studies, data-to-action strategies, success stories and challenges of GWW in the US, Asia, Latin America and Africa will be presented revealing how the challenges of watershed management are impossible to solve solely through professional research and regulation. National and international interest for GWW is growing, as more partners realize that its CBWS approach increases community involvement and mutual learning from numerous stakeholder groups, and should be a component of any strategy for protecting natural resources and improving quality of life.

The Benefits of a Well Managed Reservoir System Using as an Example The Tennessee Valley Authority's Management of the Tennessee River Basin to Reduce Flooding

Saint, Daniel

ABSTRACT:

INTRODUCTION: The Tennessee Valley Authority was formed in 1933; since then it has been successfully managing the Tennessee River Basin. Throughout the years the TVA has learned many lessons and had to adapt to changing conditions in order to properly manage the 49 reservoirs that it manages. In recent years the impacts of a man-made reservoir has been questioned and challenged; although there are many valid reasons to re-evaluate the impact of a reservoir, the necessity and benefits of the Tennessee River System needs not to be forgotten. Perhaps evaluating the benefits of the man-made reservoirs within the Tennessee River Basin would help others as they evaluate reservoirs on an individual basis.

APPROACH: Since its formation in 1933, the Tennessee Valley Authority has recorded insurmountable amounts of information which can be retrieved, analyzed and interpreted. This historical data offers an understandable interpretation to the value of the reservoirs within the Tennessee Valley River Basin. For this analysis, the basin will be looked at holistically and the reservoirs will not be addressed individually, as this would be an impossible feat for the amount of time allotted. One could interpret the records to prove that a particular reservoir possibly has more "value" or "benefit" than another, but that was not done for this study.

RESULTS AND DISCUSSION: The benefits provided by the dams in the Tennessee River Basin are: navigation, flood-damage reduction, power generation, water supply, recreation, and water quality. These will all be discussed as TVA is mandated to balance all of these benefits, no benefit can be forgone to maximize another. TVA works hard to balance the competing demands of power generation, recreation,

water supply, flood control, and water quality. The main benefit discussed will be flood control. On average, $260 million of flood damages are averted annually as a result of the optimization of the reservoir system. Study and analysis has been performed on the great amounts of rainfall the basin received throughout the year of 2013. Although greater rainfall and runoff was received during the winter months, an emphasis will be placed on the July 2013 flooding which occurred when there were more competing demands in place on the river system. Actual flooding will be discussed, the state of our reservoirs, flood control operations at hydro plants, as well as flood damages averted in order to present a clear picture of the benefits of a truly integrated and well managed river system.

Flood Prediction Using Artificial Neural Networks: A case study of Lower Tallapoosa, Alabama
Sawant, Rajesh
ABSTRACT:
Flood prediction is crucial for the design, planning and management of water resources systems. This research investigates the use of upstream streamflow, stream gage height and spatially distributed rainfall data into Artificial Neural Network (ANN) model to predict downstream flood events. The gage height (stage) at which the river overflows its banks is considered as a flood stage.
Thus, a flood event occurs when a river water stage (level) reaches or exceeds a flood stage. In this study, precipitation data from three meteorological stations, with water stage and streamflow data were used to develop an ANN model for streamflow prediction at the Montgomery Water Works site on the Tallapoosa River, Alabama. The performance of the ANN models was evaluated using coefficient of determination (R2), Nash Sutcliffe (NS), and root mean square error (RMSE) values. A rating curve was developed based on the water stages and observed streamflow at the study site. Then, using the 3 DEM, the cross section at the study site was derived and consequently the flood stage was determined. At the last step, the corresponding streamflow value to the flood stage was determined based on the developed rating curve. The result showed the capability of this method to predict the flood events at the study site. Although this is a point prediction of flood, it can be useful for design (such as hydraulic structures) and planning purposes.

Small sample sizes, collinear predictors and linear modeling: a simulation study comparing alternative methods for landscape- water quality research
Schneid, Brad
ABSTRACT:
Linear modeling and variable selection is complicated by collinear predictor variables (e.g. land-cover percentages) that increase false positive rates, and is further complicated by small sample sizes (n); both of which decrease coefficient estimate precision. Alternatives to least-squares regression are generally not considered by ecologists, but may alleviate some negative effects of collinearity and have been suggested for small n. We simulated small and highly collinear datasets to compare stepwise selection, multi-model averaging, shrinkage methods (e.g. Lasso) and partial least squares (PLS) in terms of coefficient estimation, the classification of predictors (as important or not), and predictive performance. Model-averaging, shrinkage methods and PLS showed slightly biased, but relatively precise coefficient estimation, even with small n (~15). Shrinkage methods and PLS correctly identified important variables (functionally related to the response) > 80% of the time; however, PLS alone also correctly identified unimportant variables at this rate or higher. Models predicted similarly, except for the full OLS and stepwise models, which performed markedly worse with smaller n. In a case study on nitrate concentrations of streams along the Gulf Coast, models generally agreed on the importance of riparian forest buffer intactness and its effect (slope) magnitude, but results for the other land-cover classes were less clear and differed between models. We suggest researchers begin with a well thought-out list of predictors, avoid reporting bivariate relationships,

consider alternatives to traditional methods and even the use of multiple methods for parameter estimation, prediction and inference in small n, and collinear situations.

Influence of low-intensity watershed development on small coastal Alabama streams
Schneid, Brad
ABSTRACT:
Coastal areas are under increasing pressures from human population growth and expansion. The Alabama (USA) coast has experienced an 85% increase in population size from 1990 to 2010 and widespread conversion of forested and agricultural lands to low-density residential development. We investigated physical and biotic responses generally influenced by urbanization in small coastal watersheds with low-levels of impervious surface cover (ISC; 0-11 11%) to determine if empirical evidence suggests low-density development influences streams draining these small coastal watersheds. Specifically, we examined mechanistic relationships between pre-selected land-cover categories (riparian forest, agriculture and ISC) stream hydrology, geomorphology, and water-chemistries. We further examined relationships between commonly used benthic response metrics, land-cover variables and potential environmental stressors. We used partial least squares regression, which has been shown to perform well for model selection and parameter estimation in small sample and collinear situations. Physicochemical variables TP, TSS, SPC, pH and median water temperature were significantly associated with both % riparian forest buffer (FB) and % ISC. Storm-event frequency and a baseflow index were associated with % ISC alone, whereas % FB and ISC were both significantly associated with hydrologic flashiness and bankfull width. While benthic invertebrate density was associated with % ISC and associated hydro-geomorphic stressors, benthic diversity (richness, H', evenness) and taxa sensitivity/tolerance metrics (% EPT, PTV) were more strongly associated with maximum water temperatures and gradients of organic matter and likely flow permanence in these streams than anthropogenic land-cover or associated stressors. These data suggest that ISC as low as 11% may influence hydrology, water chemistries, and benthic densities in these small coastal stream ecosystems; however, natural variations in stream permanence, maximum temperatures and organic matter may be more important drivers of benthic diversity in these coastal streams draining watershed with low-levels of urban development.

Combined Effect of Irrigation and Droughts on Surface and Baseflow Levels in the Lower Flint River Basin
Singh, Sarmistha
ABSTRACT:
Water resources around the world are being stressed due the combined impacts of climate variability and human interactions. The Apalachicola-Chattahoochee-Flint River Basin in the Southeast USA is a classic example where the population growth in the city of Atlanta and increased irrigated agriculture in southwest Georgia is affecting surface flows and aquatic ecosystems in the Flint River and the Apalachicola Bay. Since the 1970's there has been extensive implementation of center pivot irrigation systems in southwest Georgia. This study was conducted to understand the effect of irrigation water withdrawal during droughts on flow levels in the lower Flint River and its tributaries.

Streamflow data collected from four USGS gauging stations were sorted according to non-irrigation (NI) and irrigation (IR) periods. A statistical procedure called JRFit was used to test and quantify the significant difference in streamflow, baseflow and low flows between the NI and IR periods. Moreover, El Niño Southern Oscillation (ENSO) phases associated with the NI and IR periods were analyzed using JRFit to quantify the combined effects of droughts and irrigation withdrawal on the selected flow parameters. Flow levels during the growing and non-growing periods were also analyzed to provide evidence of irrigation induced depletion of flow levels in the lower Flint River basin. The results of the study suggests that

streamflow levels have decrease by approximately 20% after the introduction of irrigation in the study area. The results also show that lowering of flow levels mainly occur during La Niña phases and gets exacerbated during growing periods where the flow levels repeatedly violated the standards and can result in impairment of aquatic ecosystems.

