The Department of Biological and Agricultural Engineering applies engineering principles to biologically-based systems. Faculty research activities involve the application of engineering principles to achieve efficient utilization of biological and agricultural systems with emphasis on management, preservation and sustainability of natural systems. Scientific and engineering principles are applied to: conserve and manage air, energy, soil and water resources; to manage, protect and restore natural ecosystems; to understand and utilize biological, chemical and physical processes for the production and conversion of biomass to bioenergy; to analyze, understand and utilize mechanical properties of biological materials; to design and develop machinery systems for all phases of agricultural and food production; to design and evaluate structures and environmental control systems for housing animals, plant growth, and biological product storage; to develop improved systems for processing and marketing food and agricultural products; and to design sensor-based instrumentation and control systems for biological and agricultural applications.

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Urban Stormwater Management: Evaluation of Simple Retrofits/ Design Enhancements and Development of Simple Assessment Tools
Hunt, W., J. Page
2/1/14 - 7/31/17
$184,410.

The overall objective of this project is to compare the nutrient removal performance and life cycle costs of stormwater control measures (SCMs) using existing design criteria and innovative retrofit design enhancements to increase nutrient removal performance at various temporal resolutions. Three simple retrofits or design enhancements will be tested: (1) upflow filters retrofit at wet pondsâ€™ outlets to increase phosphorus sequestration; (2) inclusion of anoxic sumps to improve denitrification within bioretention; and (3) installing a stormwater harvesting system downstream of a permeable pavement to reduce nutrient loads discharged to the storm sewer.

Engaging Youth in Improving Burnt Mill Creek Through High Priority Storm Water Retrofits
Perrin, C., W. Hunt, R. Winston
1/1/14 - 6/30/16
$142,587.

Research by NCSU on the watershed's one parking lot bioretention cell retrofit revealed a 76-91% reduction in PAHs. Similar reductions are expected at new parking lot retrofit sites proposed herein. Most recently, the team studied runoff reductions of street retrofits, and learned that while they reduced runoff volumes and concentrations and loads of all detectable pollutants. PAHs in the street runoff were negligible. This illustrates that parking lots are a higher priority for stormwater treatment than streets if the goal is to reduce PAHs in the creek. This proposal leverages high priority parking lot stormwater retrofits at New Hanover High School and DREAMS of Wilmington to engage students and teachers in hands-on learning about watershed improvement.

Implementing Permeable Pavement in Triassic Soils and Statewide to Reduce Runoff Volume and
Nutrient Loads, WRRI Enhancement Project
Hunt, W., S. White, M. Voiland
Durham, NC
8/19/12 - 9/30/14
$31,337
A permeable pavement lot will be constructed on extremely clayey Triassic Basin soils at NC Central University in Durham, NC. Data from the lot will support a modeling effort to create an easy-to-use predictive model for permeable pavement performance that will be used throughout North Carolina, per NCDENR approval. Thus, permeable pavement usage would be able to be credited no matter the location. Due to existing development stormwater retrofit requirements in the Jordan Lake Watershed, and limited space in urban areas of that watershed this project has the potential to result in widespread use of a practice that would consequently reduce runoff volumes and nutrient loads in the Triassic Basin and statewide.

Implementation of the Regenerative Stormwater Conveyance Technology to Stabilize and Erosional Gully In Durham, NC
Hunt, W.
NC DENR/ EPA
1/1/14 - 6/30/16
$132,854.
The proposed project is a regenerative stormwater conveyance (RSC) stormwater BMP device, to be installed on an unnamed tributary to Third Creek, located just upstream of MLK Parkway, in Southern Boundaries City Park, adjacent to the DPW Operations facility, on Third Fork Road in Durham, NC. The RSC design will fill the existing incised ephemeral stormwater channel with a mixture of sand and mulch, control grade with a combination of parabolic boulder weir and cascade structures and stabilize the existing eroding channel banks. This SCM will be monitored for 12 months to determine performance of the RSC system. Pollutant loading reduction will be calculated from monitored data for TN, TP, TSS, and select heavy metals.