Nutrient Concentration Trends in Surface Waters in Two Southeastern States

Sisk, Lynn

ABSTRACT:
States have been measuring nutrient concentrations (nitrogen and phosphorus) in their surface waters for several decades in efforts to improve and protect water quality and detect trends. In recent years, limitations on the amount of nitrogen and/or phosphorus allowed in discharges of treated wastewater to rivers and streams have been promulgated by environmental agencies across the nation. As the requirements have been put in place, treatment technologies have evolved to meet the new limitations. In addition, many municipalities are now required to implement practices to reduce nutrient concentrations in stormwater runoff within their jurisdictions. But exactly how much progress has been made has not been comprehensively determined. Nutrient reduction efforts are beginning to translate to lower nutrient concentrations in rivers and streams in many watersheds. Advances in water quality data storage and availability afford environmental agencies and municipalities the opportunity to quantify the extent to which their nutrient reduction measures may be restoring and maintaining stream health. This presentation provides a summary of nitrogen and phosphorus trends in surface waters and in the effluent from municipal wastewater treatment facilities in the southeastern states of Alabama and Georgia.

Proposed Metric for Measuring Shifts in Ecological Function of Impaired Streams

Sloan-Blersch, Stacey

ABSTRACT:
The current dominant paradigm in stream restoration is one of creating stability and increased habitat heterogeneity. Through the installation of a series of re-directive structures, in-stream channel dimensions are modified to some reference condition and flow redirected to reduce bank erosion and create habitat at the pool-riffle scale. While this approach is widely applied, clear linkages between structural changes and ecological function are not well established. The lack of correlation between structural re-directive techniques and ecosystem functional response is due in part to an emphasis on monitoring methods to observe changes in ecosystem structure (e.g. diversity, abundance, targeted species) versus ecosystem function (e.g. productivity, nutrient cycling). More tools and metrics are needed to better assess the outcome of stream restoration and other best management practices that are indicators of overall ecosystem health versus just an increase in habitat heterogeneity.

As Alabama continues to expand its restoration efforts across the state, identifying metrics and methods for measuring changes in both ecosystem structure and function would ensure the success of ongoing projects, and provide a means for measuring the benefits of multiple projects that affect stream ecosystem services. A case study in an impacted watershed in rural Western New York is presented which uses stream metabolism as a metric to determine shifts in ecological function.

Results from two different methods will be presented and contrasted, as well as an evaluation of free on-line tools available to interpret monitoring results. Linkages between stream metabolism and hydraulic modeling outputs from HEC-RAS will also be discussed to show how the metric could be applied to on-going restoration planning and design efforts in Alabama and the greater Gulf region.

Arlington Cove Living Shoreline - Partnership for Natural Infrastructure Design, Installation and Education

Stejskal, David

ABSTRACT:
As the environmental and engineering communities continue to look for opportunities to protect our coast line with newer and more natural infrastructure options, utilizing our collective expertise to both develop, incorporate and educate others about available technologies is one of our greatest avenues towards success. CH2M and TNC have linked up as a part of a multi-year collaborative and master services agreement to advance this cause. One of the first opportunities to showchase this agreement was on the Arlington Cove Living Shoreline project. Having performed the conceptual layout and preliminary permitting, TNC turned to CH2M to help push the project across the finish line and prepare the design for over 1 mile long living shoreline on the western shore of Mobile Bay just south of downtown Mobile. The project faced a very tight delivery window, coordination with stakeholders such as the landowner, the University of South Alabama Foundation and permitting agency, USACE, and a new minted partnership between TNC and CH2M to integrate.

The overall objective was to provide a design that could be constructed in sections, as funds and resources were available, and by various potential parties by mainly volunteer labor. The original sections would be constructed as a part of TNC's Yearly Meeting of Senior Staff. Thru the collaboration, communication, workload sharing and a can-do attitude, the project design was complete, the initial sections were installed without a hitch and the project can now serve as an opportunity for further community engagement, test case for how a non-governmental agency and a for-profit engineering firm can successfully work together to meet both organization's needs, and a project to demonstrate to other environmental and engineering professionals that together our partnerships can be synergists.

The Economic Impact of Alabama's Navigable Waterways

Stepan, J. Craig

ABSTRACT:
The Coalition of Alabama Waterway Associations plans to deliver a twenty to thirty (20-30) minute power point presentation defining the scope and significance of Alabama's navigable waterways. The presentation will include not only the economic impact of navigation but, will review the recreational, hydropower, flood control, wildlife habitat management and social implications of Alabama's inland waterway system.
The University of Alabama, Auburn University, Mississippi State, UT-Knoxville and the University of Kentucky are collaborating on an economic impact study of the Tennessee Tombigbee Waterway. The Tenn-Tom is Alabama's connection to not only the Tennessee River but, the entire US navigable waterway system. Results of the study will be covered as a part of the presentation.

The important interconnection between the Alabama inland waterway system and the Alabama State Port Authority will be the final topic covered. Judith Adams, VP-Marketing, will assist with the formulation of this part of the presentation.

Acute Toxicity of Mobile River Basin Endemic Freshwater Mollusks

Stewart, Paul

ABSTRACT:
The Mobile River Basin has the highest number of stenotypic (narrowly endemic) species and subsequently more extinctions than any other basin in the United States. Mollusks have the greatest number of extinctions of any phyla, with 72% of freshwater mussels and 74% of freshwater gastropods now classified as imperiled. Mollusk populations are declining due to anthropogenically caused physical and chemical habitat

degradation, including pollution. Until recently, freshwater mussels and caenogastropods have not been used in establishing USEPA Water Quality Criteria (WQC) due to difficulty in rearing and propagating numbers sufficient to support toxicity tests. Objectives of this study were to determine the sensitivity (LC50) of three species of juvenile mussels (*Villosa nebulosa*, *Villosa umbrans*, and *Hamiota perovalis*) and two freshwater caenogastropod species (*Leptoxis ampla* and *Somatogyrus* sp.) Mobile River Basin endemics to five toxicants (SDS, Cl, K, Ni, Zn) in need of new or updated WQC. *Villosa nebulosa* and *V. umbrans* have been petitioned for federal protection while *H. perovalis* and *L. ampla* are listed as threatened under the Endangered Species Act. *Somatogyrus* sp. is an undescribed species found in the Cahaba River (Alabama). Toxicity trails were completed following ASTM Standard Guide for Conducting Laboratory Toxicity Tests with Freshwater Mussels (E2455-06).

The 96-hour LC50 values for toxicants were determined using ToxStat® 3.5 using the Trimmed Spearman-Karber method. Results showed that *H. perovalis*, *L. ampla*, *Somatogyrus* sp. had LC50 values lower than current WQC for Ni and Cl, and *L. ampla* had a lower LC50 value for Zn. *Leptoxis ampla* was also found to be extremely sensitive to SDS (LC50 = 26 µg/L) and chloride (>250 times lower than current criteria). All species were found to be sensitive to K when compared to other published studies. *Leptoxis ampla* had LC50 values lower than any mollusk species previously tested to date, indicating this is a very sensitive species that may require development of stringent regional criteria. Until USEPA WQC are updated, current regulations may not be inclusive of many of Alabama's imperiled aquatic mollusk species. With this study, data are now available to aid in updating WQC based on values inclusive of more highly localized (stenotypic) species that are likely more sensitive than other wide ranging species. In addition, this study suggested more localized endemics should be tested now that propagation techniques can provide animals for more comprehensive testing.

Alabama's First Aquifer Storage and Recovery and Water Reuse Programs?

Stokes, Sarah

ABSTRACT:
In June, ADEM proposed two new programs - an aquifer storage and recovery program and a reclaimed water reuse program. The aquifer storage and recovery program would allow ADEM to permit the injection of water into the ground for storage and later consumption. The water reuse program would allow irrigators to use treated waste water, instead of using more expensive drinking water. This presentation will explore similar programs and lessons learned from other states. It will also analyze the implications of ADEM's proposed programs and how they may impact water management in Alabama.

Updating Soil Hydraulic Properties under Changing Land Use/ Land Cover for Improved Hydrologic Prediction

Sufraci, Guleser

ABSTRACT:
Land use/land cover (LULC) change, especially forest to urban transition, can alter the soil hydraulic properties, including soil hydraulic conductivity, even though the soil texture and series may remain the same. Soil hydraulic properties have a big influence on hydrologic processes. Watershed models are commonly used to project the potential alterations in the hydrologic regime of streams in response to ongoing or expected LULC changes. Soil related hydrologic parameters required by these models are typically derived from soil databases. Unfortunately, when LULC changes, these soil parameters are often retained at their existing values. This is because of the lack of knowledge in quantifying changes in values of these parameters under different LULC conditions. Analyzing these measurements either in the field or in the laboratory is time consuming and costly. Further, scaling up from such small scales is not easy. Alternatively, pedotransfer functions, which are algorithms that describe soil-water relationships based on

basic soil properties, can be used to analyze existing databases of measured soil hydraulic data. Soil hydraulic properties are seldom investigated directly under LULC changes; however some information on changes in bulk density is available. Changes in bulk density can be used as an input parameter for pedotransfer functions to derive changes in soil hydraulic conductivity to use in watershed modelling. In practice, these functions often prove to be good predictors for updating soil hydraulic properties. This study aims to overcome this challenge using pedotransfer functions for updating soil hydraulic parameters under changing LULC by making use of soil maps in conjunction with historic aerial photos. The methodology has been tested in three watersheds in Northwest Georgia with the Soil and Water Assessment Tool (SWAT). All three watersheds have seen significant urbanization (formerly forest dominated) over the past two decades. Double-mass curves and trend analysis were completed to show trends through climate and hydrologic data. Initial trend analysis shows clear upward/downward trends in various climatic data and hydrologic metrics, which indicate the impact of urbanization.