Nutrient and Carbon Loading in Gross Solids in Urban Catch Basins: A Nutirent Accounting Opportunity? (557668)
Hunt, W., A. Anderson
NCSU- WRRI Storm Water Management Group
8/1/13 - 07/31/15
$45,814.
NCSU is seeking to partner with four UNC-WRRI urban stormwater consortium member municipalities to determine the mass, volume, and composition of stormwater-borne gross solids entering curbside drain inlets. Data to be collected from collection of these solids include total nitrogen, phosphorus, and carbon loadings, as well as categorizing the mass of these pollutants by type. The scope of work involves four drain inlets per community, with up to four land types represented per city.

Implementing and Evaluating Storemwater BMPs in Durham (557829)
Line, D., W. Hunt, R. Winston, J. Spooner
NC DENR
1/1/14 - 12/31/16
$64,052.
The NCSU, BAE, proposes to install stormwater runoff BMPs in the Woodcroft HOA soccer fields located in south Durham. The stormwater BMPs would replace a concrete-lined channel with a vegetated swale and the downstream wet area with probably a stormwater wetland. Surface water inflow to and outflow from the BMP combination will be monitored continuously via automated samplers. Groundwater inflow appears to be minimal and thus will not be monitored. Nitrogen, phosphorus, and total suspended solids loads will be computed and used as the measure of the reduction efficiency. Statistical analysis will be conducted to determine whether the reductions are significant with respect to unexplainable/natural variability.
**Monitoring Elmer Avenue Green Alley In the City of Los Angeles (557784)**

*Hunt, W., J. Page*
AbTech Industries, Inc.
11/15/13-07/15/14
$24,910

A green alley (pervious concrete and swale) has been constructed adjoining Elmer Avenue in northern Los Angeles, California (pictured to right). NCSU/AEWS has been approached by the Council for Watershed Heath (CWH) to assist CWH in monitoring the green alley. NCSU/AEWS would provide outreach and technical support for the data collection and analysis. Results would be documented and presented to the City of LA. The project would be completed by summer 2014.

**Develop and Test Ammonia - Oxygen Monitoring System for Poultry Houses (557299)**

*Shah, S., L. Wang, E. Oviedo*
US Poultry & Egg Association
01/01/14 - 01/01/15
$40,948

We propose to use off-the-shelf, low cost metal oxide and electrochemical sensors and couple them to scrubbers to remove vapor and interfering gas scrubbers to obtain more accurate gas levels and prolong the lives of these sensors. Because the sensors are low-cost, they can just be discarded instead of requiring expensive calibration. Gas concentrations will be corrected for humidity and temperature effects. In the first stage we will identify three each of ammonia and O2 sensors and select one of each type after intensive testing in chamber with poultry litter. Then, we will build a 6-volt battery powered sensor system weighing <3 lb. In the last stage, this system will be tested in a poultry house against established, more expensive sensors. We expect to develop a system that will be suitable for use by both producers and researchers.

**Person Street Low Impact Development Design Project (557550)**

*Hunt, W.,*  
NCSU - WRRI  
09/01/13 - 09/30/14  
$37,667

Two blocks of Person Street, between Cool Springs Road and the Cross Creek Bridge, will be redeveloped as a streetscape project. Low impact development (LID) technologies will be incorporated as part of the re-construction. These technologies include, but are not limited to, permeable pavement systems, right-of-way bioretention, and suspended pavement tree filtration systems. The City of Fayetteville has asked NCSU’s BAE Stormwater Engineering Group to design and oversee the construction of the LID portion of the project. These monitoring efforts include hydrologic and water quality data collection from the inflow and outflow of a number of the LID practices comprising the green street.

**Task Order #4 - Pollutant Loading Characterization of Gross Solids, Uran Litter and Sediment in Stormwater Control Measures in North Carolina**

*Hunt, W., A. Anderson*
AbTech Industries, Inc.
8/1/13 - 07/31/15
$84,045

AEWS Engineering, with input from North Carolina State University and WRRI communities of North Carolina, will select up to three proprietary drain insert technologies designed to remove gross solids to retrofit into up to six existing catch basins in one WRRI North Carolina municipality (probably Durham) starting in August of 2013. The catch basin inserts may vary widely in method of treatment and placement in the catch basin. Each technology type will have two replicates, each with two common, but varying, land use types to be determined. Gross solids will be collected after each storm event both at the device and post-device.

**Assessment of Thermal Pollution Associated with Riparian Canopy Clearing: Part II**
Water temperature is an important component of habitat for many aquatic organisms. The temperature of stream discharge has been shown to increase significantly in some cases when the riparian tree canopy is removed. The magnitude of the temperature increase is a function of many factors including length of reach with no canopy, discharge, stream width/depth ratio, and stream gradient/velocity. This project is a continuation of RP 2011-14 which was designed to monitor stream temperatures at 10 sites (5 intensive monitoring and 5 less intensive).

NRCS Access to NCSU DRAINMOD Training Materials
Skaggs, R.; G. Chescheir
USDA- NRCS
9/1/13 - 6/30/15
DRAINMOD is a computer simulation model developed by Dr. Wayne Skaggs and colleagues at the Department of BAE, NCSU, Raleigh, NC. DRAINMOD predicts effects of drainage and associated water management practices on water table depths, soil water regime, crop yields, transport and fate of nitrogen, salinity, drainage effects on adjacent wetlands and hydraulic capacity of systems using wastewater land treatment. DRAINMOD can be used to simulate the performance of drainage water management (DWM) systems. Instructional materials for the application of DRAINMOD have been developed at NCSU and are used in advanced courses on drainage and water management.

Eden Area Watershed Modeling Project
Burchell, M.; J. Blackwell, K. Bass
Clean Water Management Trust Fund
5/1/13 -11/30/14
$28,000.
The Piedmont Triad Regional Council (PTRC) is working on watershed planning effort in and around the City of Eden, NC. The planning effort is entering advanced stages, and the project team is utilizing stakeholder input to further identify and develop water quality and conservation projects throughout the watershed. NCSU Biological and Agricultural Engineering will work with the PTRC to utilize existing watershed information to identify and prioritize potential projects for the plan to, foremost, reduce loadings of sediment and fecal material to local receiving waters. Our staff expertise on practices, costs, and feasibility will provide valuable additions to the on-going planning efforts.

Water Quality Benefits Associated with Retrofitting Swales with Check Dams and Pathogen Reduction by a Bioswale
Hunt, W.; R. Winston
NC DOT
8/16/13 - 8/15/15
$197,547
This research project is actually two sets of studies that may improve swale performance: (1) check dams and (2) bioswales. Check dams, structures placed perpendicular to flow to retain water in a swale, are a simple retrofit that could be used in existing roadside swales across North Carolina. Little previous research or design specifications are available, and therefore research is justified to quantify their water quality and hydrologic benefits. Check dams decrease flow velocity, and thus should provide greater treatment for sediment-bound pollutants.

Develop Sampling Protocols to Detect Aflatoxin in Maize and Groundnuts in the Food/Feed Supply Chain for Regional Trade in Africa
Whitaker, T., A. Slate
USDA
6/10/13 -9/30/16
$380,754.
Objectives: Specific objectives defined by the participants of the Nairobi, Kenya meeting included: 1. Initiate the drafting of a commodity sampling protocol for small lots. 2. Better understand the African situation and things to consider when developing the sampling protocol. 3. Better understand the science and statistics behind the development of sampling protocols. 4. Identify, review and evaluate current analytical methods with the objective of establishing a
common set of analytical methods to be used within Africa. 5. Develop an action plan over the next two years to develop and adopt a harmonized sampling protocol and to establish common aflatoxin testing methods.

Evaluating Cotton Field Soil Health Improvements by Cover Crops

Veal, M
Cotton, Inc.
1/1/13-12/31/13
$30,000.
Objectives 1) Quantification of soil compaction associated with mechanized cotton operations across a range of soil types 2) Evaluation of multi-species cover crops to improve soil health. 3) Demonstrate and evaluate methods of cover crop management 4) Identify marketing opportunities for winter cover crops 5) Develop economic models to discuss the impact of cover crop plantings on cotton operations

GOALI/Collaborative Research: Additive Manufacturing for a Highly Efficient Artificial Photosynthesis Device with Multi-layer Interconnected Channels and Micro-Porous Structures

Yuan, W.
NSF
6/15/13 - 05/31/16
$125,000
The main objective of this research is to fabricate an artificial photosynthesis device that is capable of converting sunlight, CO2 and water into sugars/glucose for the production of biofuels. Additive manufacturing (AM) enhanced by high-resolution heterogeneous material printing technology and multi-function nozzle array will be investigated to design and build the innovative device with multi-layer interconnected channels and micro-porous structures. This research will enable manufacturing and deployment of large-scale solar conversion systems that not only mimic the nature process of photosynthesis for the production of biofuels, but also make these reactions independent of the life of nature plants.