Streamflow Reconstruction Potential: Choctawhatchee River
Tootle, Glenn
ABSTRACT:
Tree ring samples were collected from Bald Cypress species in watersheds adjacent to the Choctawhatchee River. These samples were collected to update an existing tree ring proxy that was developed in the late 1980's as some of the most severe droughts were identified in recent (~2000 to present) observed streamflow records. Combining the new tree ring proxy with other regional proxies, seasonal streamflow was reconstructed for the Choctawhatchee River. The reconstructed streamflow allows water managers and planners to observe past wet and dry periods that may exceed magnitude, duration and/or severity of wet and dry periods in observed records. Our research focuses on the USGS streamflow gage at Newton, AL.

Quantitative Estimation of Land Use Land Cover Evolution Across the Middle Tennessee Elk Region over the Past four Decades
Wagaw, Mezemir
ABSTRACT:
A rapid change of land use from prime agricultural and forest covered land into housing units, manufacturing, retail and office space development is observed especially in the Alabama region of the Middle Tennessee Elk Watershed. This permanent land use alteration entails a change in surface moisture, hydrodynamics pattern and flush-runoff behavior of the watershed. This by itself leads to change in hydrologic runoff and infiltration properties in to a completely new set of micro-hydrologic pattern. In this study we will quantitatively estimate the land use evolution of the area over the past forty years. Historical topographic map from 1976, Land Use Land Cover classification output from the years 1992, 2001 and 2011 will be used as an input data. Taking on multiple scales, spatial and temporal variation over the four decades will be analyzed. Further, the validity and potential limitation of LULC data use as an input into hydrologic models will be discussed. Key words: Urban expansion, water infiltration, hydrologic modelling, water demand, environment management.

An evaluative tool for prioritizing removal of hazardous debris to improve the watershed; a final review
Wessel, Caitlin
ABSTRACT:
The overarching goal of this study was to create an effective tool to prioritize the removal of hazardous debris (namely derelict vessels) from the watershed, create artificial reefs, raise public awareness and restore habitat in suitable locations. Derelict vessels (those that are aground, broken apart, sunken, show no sign of maintenance, use, or are otherwise dilapidated in their condition) and debris impact coastal marsh and

riparian habitat around the world. Bank erosion/stability, water quality, marsh growth, and submerged grasses are impacted by these abandoned materials. An all too common practice in the Gulf region by boat owners is to anchor vessels in river systems prior to hurricane landfalls- a poorly understood, unlawful act. These boats often lose their mooring and then drift into marshes and stream banks. As a direct result of hurricanes (Ivan 2004, Katrina 2005, Isaac 2012) dilapidated docks and vessels remained along the rivers and tributaries that drain into Mobile Bay, AL. These structures impact estuarine habitats, fisheries resources, are aesthetically unappealing and may be a hazard to navigation and recreation. Considering the large number of derelict items present in coastal areas an effective tool needed to be developed to help determine which items pose the largest threat to both the environment and human health. A triage based selection process was used to determine the most appropriate action; removal, repurpose, or no change. To this end we have developed a 100 point spreadsheet to quickly evaluate each vessel. The categories were selected after careful review of state and federal regulations regarding derelict vessels and for and for creating artificial reefs. A case study was then conducted in Dog River, AL to test the efficiency and effectiveness of the evaluation tool with pre and post (6 month and 1 year) removal habitat surveys. Over the course of 1 year 87% of the removal/repurpose areas have seen an increase in the amount of submerged aquatic vegetation and 75% have seen an increase in the number of fauna present. Since its development this evaluation tool has been used in Alabama, Florida, and the U.S. Virgin Islands and was presented at the Abandoned Derelict Vessel Workshop sponsored by NOAA in April 2015.

Watershed assessment of the Big Canoe Creek system for the recovery and restoration of imperiled aquatic species

Wynn, Anne

ABSTRACT:
The Big Canoe Creek watershed in east-central Alabama has been designated a strategic habitat unit (SHU) for the restoration and recovery of imperiled aquatic species. The animals of concern include: three mussel species now extirpated from the state (Upland Combshell, Southern Acornshell, Georgia Pigtoe), a federally threatened (Finelined Pocketbook) and three federally endangered mussel species (Southern Pigtoe, Rayed Kidneyshell, Southern Clubshell), a mussel species only found in the Big Canoe Creek watershed and of highest state conservation concern (Canoe Creek Clubshell), and a fish species of highest state conservation concern (Trispot Darter). Data on freshwater biology, habitat, and water quality conditions have been compiled in this assessment. Recent mussel surveys have confirmed the presence, in good abundance, of some listed species while other species were found only in marginal numbers. Biological condition in the watershed is generally good, particularly in upper Big Canoe Creek and Little Canoe Creek (west), but poor to fair conditions were noted in the lower main channel of Big Canoe Creek and Gulf Creek. Stream habitat surveys identified several sites in poor to marginal condition while many other sites were rated suboptimal to optimal. Sedimentation risk surveys of road-stream crossings found 15 crossings at high risk for sedimentation and 20 sites with significant fish barriers in the form of blocked and perched culverts that prevent movement of imperiled aquatic fauna. Upper Big Canoe Creek from U.S. Hwy. 11 and Little Canoe Creek (west) from its mouth upstream to Springville are priority subwatersheds for implementing habitat restoration projects and conducting future monitoring.

The Role of Information Management in Coastal Hazard Analysis

Zanotti, Jeff

ABSTRACT:
As Alabama's Coastal Hazard update continues within the FEMA update process for Baldwin and Mobile Counties, it is time reflect the major role that GIS and information management has played in not just modeling but also the formatting of mapping deliverables to FEMA specifications. The need to easily

reference spatial data, compile large datasets, and seamlessly integrate this data with other FEMA specified software has made GIS instrumental in the coastal hazard updates for Alabama. The complexity of coastal modeling requires a combination of the most recent Digital Elevation Models (DEMs) for each county, as well as the ability to combine these DEMs with bathymetric and sounding information into a single raster layer. Coastal modeling also requires the need to analyze wave properties as they come on to shore. Using GIS we can use simple point files to create individualized rasters that represent wave height and wave recurrence intervals. GIS also allows us the flexibility to select the raster resolution that allows for the optimal combination of accuracy and size limitations. Advanced Circulation Model (ADCIRC) data was utilized to create still water elevation (SWEL) rasters and handle flooding extents when dealing with physical barriers and hydraulic connectivity. FEMA's specifications call for transect computations to be carried out by Wave Height Analysis for Flood Insurance Studies (WHAFIS). Utilizing a project specific modeling tool within GIS, the inputs and outputs from WHAFIS are automated along for efficient processing of these massive data sets. Among the outputs produced is a nodes spatial file that portrays specific data logs from the standard WHAFIS text output. This tool also allows for a two dimensional profile along each transect. This profile enables a visual and interactive platform to more fully convey the base flood elevations and the effects vegetation, dunes, and buildings have upon them. Being able to visualize these results in a user friendly format allows for a more accurate analyses of the computer tabulated results. This presentation will aim to show how GIS and Information Management is allowing for the modeling and mapping of hundreds of transects in Baldwin and Mobile Counties. It has a flexibility to integrate data from various formats that allows the best available data to be used while adhering to FEMA's specifications and guidelines.

Developing a multi-sector, multi-basin drought decision support system Incorporating Economic Consequence Assessment

Zhu, Lian

ABSTRACT:
Drought is one of the most economically disastrous natural hazards, one whose impacts are exacerbated by the lack of abrupt onset and offset that define tornados and hurricanes. In the United States, about 4 billion dollars losses is caused by western drought in 2014, resulting in widespread economic impacts for societies, industries, agriculture, and recreation. Driven by a variety of factors including climate change, population growth, increased water demands, alteration to land cover, drought occurs widely all over the world. Decision support system for drought management and responses are greatly needed to allow decision makers and stakeholders to anticipate and respond effectively.

In this study, current drought economic impact modeling methods were reviewed. Most of these models deal with the impact in the agricultural sector with a focus on a single basin. However, drought impacts are rarely restricted to basin boundaries, and cascading economic impacts are likely to be significant. A holistic approach to multi- basin, multi-sector drought economic impact assessment is needed.

In this work, we develop a new framework for drought economic impact assessment based on previous efforts done on economic consequence assessment in the event of disruptions in water services. This model focuses on all economic sectors across multiple basins using a continuous dynamic social accounting matrix approach, coupled with calculation of the indirect consequences for the local and regional economies and the various resilience and other strategies implemented. The purpose of this research is to develop an efficient drought economic impact model which can take into consideration sector vulnerability and resiliency strategies to assist decision makers in devising drought response strategies.

ABSTRACTS (alphabetical order using author's last name):

Poster Presentations

Bates, Bradford - *Observed historical flood classification for hydraulic model validation*
Bohlman, Allison - *Escherichia coli monitoring of the Flint and Limestone Bay watersheds in north Alabama*
Bridge, Emily - *Nutrient loading in Graves Creek Downstream of a Chicken Processing Plant*
Brown, Kaila - *Spatio-Temporal Investigation of E-coli Contamination of Tributary Creeks: From Tallaseehatchee to the Coosa*
Carter, Shawn - *Alabama Floods, an Open Source Common Operating Picture for Flood Response*
Davis, Kelsi - *Linking remote sensing of land use cover to water quality in the Osa Peninsula, Costa Rica*
Davis, Lisa - *Filling in the blue lines: a map of the fluvial complexity of the Cahaba River, AL (USA)*
Dosdogru, Furkan - *Climate Change Impacts on the Ecologically Relevant Flow Metrics in the Cahaba River*
Ferguson, Paige - *Structured decision making: a tool to support decision making about water resources*
Gutenson, Joseph - *The National Flood Interoperability Experiment and a Means of Damage Estimation During Flooding Events*
Hudson Duran, Sue - *Monitoring of Pharmaceuticals in Streams and Drinking Water: A review of current surveys*
Janosik, Alexis - *Detection of rare aquatic species: using environmental DNA to locate populations of Alabama and Gulf Sturgeon in Alabama*
Johnston, Brian - *Measuring Mesopotamian Marshland Change Using Landsat Imagery From 1986 To 2015*
King, Xavier - *Historical water quality data compilation for the Wheeler Lake Watershed, Alabama - A preliminary analysis*
Lawhorn, Andrew - *The Effects of Prescribed Burning on the Water Quality of Ephemeral Streams at Guntersville State Park, AL*
Majors, Kyle - *Utilization of GIS tools for assessing land use/cover change for the Flint River Watershed*
Mason, Jessica - *Big Valleys and Big Floodplains: A Case Study on Flint Creek*
Mishra, Vikalp - *Satellite Assisted Agricultural Modeling in the Southeastern United States*
Mostafa, Mohamed and Saadeldin Mostafa - *Simulation of Cooling Water in Kafr-Al-Batek Power Station at the Damietta Branch, Egypt*
Richard, Sarah - *Bioavailability of Polycyclic Aromatic Hydrocarbons in Biochar-Amended Soils*
Rucker, Lacy - *Impact and Potential Mitigation of Stream Siltation: Case study Flint River in Northern Alabama*
Russaw-Scissum, Gabrielle - *Identification and Enumeration of E. coli and the Impact of Climate Change and Variability to determine the Water Quality in the Flint Creek Watershed (FCW)*
Sferra, Christopher - *Does time matter? The importance of habitat age in structuring pond zooplankton metacommunities*
Stone, Monica - *Quantifying the influence of land use/land cover and climate change on inland flooding occurrence and severity following tropical cyclone events using a physically-based hydrology/hydraulics model*
Therrell, Matthew - *Paleo-hydroclimate of the southeastern United States*
Williams, Cedric - *Influence of Agricultural Practices on Water Quality*
Williams, Jessica - *Campus Wetlands and Rain Gardens: Green Infrastructure Demonstration Project*
Wan, Tong - *Development of Software based on GIS for running LISFLOOD-FP model*
Yuan, Jing - *Comparison of different sampling and enumeration protocols for indicator microorganisms in water and in sediment*
Zhang, Xiaoyin - *NIFE-Flood Warning System*

Observed Historical Flood Classification for Hydraulic Model Validation

Bates, Bradford

ABSTRACT:

There are many models to identify the extent of flooding, however it seems that there is not any appropriate source for calibration, evaluation and comparison of their performance. This project focuses on the flood extent of historical floods by extracting the remote sensing images corresponded to the flood events. An automated procedure is developed to determine historical flood date ranges for a specified list of USGS gauging stations; after storing these date ranges, Landsat images corresponding to these dates are downloaded. In addition to Landsat products, Synthetic Aperture Radar is useful for water boundary delineation due to its high spatial resolution and its ability to penetrate cloud cover. In this study, a combination of Sentinel-1 (SAR) and Landsat 8 images are classified to determine inundation extents, which may be used to validate outputs from hydraulic models.

Escherichia coli Monitoring of the Flint and Limestone Bay Watersheds in North Alabama

Bohlman, Allison

ABSTRACT:

Escherichia coli (E. coli) is a well-known indicator for fecal contamination in our rivers, lakes, and wells. Monitoring for E. coli and other water quality standards frequently can be used to identify when pollution may be detrimental to the health of people and wildlife that rely on local water sources. In Madison and Limestone counties surrounding Huntsville, AL there are rivers currently listed by the US EPA for impairment for pathogens (fecal coliforms) which is the focus of our quantitative study which began in the spring 2015. Regular water quality sampling was conducted in the Flint River watershed (N = 3) and the Limestone Bay Watershed (N = 3). Escherichia coli contamination in these watersheds can be attributed to increased urban development, construction, agricultural practices, or faulty septic systems. Escherichia coli rates may also be affected by other water quality variables including: dissolved oxygen, conductivity, turbidity, pH, nitrate/nitrite, rainfall, and temperature. Escherichia coli was detected at higher rates in the Limestone Bay Watershed than in the Flint River Watershed.

Nutrient loading in Graves Creek Downstream of a Chicken Processing Plant

Bridge, Emily

ABSTRACT:

Nutrient pollution causes eutrophication of aquatic systems. Although eutrophication is associated with collapse of lotic ecosystems, rivers and streams are also impacted by excess nutrients. In 2014, Alabama reported 193 and 586 river miles impaired by nitrogen and phosphorus, respectively. Waste from animal feeding and processing operations may contribute to this nutrient loading. Alabama has numerous poultry operations, including an active chicken processing plant in Blount County. This plant discharges wastes into a wetland that empties into Graves Creek, a tributary of the Locust Fork of the Black Warrior River. We predicted that these discharges would result in higher conductivity and elevated levels of Nitrates and Phosphates in Graves Creek downstream of the plant compared to upstream. We collected duplicate water samples on two occasions at eight locations in Graves Creek, monitored the conductivity, and tested them for Nitrates and Phosphates using HACH colorimeter test. We also used a Spectrometer (Shimadzu ICPE-9000) to do elemental analysis of the water samples. Nitrates, and Phosphates downstream of the plant were significantly higher than upstream as were elemental calcium, potassium, sodium, phosphorus, and conductivity. Although Alabama does not regulate nitrates and phosphates in surface waters designated for "Fish and Wildlife," the levels in the discharge were higher than recommended for aquatic life by other

states. The discharges of phosphorus from the wetland exceeded ADEM water quality criteria (AL 335-6-10) for aquatic life (1.0 mg/l). The discharges into Graves Creek have the potential to create eutrophication and contribute to Alabama's impaired waters.

Spatio-Temporal Investigation of E-coli Contamination of Tributary Creeks: From Tallaseehatchee to the Coosa.

Brown, Kaila

ABSTRACT:
In an attempt to determine the level and potential origins of bacteriological contamination in the local tributaries of Tallaseehatchee Creek in Jacksonville Alabama, a one-year preliminary study was conducted. Two of the three tributaries (x and y) are identified as public use or park areas. The third is a drainage area passing under Hwy 204 east of Gadsden Rd., near a popular Jacksonville restaurant. The project was specifically designed to determine the levels and potential origins of *Escherichia coli*, also known as *E. coli* bacteria in these creeks. All three testing sites are set up on tributaries to Tallaseehatchee Creek, which serves points west of Jacksonville eventually dumping into the Coosa River. Using the Alabama Water Watch (AWW) bacteriological monitoring standards and monitors certified by AWW, samples were taken monthly for each of the monitoring sites and processed according to rigid standards. These standards are approved by the Environmental Protection Agency and the Alabama Department of Environmental Management. *E. coli* colonies were counted from test samples collected from the tributaries. This study found varying elevated levels of *E. coli* bacteria in the water bodies. The results were then averaged for the year. Descriptive statistics have shown what appear to be temporal and spatial patterns of *E. coli* distribution in this environment. While none of the sites have shown presence of *E. coli* at levels high enough to create an alarm, the values detected in some cases were high enough to raise concerns. Statistical analyses of the three sites have indicated statistically significant seasonal levels when compared to all monthly levels. Ground truthing and high-resolution Landsat ETM+ imagery along with evaluations of the agricultural calendar will be used to evaluate land-use land-cover (LULC) in the drainage areas of the test sites. A review of seasonal factors as well as potential sources of pollution is being conducted to better understand the risks of human exposure to *E. coli* in the recreational freshwater areas.