Intensive Monitoring of Nutrient and Material Load in Claridge Nursery Stream "The Canal" Pre-, During and Post Construction of Highway 70 Bypass in Wayne County, NC

Birgand, F.
NCDOT
5/16/13 - 4/15/16
$367,544
This project proposes to monitor both the hydrology and water quality on a continuous basis using state-of-the-art flow and water quality equipment to dramatically increase information on and decrease uncertainty in estimating nutrient and mass loads. Experience acquired by our team using the new water quality probes and the technical solutions found to overcome signal fouling are key to the project. Three years of monitoring for pre- and during construction of Highway 70 Bypass and canal restorations will be used to document in details the effects of such practices. Documenting the post-construction/restoration recovery is envisaged but will be part of a future effort.

A Mesocosm Study to Determine Nitrogen Assimilation Capacity of a Restored Wetland Slated to Receive Pumped Drainage Water - a Critical Component to Maximize

Burchell, M., S. Broome, F. Birgand
NCSU - WRRI
3/1/13 - 2/28/14
$29,914
Major objectives include: 1. Utilize mesocosm-scale wetlands with restoration site soils to determine the nutrient assimilation potential. 2. Determine ideal volumes of water and loads of nutrients that can be diverted away from the Pamlico Sound and into the restored wetlands. 3. Increase stakeholder confidence in wetland restoration projects through more rigorous experimentation, and document challenges faced and changes in attitude to improve partnerships in future large-scale restoration/water quality projects.

Demonstration and Evaluation of Effective Drainage Water

Youssef, M., G. Chescheir, R. Skaggs, T. Appelboom, C. Poole
The goal of this project is to demonstrate and evaluate the effectiveness of drainage water management for conserving water, increasing crop yields, and improving water quality. Specific objectives include:
1. Installing automated drainage water control structures on up to five sites in Eastern North Carolina.
2. Investigating the effects of drainage water management on crop yield, drainage outflow and drainage water quality.
3. Providing guidance to producers who are using the automated drainage control structures.

Bioretention Testing with AbTech Amendment and Extension/Outreach at Ft. Bragg, NC

Hunt, W., A. Anderson
AbTech Industries, Inc.
11/1/12 - 08/31/14
$141,946.

Bioretention Cells will be designed and monitored at Ft. Bragg. They will be amended with a media specially formulated to sorb metals. Outreach workshops will be conducted and an extension document will be produced for military personnel and others.

Wetland Restoration At Great Dismal Swamp State Park

Burchell, M., J. Blackwell, K. Hall, K. Bass
NC DENR
1/1/13 - 10/31/15
$31,285.

The project is a joint effort that will contribute to a larger wetland restoration and research efforts that are on-going in the Great Dismal Swamp area in NC and Virginia. The NCSU Department of Biological and Agricultural Engineering is uniquely suited to assist with the data collection and design services needed to support this project. The project will supplement our on-going research program in the area of wetland and peatland restoration for water quality improvement and provide a platform for extended cooperation between state and federal agencies. NCSU BAE is providing this proposal to assist Parks and Recreation in developing their wetland restoration activities at the Park.

Stormwater Best Management Practices in the Robeson Creek Watershed

NC DENR
1/1/13 - 12/31/15
$267,172

This project will implement stormwater BMPs recommended by both the 2003 TMDL implementation plan and the 2010 Robeson Creek Watershed Restoration Plan to help meet goals of reducing peak stormwater flows, Total Phosphorus (TP), Total Nitrogen (TN), total suspended solids (TSS), and improve and maintain aquatic habitat. Focus will be primarily on the Little Creek subwatershed. A stormwater wetland, a bioretention area, buffer plantings, and cisterns will be installed along a critical continuous segment of Little Creek tributary 1A that captures stormwater from urban development and a large parking lot in Pittsboro.

Evaluating the Hydrologic and Water Quality Performance of Infiltrating Wet Ponds and Development of Supplemental Infiltrating Pond Design Guidance, WRRI/UWC/SWG Enhancement Project

Fayetteville, NC

Hunt, W., R. Winston
NCSU WRRI Storm Water Management Group
12/1/12 -12/31/14
$122,849

The purpose of this proposal is to monitor a pair of wet ponds in Fayetteville, one which infiltrates and another that has limited infiltration. After the monitoring period, a supplemental design guidance will also be produced so that infiltrating ponds do meet multiple objectives including: hydrology, water quality, aesthetic/vegetation, and mosquito control.
On-Farm Biomass Processing Towards an Integrated High Solids Transporting/Storing/Processing System  
*Chinn, M, M. Veal, J. Bruno-Barcena*  
USDA  
7/1/12 - 6/30/15  
$807,479  
Integration of biomass feedstock production, storage and conversion of on-farm has potential to minimize costs associated with the generation of biofuels. Crop cultivation, harvest, transporation and storage practices will be investigated for several grass species for suitablity of use in on-farm microbial conversion systems. Use of biomass residues from anaerobic solid state fermentation processing in gasification will be examined and functional use of produced syngas in the microbial conversion process will be determined.

**Statement of Interest and Qualifications For Hydrologic and Thermal Monitoring of Stormwater Best Management Practices**  
*Hunt, W., R. Winston*  
NOAA  
07/01/12 - 07/31/14  
$158,903  
NCSU proposes to partner with Biohabitats, Inc. to monitor 6 stormwater BMPs in NE Ohio (Cleveland area). Monitoring will occur from July 2012 through July 2014 during spring, summer, and early fall months. Monitoring will include by hydrologic and thermal. At the conclusion of the monitoring project, NCSU and Biohabitats will conduct a workshop in the Cleveland area. NCSU proposes to partner with Biohabitats, Inc. to monitor 6 stormwater BMPs in NE Ohio (Cleveland area). Monitoring will include by hydrologic and thermal. At the conclusion of the monitoring project, NCSU and Biohabitats will conduct a workshop in the Cleveland area.

**Southeastern U.S. Regional Targeted Watershed Initiative**  
*Hunt, W., R. Winston*  
EPA  
05/01/12 - 09/30/14  
$36,000  
A permeable pavement lot will be constructed on extremely clayey Triassic Basin soils in Durham, NC. This is believed to be the first permeable pavement device monitored in such a tight underlying soil condition in the Southeast. Data from the lot will support a modeling effort to create an easy-to-use predictive model for permeable pavement performance that will be used throughout North Carolina, per NCDENR approval. Due to existing development stormwater retrofit requirements in the Haw Watershed, and limited space in urban areas of that watershed, this project has the potential to result in widespread use of a practice that would consequently reduce runoff volumes and nutrient loads in the Haw Basin and statewide.

**Pre-Construction Monitoring of an Existing Hydrologic Reference Condition in Raleigh, NC**  
*Hunt, W.*  
Lifetime Fitness  
09/01/12 -03/15/14  
$28,901  
Lifetime Fitness plans to develop an existing driving range in Northeast Raleigh into a Personal Fitness Center. Before construction commences, and during the permit process, LTF would like to establish the site’s existing hydrology and pollutant load. NCSU-BAE proposes to collect hydrologic and water quality data from the driving range immediately before flow exits the property. Data collected during this phase will be compared to a later monitoring project that will commence after the LTF facility is constructed. NCSU faculty and staff will participate in up to 8 public meetings to discuss the project as part of public service/outreach.

**Development, Evaluation, and Demonstration of Simple Tools for Nitrogen Credit Trading System Involving Drainage Water Management**  
*Youssef, M.; Skaggs, R, Chescheir, G., Evans, R., Burchell, M.*  
USDA
Specific objectives include: a) Develop an easy to use and reliable DRAINMOD-based tool to quantify the reduction of annual N mass losses due to the implementation of DWM. This tool can be utilized by the Midwest and Southeast states as part of a water quality credit trading system involving DWM. b) Test the accuracy of the tool by comparing DWM-caused reductions of annual N mass loss estimated by the developed tool to measured and/or DRAINMOD-NII predicted losses for Indiana, Illinois, Minnesota, Iowa, Ohio, and North Carolina. c) Develop a website for the tool which includes educational material on DWM, instructional material on how to use the tool, and utilities for preparing the required inputs.