Alabama Floods, an Open Source Common Operating Picture for Flood Response

Carter, Shawn

ABSTRACT:
Emergency Management Agencies use the National Incident Management System to scale response to incidents. For example, as a wildfire grows in size and resists containment, more firefighting units may be deployed along with more command and control nodes. The keystone of effective incident and emergency management is the development of a common operating picture which details the latest incident/threat situation as well as the distribution of assets and personnel assigned to mitigate the incident/threat. Most incidents requiring emergency management are unpredictable in timing (such as wildfires or tornados), generally grow at a known rate (disease outbreak and fires), or are self-contained (major transportation accidents and other manmade disasters). Flooding, however, is predictable in many cases and presents opportunity for emergency management and first responders to be forward leaning and switch from a reactive force to a pro-active force.

The material presented in this poster is inspired by the work conducted during the 2015 National Flood Interoperability Exercise held at the National Water Center in Tuscaloosa, Alabama. In this poster I present an example and development road map of providing emergency management and first responders with a pro-active common operating picture to deploy response personnel ahead of flood threats. The Alabama Floods application couples river forecasts from the Southeast Region River Forecast Center with demographic,

cadastral, floodplain delineation, and road network spatial layers. Coupling these datasets will provide emergency management personnel estimates on the number of houses, roads, and people that could be affected by rising water levels.

This example system is built using open source software to mitigate the costs of license fees and increase its accessibility to citizens, first responders, and emergency management personnel alike. With the preponderance of Alabama fire departments being crewed by volunteer and county association firefighters, limiting the cost of deploying a flood common operating picture is imperative. Likewise, by creating an application that highlights flood potential in an spatially explicit manner may serve to increase flood risk awareness by citizens.

Linking Remote Sensing of Land Use /Cover to Water Quality in the Osa Peninsula, Costa Rica
Davis, Kelsi
ABSTRACT:
Poor water quality effects millions of humans globally resulting in reduced human life-span and quality of life and also dramatically reducing biodiversity and ecosystem function, in particular in freshwater ecosystems. Developing countries in tropical regions in particular are faced with problems related to water quality due to reduced availability of water treatment plants and adequate septic facilities. We are linking our ongoing remote sensing analysis of land use and land cover change (LULCC) in the Osa Peninsula and Golfito regions located in southwest Costa Rica with measurements of water quality parameters that would most likely be impacted by the documented LULCC, focusing on nutrient runoff, e-coli concentrations, and herbicides and pesticides. We will then link the remote sensing derived maps at the sub-watershed scale with the quantified water quality parameters to link land cover and changes to their resulting impact on water quality. Here we present initial results and discuss our upcoming research on this topic.

Filling in the Blue Lines: A Map of the Fluvial Complexity of the Cahaba River, AL (USA)
Davis, Lisa
ABSTRACT:
Fluvial complexity describes the heterogeneity of geomorphic features and structures existing in a river system. Because habitat heterogeneity is assumed to lead to greater biodiversity, and thereby increased ecosystem health and resilience, river restoration and conservation efforts increasingly aim to create and/or preserve fluvial complexity. Yet, the fluvial complexity of rivers is rarely mapped, particularly at the system scale. Here we present a map of the fluvial complexity of the Cahaba River in AL "€ one of the most biologically diverse rivers in North America "€ created with the help of a fluvial geomorphology class at the University of Alabama, Tuscaloosa in fall 2015. In addition to providing insight into system scale fluvial complexity of a mid-sized (6th order on Strahler classification) river, the Cahaba fluvial complexity map has potential to help explain spatial heterogeneity of aquatic habitat and water quality, as these phenomena are directly and indirectly influenced by changes in the physical structure of the river.

Climate Change Impacts on the Ecologically Relevant Flow Metrics in the Cahaba River
Dosdogru, Furkan
ABSTRACT:
In this study, past, present, and future state of the ecologically relevant flow metrics in the Cahaba River Watershed in north Central Alabama will be analyzed. Cahaba River watershed has several endangered species, the most well-known is the Cahaba Lilies (*Hymenocallis coronaria*). Once abundant in the Southeast, Cahaba Lilies have been totally wiped out from many areas and are only abundant in certain regions. Construction of dams are listed as the main reason for this, which indicate the sensitive nature of

these species to variations in flow. Changes in land use/cover (LULC) and climate can both modify the stream hydrology. The Nature Conservancy has identified 32 key flow metrics that captures low, high, median flow as well as flashiness having significant impact on the flora and fauna. These flow metrics, thus the ecology, will certainly be effected by LULC and climate change. Daily streamflow data will be produced from 1983 to 2015 using historical climate and LULC data with the Soil and Water Assessment Tool (SWAT). Future daily streamflow data will be produced using CMIP5 (Coupled Model Intercomparison Project) climate data up to 2055. The 72 year period from 1983 to 2055 will be partitioned into 3 interval each 24 years in length. The daily streamflow from each period will be fed into the Indicators of Hydrological Alterations (IHA) software to calculate the 32 flow metrics in each period. Differences in the flow metrics will be assessed, which may hint for increase/decrease in native species' density that may have occurred in the past or might occur in the future.

The National Flood Interoperability Experiment and a Means of Damage Estimation during Flooding Events

Gutenson, Joseph

ABSTRACT:
The National Flood Interoperability Experiment (NFIE) in Tuscaloosa, Alabama seeks to increase predictive capacity of the coterminous United States (CONUS) in regards to flooding. Accordingly, NFIE technologies offer the ability to forecast damage estimates that coincide with the hydrologic and hydraulic estimations these physics-based models generate. A model providing an accurate prediction of damage to structures is a valuable asset when allocating funding for disaster response, recovery, and relief. The authors will evaluate a purposed methodology which relies upon existing, highly available datasets to forecast damage estimates to structures in CONUS.

Most county tax assessment offices throughout CONUS produce georeferenced property value data. In many cases, these tax assessment datasets offer information on both land value and appraised value of the structures in the county. Updated regularly by the county, tax assessment data are intrinsically adaptive to the changing view of flood risk in the community. Physical structures recorded in these tax records change location in accordance to relative susceptibility to flood damage. This adaptability stems from the change of residences that typify areas prone to natural hazards.

Coincidental to parcel data are point data produced by emergency management personnel, also at the county level. These data provide the point location of all addresses within the county and are also updated regularly, alongside the parcel data. Thus, these datasets adapt through the movement of physical structures as the records are updated.

The combination of these datasets offers a fundamental yet adaptive means to forecast damage that occurs during a flooding event. This research identifies one possible methodology for providing such a system. The proposed methodology relies upon the wealth of geospatial data collected by many county-level governments' tax assessment offices and emergency officials.

Structured Decision Making: A Tool to Support Decision Making about Water Resources

Ferguson, Paige

ABSTRACT:
Decision making about water resources may be difficult because there are multiple objectives, disagreements among stakeholders, constraints on available resources, and uncertainty in system dynamics. Structured decision making (SDM) is a decision support tool that can overcome these challenges. Further, decisions made through a process such as SDM that explicitly defines objectives, weights conflicting objectives, and

incorporates uncertainty are expected to produce desirable outcomes more often than decisions made less systematically.

SDM is based on decision analysis, the use of quantitative methods to evaluate decision options. The main components of SDM are a definition of the decision problem, objectives based on values, attributes to make objectives measurable, decision options that could help achieve objectives, one or more models to describe the expected outcomes of decisions, and a method to evaluate the degree to which each decision is expected to fulfill objectives. These components are developed through an iterative process where stakeholders provide input and facilitators synthesize information while attempting to remain value-neutral. SDM recognizes the distinction between value-based information and technical information while explicitly integrating both.

We describe SDM and illustrate how it can be applied to decision making about water resources. Using case studies, we present details about running SDM workshops, eliciting objectives from stakeholders, building Bayesian decisions networks, using models to evaluate decision options, and identifying the decision option that is most likely to achieve stakeholders' objectives. We demonstrate how multiple, conflicting objectives and uncertainty can be integrated in the decision network with the potential for improving decision making about water resources.

Monitoring of Pharmaceuticals in Streams and Drinking Water: A Review of Current Surveys
Hudson Duran, Sue
ABSTRACT:
Advances in analytical and detection methods have improve the ability to monitor drugs in the drinking water. Trace pharmaceuticals (active ingredients with pharmacological effects) have been reported in surface water, groundwater and waste waters. Most of these occur through the waste treatment system as by-products of human and animal excretion of pharmaceuticals. There is no federal requirement for testing drugs in the drinking water. The purpose of this presentation is to review current standards for quality methods for removal of pharmaceuticals and present some options for different molecular sizes of drugs. The review will concentration of the drugs that have been identified throughout the US and the implications of damage to marine life as well as humans. Filtration, reverse osmosis, ozonation and advanced oxidation technologies have resulted in a lesser extent present in drinking water, usually in nomograms per liter. Free chlorine also removed about 50% of antimicrobials such as sulfamethoxazole, trimethoprim and erythromycin. Other methods and particularly activated charcoal, membranes and polymers placed in water reservoirs achieve as high a rate as 99% for targeted large molecule pharmaceuticals. However, some areas may not have access to all of these modern techniques and reverse osmosis is not a requirement. The World Health Organization (WHO) as well as the Environmental Protection Agency and US Geological Survey have resulted in ad hoc surveys or select research projects with results stating that these levels of drug present are 1000 times lower than the therapeutic dosage being administered to humans. However, increased studies need to be conducted to assess the risks to human-marine health due to long term exposure and possible side effects of combinations of products ingested from the water.