**Arundo Donax Response to Nitrogen**

*Veal, M.*

Biofuels Center of NC

06/29/12 - 07/03/13

$568,601

This project seeks to fund an assessment of the rate of nitrogen application on Arundo donax to determine the optimum agronomic yield and economic return. The project will establish at least two sites to evaluate the response of Arundo donax to various rates of nitrogen ranging from zero to 600 pounds per acre in 60-pound increments. Plots will be designed to compare a split-harvest scenario (summer and pre-senescence) to a single harvest at pre-senescence. A plot on Williamsdale Biofuels Farm will represent the soils in the southern Coastal Plain. A plot on the North Carolina's Biofuels Campus will represent Upper Piedmont soils.

**Value-Added Utilization of Biochar in Syngas Cleanup and Conditioning** *Yuan, W.*

USDA

01/01/12 - 10/31/13

$38,360

The goal of this project is to improve the economic and environmental sustainability of biomass gasification through value-added utilization of biochar byproduct and effective syngas cleanup and enhancement. The novelty of the proposed work lies in two aspects: (1) it develops an inexpensive catalyst for effective syngas cleanup and conditioning and (2) it provides a value-added use of gasification by-product.

**Ammonia Recovery from Swine Urine Liquid with Selective Membrane Technology** *Classen, J., J. Rice, P. Kolar, K. Zering, C. Williams*

USDA - NRCS

09/20/12 - 08/31/15

$293,151

This project will demonstrate this gas permeable ammonia-selective membrane system in three different manure collection systems: the NCSU under floor belt system (current CIG demonstration under NRCS Agreement #69-3A75-10-165), an under floor scraper system, and a mesophilic anaerobic digester. The purpose of the project is to remove at least 50% of the ammonia nitrogen in a concentrated form that can be economically moved off the farm and managed as a valuable resource. The project plan is to develop a modular mobile membrane ammonia recovery system with appropriate tanks, pumps and supplies; this mobile system will be moved to each of three sites where effluent will be stored in an on-site tank.

**Effects of Biofuel Planting, Growth and Harvesting on the Hydrology and Water Quality of Pine Plantations** *Chescheir, G., F. Birgand, M. Youssef, R. Skaggs*

Weyerhaeuser NR Company

04/19/12 - 12/31/15

$780,000

The overall objective of this project is to evaluate the environmental effects of large-scale forest bioenergy crop production and utilize these results to optimize cropping systems in a manner that protects the important ecosystem services provided by forests while contributing to the development of a sustainable and economically-viable biomass industry in the southeastern U.S. This project consists of plot-scale and watershed-scale experimental studies linked with a modeling effort that will enable us to apply our experimental results broadly across the region.
Automated Water Control Structures for Increased Soybean Yield and Quality
Youssef, M., C. Crozier, R. Skaggs, G. Chescheir, T. Appelboom, C. Poole
NC Soybean Producers Association, Inc.
04/01/12 - 03/31/15
$67,111
Specific objectives are: 1) Develop a functional cost effective automatic water control system that can be retrofitted to existing riser systems designed to enhance soybean yield and improve water quality; 2) Promote plant health and increase soybean quality; 3) Document the yield and water conservation benefits of the practice; 4) Reduce irrigation expenses by managing soil water stresses; 5) Demonstrate the use of the automated water control system to producers; 6) Develop a cost-benefit analysis on the feasibility of the system.

Evaluation of Stream Crossing Culverts to Assess Impacts on Stream Morphology and Aquatic Passage-Part II
Line, D., J. Spooner, M. Shaffer, G. Jennings, J. Blackwell
NC DOT
08/16/12 - 08/15/13
$32,122
This project will document whether this instability has occurred at 11 culverts encompassing a variety of topographic and hydraulic conditions, stream channel variations, and locations. Documentation will include longitudinal and cross sectional surveys of the stream channels upstream and downstream of the culverts, which will be compared to similar surveys conducted in 2005. If the survey and geomorphic data show the stream channel has not changed significantly, then it will be considered stable. Rainfall and land use data for the period between assessments will be obtained to document changes that could have caused stream instability.

Beneficial Reuse of Diamond Grinding Slurry Wastewater
NC DOT
08/16/12 - 08/15/14
$99,600
This project will evaluate methods to collect representative samples of slurry. Then collect and analyze (list of analytes required by permit) samples of wastewater slurry from at least 3 sites. Possible methods of field treating the slurry to meet permit requirements will be investigated. Soil will be gathered for 3 potential land applications sites. Diamond grinding slurry will be collected and applied to the soil in a controlled environment where common vegetation species will be grown on the soil. Changes in soil properties will be documented along with the health of the vegetation.