Detection of Rare Aquatic Species using Environmental DNA to Locate Populations of Alabama and Gulf Sturgeon in Alabama
Janosik, Alexis
ABSTRACT:
Environmental DNA (eDNA), is a relatively new technique that has proven to be a successful tool in the detection of rare and/or spatially and temporally variable organisms. For aquatic species, field sampling can require extensive effort and may be unreliable in terms of determining the presence or absence of a target

species, especially when the target species is rare. For this study we used eDNA to detect populations of Alabama sturgeon (*Scaphirhynchus suttkusi*) and Gulf sturgeon (*Acipenser oxyrinchus desotoi*) in the Alabama, Cahaba, and Tombigbee rivers. These two species of sturgeon make ideal model organisms for examination of this technique in the detection of rare species, as the Alabama sturgeon is critically endangered and the Gulf sturgeon is listed as vulnerable on the International Union for Conservation of Nature (IUCN) red list. Results have revealed positive detections of Gulf sturgeon in all three major river systems; however, no detections for Alabama sturgeon were observed. Successful detection of these species could reveal vital information such as understanding of habitat use for management purposes as well as identify specific localities for field sampling.

Measuring Mesopotamian Marshland Change Using Landsat Imagery from 1986 to 2015

Johnston, Brian

ABSTRACT:
The marshes of southern Iraq have seen a great deal of attention in public media over the past decade. Their gradual declines through the 1970s due to diversion of upstream water sources in Syria, Turkey, Iraq and Iran were evaluated as part of the building notion of human effects on land use. However, previous damages were completely eclipsed by the precipitous losses suffered in 1991 when then dictator Saddam Hussein purposely diverted water from the marshes to smother a safe haven for his political adversaries in southeastern Iraq. Their collapse and subsequent rejuvenation after the dictator's fall in 2003 have been the subject of coverage on 60 Minutes and in The New York Times, among other popular news sources, as well as various journals in the academic community. Independent of their decline, the marshes were well studied and documented for their significance to human development, boasting what may be the oldest persisting way of life still practiced. The marshes are recognized as part of the The Cradle of Civilization and possible origin of things like the wheel, agriculture, and the written word. However, since the U.S. invasion of Iraq in 1991, the location has become inaccessible and dangerous, requiring study using satellite images. Previous studies have looked at Landsat images for periods immediately after the purposeful desiccation in 1991 and again after the US invasion in 2003, but none have looked at images spanning the entirety of available data. Unfortunately due to the failure of Landsat 7's Scan Line Corrector (SLC) on May 31, 2003, there is a break in useful data until May 30, 2013. This study endeavors to compare water and vegetation land cover in the region in anniversary Landsat images from 1986 to 2015 using Landsat 4, 5, 7, and 8 imagery, calculated Normalized Difference Vegetation Index (NDVI,) and Modified Normalized Difference Water Index (MDVWI). The comparison shows gradual decline in overall cover from 1986 to 1989, nearly complete loss of coverage between '89 and 2000 at the pinnacle of their desiccation. Water coverage in the region increased in late May of 2003, mere weeks after the fall of Baghdad in April that same year. There is further recovery of both vegetation and water between '03 and 2015. However, the marshes have failed to make a complete recovery during that time as there is significant disparity between coverage measured in '86 and what was present in 2015.

The Effects of Prescribed Burning on the Water Quality of Ephemeral Streams at Guntersville State Park, AL.

Lawhorn, Andrew

ABSTRACT:
Prescribed burns are a forest management tool commonly utilized in the southeastern United States in order to reduce fuel loads and prevent catastrophic wildfires. While forest buffers are often used around large water bodies, headwater, ephemeral streams typically receive no buffer protection during prescribed burns. This could have effects on downstream water quality. Water quality and riparian data were monitored before and after a prescribed burn for three ephemeral streams found at Guntersville State Park, where a prescribed burn

was used to reduce fuel loads and improve aesthetics in the park. Large amounts of fuel from down trees were still present from the tornadoes that occurred in spring of 2011. Beginning in the Fall 2013, we measured water quality and habitat characteristics including: pH, water temperature, dissolved oxygen, turbidity, hardness, alkalinity, nitrate, nitrite, phosphate, conductivity, total dissolved solids, leaf litter thickness, water depth, embeddedness, substrate erosion, bank composition, bank slope, stream flow, and riparian vegetation parameters. We also collected 3 samples of invertebrates per stream using a standard dipnet. We repeated these measurements in the Fall of 2014 prior to the forest burning in winter of 2015. The water quality and habitat measurements were repeated shortly after the burns in February 2015. Preliminary analysis of data suggests that the burn did not significantly affect the quality of runoff or increase sedimentation in the streams. Burning did not significantly change water quality parameters such as concentrations of nitrite, nitrate and phosphate. Additional analyses will be performed on habitat and invertebrate data in the coming year. However, preliminary results demonstrate that low intensity prescribed burning in watersheds with ephemeral streams do not have substantial impacts on water quality and may not require the implementation of forest buffers to protect water quality downstream. Additionally, a larger scale project would likely yield more conclusive results.

Utilization of GIS Tools for Assessing Land use/cover Change for the Flint River Watershed

Majors, Kyle

ABSTRACT:
This study has been carried out to observe the change in land use and land cover pattern for the Flint River Watershed (FRW) located in the Northern Alabama. The land cover data during the years 2006 and 2011, are obtained from the National Land Cover Data (NLCD). The FRW is delineated into a number of sub-watershed utilizing Geographic Information System (GIS) tools and the change in land use pattern for each sub-watershed is assessed for 2006 and 2011. The major land uses are reclassified using GIS tools into 8 major classes: water/wetlands, urban, barren/mining, forest, upland/shrubland, agri-cropland, grassland and agri-pasture. Among all land uses, forest, agri-cropland, and agri-pasture covered the higher percentage in each sub-watershed. The number of pixels for each land use in each sub-watershed are counted for both years and compared to calculate the change in land use. An increase of 0.2% to 8% is calculated for the urban land use, while a decrease of up to 4% is calculated for the agri-cropland and agri-pasture respectively. This implies an increasing urbanization pattern for various regions of the FRW which could significantly impact the water availability and demand over the regions in future periods. This study is a part of the GERC research project and this analysis will be utilized for hydrologic modeling to evaluate the impacts of land use/cover change on water availability over the watershed.

Big Valleys and Big Floodplains: A Case Study on Flint Creek

Mason, Jessica

ABSTRACT:
As the ongoing effort to update Alabama's floodplains continues as part of FEMA's Risk MAP program, a study of the Wheeler lake watershed is underway in North Alabama. The Wheeler lake watershed sits in the foothills of the Appalachian mountains along the Tennessee River. The watershed is characterized by several major tributaries feeding into the Tennessee River that travel through wide valley areas. Among these tributaries is Flint Creek which travels the length of Morgan County through a series of wide flood prone valleys.

This presentation will focus on the Flint Creek restudy in Morgan County. Utilizing new hydrologic and hydraulic modeling, along with the LiDAR data from the county, the Flint Creek floodplain has dramatically increased in size as compared to the effective modeling shown on the current Morgan County Flood Insurance Rate Maps. This presentation will demonstrate how special considerations were made during all

phases of the model development to ensure that this rapid expansion of the floodplain was represented as accurately as possible. This presentation will describe the challenges associated with hydrologic modeling, hydraulic modeling, and floodplain delineation. It will also explain the processes used to solve those challenges in order to deliver the most accurate representation of the flood risk along Flint Creek.

Satellite Assisted Agricultural Modeling in the Southeastern United States

Mishra, Vikalp

ABSTRACT:
Agricultural production declined sharply in the Southeastern US during the latter half of the 20th century. While several reasons have been given to explain this decline, a major factor was that southern farmers engaged in rain fed agriculture could not compete with irrigating farmers in the west and central portions of the country. However, a major effort is currently underway to revitalize the agricultural economy of the region through enhanced irrigation. In order to evaluate the potential advantages and disadvantages of increased irrigation in Southeastern agricultural fields, a significant amount of crop modeling is necessary. To that end, the Decision Support System for Agricultural Technology (DSSAT) model is run daily over the entire Southeast during the growing season. The model is currently driven by NWS Stage IV multi-sensor precipitation estimates and operates at roughly the NEXRAD grid spacing (≈ 5 km). However, because the model grid encompasses both rain fed and irrigated fields, and the soil hydrology component is relatively unsophisticated, model calibration can be difficult. Past studies have shown that model results can be significantly improved through the inclusion of soil moisture conditions measured from satellite data. The combination of microwave sensing of surface conditions and thermal infrared estimates of root zone moisture content can be very effective in guiding and correcting the soil moisture states of the rain-fed crop model. The Atmosphere–Land Exchange Inversion (ALEXI) model employs thermal infrared measurements from the GOES satellite to infer total root zone soil moisture. In contrast, the microwave sensed estimates from the Advanced Microwave Scanning Radiometer (AMSR-E) mission and the Soil Moisture Active Passive (SMAP) instruments can provide accurate estimates of near surface (≈ 5 cm) moisture, albeit at low spatial resolutions. The microwave observation must be downscaled to the higher resolution of the ALEXI data (4 or 10 km) to produce an integrated soil moisture data set. These estimates can be employed in a maximum entropy (maxent) model to produce vertical soil moisture profiles with a high degree of precision. The maxent profiles are then ingested into the DSSAT crop model via the ensemble Kalman Filter to update the soil moisture states of the model and thus improve the crop yield estimates. Previous proof of concept studies have shown that the DSSAT yield estimates can be improved by up to 20% than taking just rainfed into account.

Simulation of Cooling Water in Kafr-Al-Batek Power Station at the Damietta Branch, Egypt

Mostafa, Mohamed
Mostafa, Saadeldin

ABSTRACT:
The main purpose of this research effort was to investigate and reduce the volume of thermal polluted cooling water from returning to the Kafr-Al-Batek power station. Traditional cooling systems, such as cooling towers or ponds can be very challenging with regards to implementation in developing countries; mainly due to the lack of financial capacity. This research focused on low-cost simulation solutions that could improve thermal outcomes. Comparisons were performed between three different scenarios to decrease the elevated temperature of the discharged water (43ºC) released by the Kafr-Al-Batek power station on the Damietta branch. The different scenarios were simulated by using STAR CCM+ software. The base scenario examined the discharge angle of an existing outlet.

The second scenario examined a new outlet downstream from the existing outlet. The third scenario increased the width of the existing outlet in order to reduce low velocity. A comparative analysis is provided between the aforementioned solutions to identify the most suitable and cost effective alternative. Simulation results showed that changing the discharge angle from 90^{o} to 135^{o} is the most effective solution. Applying this solution has the potential to decrease the water temperature at the inlet by 7 degrees Celsius (from 32^{o}C to 25^{o}C).

Bioavailability of Polycyclic Aromatic Hydrocarbons in Biochar-Amended Soils
Richard, Sarah
ABSTRACT:
Mounting concerns regarding fossil fuels and anthropogenic carbon emissions has resulted in an increased interest in biofuels. Biofuels provide a sustainable energy source as well as a potential mechanism for mitigating climate change. Although more studies are necessary in order to ensure sustainability, biofuels may result in an overall carbon negative process through soil application of biochar, a byproduct of pyrolysis. Although biochar has potential to add organic carbon and sequester carbon in soil, the contaminants present in biochar can negatively affect the environment. This study quantified the concentration of total and bioavailable polycyclic aromatic hydrocarbons found in the biochar of feedstocks that underwent slow pyrolysis at 400, 550, and 700 degrees Celsius. Total concentrations of polycyclic aromatic hydrocarbons (PAHs) were measured using Soxhlet extractions and gas chromatography-mass spectrometry. Bioavailable concentrations were measured using polyoxymethylene passive samplers. When pyrolysis method and residence time remain constant, it is hypothesized that temperatures around 550 degrees Celsius will result in a higher concentrations of bioavailable hydrocarbons in grasses and woody feedstocks. The results of this project will provide critical information for researchers and farmers regarding the suitability of biochar, when utilized for carbon sequestration, as a soil amendment. The results of this study will also provide necessary information on the potential bioaccumulation of PAHs and will allow researchers to start assessing public health risks when dealing with biochar amendment to fields that may potentially grow food crops. Policy makers will be able to use the results to determine the potential of biochar amendment as a clean development mechanism under the Kyoto Protocol.

Impact and Potential Mitigation of Stream Siltation: Case study Flint River in Northern Alabama
Rucker, Lacy
ABSTRACT:
Siltation is the most dominate form of pollution that enters streams in the southeastern United States. Excess siltation in streams can have severe repercussions that can lead to decreased wildlife diversity, poor water quality, and stream channel alteration and fill. All streams carry siltation and other suspended solids naturally; however, anthropogenic practices have astronomically increased the amount of siltation in streams. This study looked at the effects siltation had on water quality in a section of the Flint River, located at the Public Access Canoe Trail in Brownsboro, Alabama. Sampling was conducted in correspondence with predicted flood patterns derived from NOAA during a rain event. Water quality measurements, specifically pH, dissolved oxygen, conductivity, and total dissolved solids, were taken using an YSI Professional Plus Multiparameter Meter. Nephelometric Turbidity Unit (NTU) measurements were taken using an Oakton T-100 turbidimeter. NTU readings were the greatest water quality measurement negatively affected by siltation, followed by % dissolved oxygen. This demonstrates that siltation levels increase in the Flint River during rain events, suggesting land use around the Flint River greatly influences how the river behaves during a flood event. Rain events also lowered the pH level, making the stream more acidic. Mitigation methods for

siltation in the Flint River could greatly increase its overall aquatic health producing more stable water quality readings throughout all weather events. Further research should be conducted to determine how rain events of different intensities affect the water quality in the Flint River.

Identification and Enumeration of E. coli and the Impact of Climate Change and Variability to determine the Water Quality in the Flint Creek Watershed (FCW)

Russaw-Scissum, Gabrielle

ABSTRACT:
Studies are being conducted to evaluate the water quality of the Flint Creek Watershed (FCW) located in southeast Lawrence County, western Morgan County, and the northern part of Cullman County in Alabama. FCW is a one of the major tributary to the Tennessee River and also to the Wheeler Wildlife Reservoir. The major sources of waste discharge into the watershed are from surrounding communities, and public and private facilities within the area. The presence of cattle farms, goat farms, and cropland may be linked to the contamination of soil and water resources. This particular study evaluated the impacts of nutrients (Nitrogen, Phosphorus, and Mercury), climate change/variability and land use and demographic change on the presence of E.coli, a fecal indicator bacterium in surface water of the FCW. Analysis was conducted on three (3) sites of Flint Creek (FC): Red Bank Road (Site 1), Highway US-31(Site 2), and Vaughn Bridge Road (Site 3) with six (6) samples taken in triplicate once a month for two (2) years. We hypothesized that the levels of E.coli fecal coliforms would be higher in the warmer months of May-September and decrease from October-April. Additionally, changes in climate and land use and the concentration for nutrients would have a significant impact on overall bacterial levels of E.coli. Initial results (April-July) indicate that Site 1(Increase in from April 25 cfu/100ml to 64 cfu/100ml for May, and with July being high, 192 cfu/100ml) and Site 3 (Increase in from April 27 cfu/100ml to 99 cfu/100ml for May, and with July being high, 103 cfu/100ml) have higher levels of E.coli fecal coliforms indicators from July to April. For Site 2, the levels in April (278 cfu/100ml) were higher than the month of May (128 cfu/100ml) and July (142 cfu/100ml). There is no data for June.

Does time matter? The importance of habitat age in structuring pond zooplankton metacommunities

Sferra, Christopher

ABSTRACT:
Metacommunity theory invokes both local and regional processes to explain community assembly, but the role of habitat succession in influencing metacommunity dynamics has been ignored to date. To address the importance of succession in structuring species diversity at local and regional spatial scales, we evaluated the influence of habitat age and the associated environment on zooplankton species richness and composition in beaver-formed forest ponds connected by stream flow in the Talladega National Forest, Oakmulgee Wildlife Management Area. Analyses testing for effects of pond age on the local environment suggest that pond age influences key environmental variables that have been shown to influence zooplankton species richness and community composition. Older ponds were deeper, warmer, had lower colored dissolved organic carbon and lower total dissolved phosphorus concentrations relative to younger ponds. These findings strongly suggest age-dependent environments that can structure resident zooplankton communities in the larger pond metacommunity.