CAREER: Multi-Scale Structured Solid Carriers Enabling Algae Biofuel Manufacturing in the Ocean
Yuan, W.
NSF
06/01/12 - 06/30/15
$14,830
The long-term career goal of the PI is to enable economically viable energy manufacturing from renewable sources such as algae. The PI's vision is to produce algae, for biofuel manufacturing, on solid carriers (e.g., thin sheets of metals or polymers) that float in the ocean. The research objective of this CAREER proposal is to test the hypothesis that micro- and meso-scale structures of solid carriers enhance attachment of algae. Such structures (e.g., dimples or channels) will be fabricated on the surface of the carrier.

CAREER: Multi-Scale Structured Solid Carriers Enabling Algae Biofuel Manufacturing in the Ocean
Yuan, W.
NSF
06/1/12 - 06/30/15
$315,040
The research objective of this CAREER proposal is to test the hypothesis that micro- and meso-scale structures of solid carriers enhance attachment of algae. Such structures (e.g., dimples or channels) will be fabricated on the surface of the
carrier. Knowledge obtained from this research will foster design and manufacturing of solid carriers / the major
equipment proposed for manufacturing algae biofuels in the ocean. The approach includes (1) experimental study of cell
attachment to structured carriers, (2) physics-based modeling of cell-carrier interactions, and (3) prediction of the effect
of carrier structures on algae attachment using the surface element integration (SEI) technique.

EAGER/Collaborative Research: Solid Freeform Fabrication of a Conceptual Artificial Photosynthesis
Device
Yuan, W.
NSF
01/01/12 - 07/31/13
$90,615
The main objective of this research is to fabricate an artificial photosynthesis device that is capable of converting
sunlight, CO2 and water into sugars for the production of biofuels. Solid freeform fabrication (SFF) enhanced by high-
resolution heterogeneous printing technology will be investigated to design and build the innovative device with multi-
layer interconnected channels and micro-porous structures. This research will enable manufacturing and deployment of
large-scale solar conversion systems that not only mimic the nature process of photosynthesis for the production of
biofuels, but also make these reactions independent of the life of nature plants.

A Smart Water Management System to Increase Crop Yields and Profits, Conserve Water, and
Improve Water Quality for Crop Production Systems on Artificially Drained Lands
Youssef, M.; Chescheir, G.; Skaggs, R.; Appelboom, T.
USDA
04/01/12 - 03/31/16
$480,000
We propose to develop and assess a "smart" water management system to increase crop yields and profits, conserve
water, and improve water quality for crop production systems on artificially drained lands. The system is comprised of:
1) a "smart" irrigation technique that is automatically triggered based on the soil moisture in the root zone or the water
table depth; 2) an automated controlled drainage system that automatically adjust the elevation of the outlet of the
drainage system based on water table depth and precipitation. There will be three treatments: conventional (unmanaged)
drainage as control, manual (traditional) controlled drainage, and smart water management system (automated controlled
drainage combined with smart irrigation).

Downspout Disconnection & Rain Catchers Assistance, WRRISWG Enhancement Project Hunt, W.;
Anderson, A.
WRRI
04/15/12 - 04/30/14
$83,554
To evaluate the benefits of disconnecting downspouts and to properly credit them for runoff reduction, four properties in
Durham are proposed to be used as study locations. At each property, 2 to 3 downspouts will be disconnected, the
surrounding soil investigated for compaction and infiltration rate, and 2 to 3 lengths of disconnection will be tested. The
distances expected to be examined will be approximately 5t,15, and/or 25 ft, and are meant to reflect potential retrofit
lengths available. After 9 months of evaluation, the soil associated with one-half of the examined disconnections will be
amended with compost to improve their infiltration rate. Expected amendment depth is 4 inches.