Quantifying the Influence of Land use/land cover and Climate Change on Inland Flooding Occurrence and Severity Following Tropical Cyclone Events using a Physically-based Hydrology/hydraulics Model
Stone, Monica
ABSTRACT:
Tropical cyclones are the most severe rain events that impact the Southeast United States and often cause widespread flooding. These storms are the most costly weather hazards that occur in the United States, and the subsequent flooding is the leading cause of death from natural hazards in the United States. Most past research has focused on predicting storm surge following tropical cyclone events, but not much research has been conducted to study the effects of tropical cyclones on inland-river flooding in the Southeast United States, or how inland-river flooding following these storms is likely to change in the near future. Both the expected increase in tropical cyclone intensity with global climate warming, and future changes in land use/land cover are likely to alter flooding conditions following tropical cyclones. Here we present initial results from a study that aims to quantify the impact increased precipitation, from tropical cyclone intensification, and changes in land use/land cover have on flooding magnitude and duration in five basins in the Southeast United States. This study utilizes the Soil and Water Assessment Tool (SWAT) model. Two watersheds have been analyzed using the SWAT model, that of the Mobile River in Alabama, as well as that of the Neches River in Texas. Hydrological conditions in the selected basins were predicted for 2100 given climate-induced tropical cyclone intensification, as well as possible land use/land cover change. While this research is still in progress, preliminary results suggest that tropical cyclone floods typically have a higher magnitude and a longer duration than other flood events, and that this is likely to increase with both increased precipitation rates and increased urbanization in 2100. Further, land use/land cover seems to have a greater impact on the changes in magnitude and duration of flood events than those resulting from increased precipitation intensity. Future work will extend this study to include the Roanoke River watershed in North Carolina, the Pearl River watershed in Mississippi, and the Red River watershed in Texas/ Louisiana. This study will help address the National Science Board's call for a "[prediction of]" inland flooding from hurricanes and tropical storms," and will hopefully help inform future mitigation and preparedness efforts in the Southeast United States.

Paleo-hydroclimate of the Southeastern United States
Therrell, Matthew
ABSTRACT:
A review of the research on the history as well as causes and consequences of extreme hydroclimate variability in the southeast with particular emphasis on the northern Gulf Coast states is conducted. As might be expected, the observational record suggests that extreme hydroclimate events such as drought and flooding occur frequently in the southeast. However paleoproxy studies of these events in the region are relatively uncommon particularly in the northern Gulf States region. A limited number of paleo-reconstructions of drought in general have been developed for the region but reconstructions of streamflow for specific basins are very infrequent including for those basins where water management is most contentious (e.g., the Apalachicola-Chattahoochee-Flint river basin). In addition, paleorecords of flooding are quite limited in general and are mostly restricted to coastal flooding associated with landfalling tropical cyclones. Though limited, most of the long-term hydroclimate research conducted in the southeast suggests that the modern observational record does not reflect the full range of natural variability of hydroclimate especially in regards to extreme events. Regardless of any potential negative consequences of anthropogenically-driven climate change, continued and increasing population growth in the region as well as attendant demand for increased water resources suggests that water supply and natural hazards management in the southeast will benefit from a close examination of extant paleohydroclimate records as well as the development of additional records, particularly in those areas where conflicts and or hazard threats are most likely.

Development of Software Based on GIS for Running LISFLOOD-FP Model
Wan, Tong
ABSTRACT:
LISFLOOD-FP is a well performed hydraulic model that is used by European Flood Alarm System (EFAS) to simulate and predict flood. Currently, however, there exists few GUI for LISFLOOD-FP model and therefore it is difficult for beginners to use it.

In our project, a LISFLOOD-FP Arc-Map add-in that include functions to run the diffusive solver and subgrid solver is developed under the environment of C# and ArcObject. With this tool, LISFLOOD-FP users can get rid of the difficulties for preparing all the input files in GIS manually. Instead, a friendly LISFLOOD-FP GUI is provided that can generate cross-sections based on certain spacing, creating profiles for each cross-section, making the various input files needed by the solvers, running the model and view the simulation results. All these processes are automated by using DEM and Stream line and users just need to follow the steps in the tool and set proper parameters/configurations. Also, we tested our tools with several reaches in United Stated based on 100-year flood and this tool shows advantages in generating flood maps all over the United States and providing an easier and more visible way in running LISFLOOD.

Influence of Agricultural Practices on Water Quality
Williams, Cedric
ABSTRACT:
This project assesses the water quality of Limestone watershed and analyzes the effectiveness of selected conservation practices. It will also provide status of the overall watershed condition. Research from this watershed will predict the long term impacts conservation practices have on water quality. Limestone watershed is a 1,000 km^2 primarily agricultural watershed located in northern Alabama with several impaired streams as identified by ADEM. The purpose of this study is to assess agricultural impacts on water quality, focusing on cropland and pastureland. It also will assess the application of conservation practices to improved water quality focusing, on riparian buffers, terrace systems, and conservation tillage. Baseline water quality data was taken in May 2015 at 40 sites spatially distributed throughout the watershed. All parameters are within acceptable ranges apart from E coli. For more discreet analysis, water quality parameters along with turbidity and stream flow are being measured for eight subwatersheds monthly (high crop and low pasture, mod crop and mod pasture, low crop and high pasture, and low crop and low pasture). A watershed farm survey was used to assess the activities that are taken place on each cropland within the eight strategic subwatersheds. The watershed assessment should help provide logic in controlling soil erosion, provide adequate supply of good quality water for agriculture uses, and remove excess water from surface and the soil profile in hopes of protecting and enhancing our environment. Over the next year further data on landuse and conservation practices will be used to assess patterns as it relates to water quality.

Campus Wetlands and Rain Gardens: Green Infrastructure Demonstration Project
Williams, Jessica
ABSTRACT:
Storm water runoff is an issue commonly found in urban areas, where there is a higher percentage of impervious cover. Storm water runoff contributes to erosion and flooding in areas where the runoff volume is high. The improvement project aims to enhance the beautification of campus, as well as integrate green initiatives throughout campus by developing small scale demonstration projects, including rain gardens and wetlands. These things are important because they filter storm water runoff and decrease erosion. By implementing these practices, it will increase educational and environmental awareness, as well as assess the impact of storm water runoff on Alabama A&M University's campus.

Comparison of Different Sampling and Enumeration Protocols for Indicator Microorganisms in Water and in Sediment

Yuan, Jing

ABSTRACT:

Water quality, such as drinking water quality, irrigation water quality, and recreational water quality, is of great important for the public health. *Escherichia coli* have been used as indicator organisms to monitor the potential fecal contamination of water. In recent years, it is proposed that Enterococci can be used as a new indicator for surface water quality monitoring. Enterococci belong to the normal floras of the gastrointestinal tract of humans and animals and have been the indicator microorganisms for monitoring sea water quality. The purposes of this study were to better understand the fluctuations seen from E. coli enumeration results, investigate the role sediments may play in water quality, and compare the efficacy of different Enterococci enumeration protocols.

For the whole study, two lakes in the state of Alabama were chosen. At each lake, two sampling spots were chosen. Fifty milliliters of surface water and 25 grams of sediment from each sample site were collected and plated on the 3M™ Coliform/*E. coli* Petrifilm. The numbers of indicator microorganisms were enumerated following the manufacture's manual and compared with the *E. coli* Coliscan® Easygel method. For the Enterococci study, four enumeration protocols, including Enterolert® method, Easygel Enterococci card method, mEI plate method (EPA), and real-time PCR method were applied to water samples collected and compared.

The results showed that sampling times (morning vs. afternoon and seasons), sample types (sediment vs. surface water), and the sample volumes impacted the enumeration results ($P < 0.05$). While the Easygel Enterococci card method has the lowest price, the PCR method has the widest detection range and the best sensitivity for Enterococci enumeration. However, the PCR method requires more training than the other three methods. The results of this study indicate that a more accurate water sampling, preparation, and enumeration protocol is still needed for more efficient water quality monitoring.

NIFE-Flood Warning System

Zhang, Xaioyin

ABSTRACT:

Flood incidents can endanger human life, cause extensive property damage and result in significant harm to the environment. Effective warning and response to regional floods requires a multipronged, non-linear approach to reduce loss of life, property and harm to the environment. These coordinated responses highly rely on the effectiveness and efficiency of each warning and recommendation. In order to provide the basic knowledge and guidance to develop or to set up an appropriate and tailored system for any case in which a flood forecasting and warning system is required, WMO (World Meteorological Organization) issued The Manual on Flood Forecasting and Warning. Based on the framework of WMO and historical inundation records, a decision support system of flood warning system has been developed to provide precise warning and recommendation to help the community leaders and emergency management authorities to make a sound responsible plan and to take effective actions. FWS (Flood Warning System) in local community scale is a component of an ongoing research of a functioning hybrid decision support system and expert system framework, Water Wizard, which is used to provide warning message and recommendations for local communities based on their own situations. FWS is a self-contained software system based on the programming language of Python comprised of an over-arching framework, a rule based decision support tool, and a graphical interface model for the inundation events. The backward-chaining rule based decision support tool, which allows interview style interactivity with the users, is cooked in Python Knowledge Engine (PyKE) and the graphical interface model, which provides not only friendly graphical user interface but also innovative user interface, such as multi-touch applications, is cooked in Python Library-Kivy. FWS

can use its vast knowledgebase including multiple triggers such as data of weather forecasting and monitoring combined with the information of historical and current local environmental conditions furnished by the user to provide flood warnings and response recommendations on the flood events. In the future, FWS will work with output from NIFE River or other hydraulic models and give the users guidance to make a quick and efficient flood response plan.