Environmental sample collection on research extension station tomato farms located In North Carolina
Simmons, O.; Jaykus, L.; Gunter, C.
Lifesource Biomedical
06/01/12 - 10/31/14
$236,335
The purpose of this research will be to conduct a three-year environmental surveillance of the North Carolinian tomato
production environment. Recent outbreaks of Salmonella associated with tomatoes grown along the East Coast have
underscored the need for more detailed source tracking of naturally-occurring Salmonella strains isolated from numerous
distinct ecological niches along the East Coast. Approximately 5 billion pounds of fresh-market tomatoes are consumed
annually in the United States, thus the potential for large outbreaks of Salmonella infections is a concern.
Heating Poultry Structures with Crop Residues
Veal, M;
USDA
09/15/2011 - 09/30/13
$75,000
Biomass heating is a popular idea in many farm communities as the price for traditional non-renewable energy resources continue to rise. Common sources of biomass for heating, including wood chips or pellets, can be cost prohibitive as a result of excessive labor or procurement costs. This study will demonstrate the use of round bales of crop residues as a means to heat a poultry structure. Round bales are readily available, have low production and storage costs, and contain nearly 3.5 million BTU’s of energy potential.

Catalytic Oxidation of Lignin Into Value-Added Aromatics - CBERD Core Project
Kolar, P.; Sharma, R.
CBERD - NCSU Research Site
01/01/12 - 12/31/13
$27,000
Considering the unique structure and chemistry of lignin, there is a great potential for catalytically oxidizing lignin into fine chemicals such as vanillin, p-hydroxybenzaldehydes, etc. In this project, we propose to synthesize and test activated carbon (surface areas > 1000 m²/g) supported metal oxides and noble metal catalysts for partial oxidation of switchgrass lignin. We propose to: 1. Synthesize (a) activated carbon supported nickel and cobalt oxides by electrochemical deposition and (b) activated carbon supported platinum and palladium catalysts by wet impregnation. 2. Test the activity of noble and metal oxide catalysts for oxidation of switchgrass lignin into vanillin, syringaldehyde, and p-hydroxybenzaldehydes.

Monitoring of BioPave® & Filterra® Stormwater Systems in Fayetteville, NC
Hunt, W.; Anderson, A.
Filterra Bioretention Systems
3/1/12 - 12/31/13
$122,248
The proposed BMP system is a treatment train consisting of a permeable paver (Biopave) section of the train station parking lot, a Filterra bioretention unit, and a third proprietary Filterra stormwater treatment system. At a separate location in the parking lot, a standard Filterra bioretention unit will be installed, which will receive runoff from 100% impermeable pavement. At this time, it is expected that the Biopave / Filterra treatment system will be located in the northeast corner of the lot. The stand-alone Filterra unit is expected to be installed near the southern entrance to the lot, a location with high visibility.

Automated Water Control Structures For Increased Water Use Efficiency on Agricultural Drained Lands
Youssef, M., R. Skaggs, G. Chescheir, T. Appelboom, Chad Poole
USDA
09/15/11 - 09/30/13
$74,974
This project will demonstrate an effective automated method for controlling flashboard riser systems that will significantly reduce producer management. It will have significant water conservation benefits, water quality benefits and may have crop yield impacts. It will also have a significant impact on the mandated reductions for nitrogen in the river basins.

Retrofitting a Naturally - Ventilated Hog Finishing Barn with a Geothermal Zone-Cooling System (554774)
Shah, S., VanHeugten, E., Currin, R.
NC Pork Council
1/1/12 - 09/30/13
$24,972.
The overall objective is to evaluate the economic and technical feasibilities of using a liquid-to-air geothermal zone-cooling system in a naturally-ventilated pig finishing barn in Raleigh, NC. A 5-ton (60,000 Btu/hr) geothermal zone-cooling system to provide 2,500 cfm of cooled air to 100 finisher pigs housed in a row of 20 pens will be built at NCSU’s Swine Education Unit and monitored over 8 months (summer and winter). Comparison of temperature and pig performance will be made relative to 100 pigs in an adjacent row of 20 pens without geothermal zone-cooling. Performance of the geothermal zone-cooling system will be analyzed for scaling up to a commercial size and to determine the economics of such a system.

Chescheir, G.
US Dept of Energy
06/13/11 - 9/30/14
$27,500
The overall objective of this Project is to evaluate the environmental effects of large-scale forest bioenergy crop production and utilize these results to optimize cropping systems in a manner that protects the important ecosystem services provided by forests while contributing to the development of a sustainable and economically-viable biomass industry in the southeastern U.S.

N C Sweet Potato Sustainability Initiative
Boyette, M.
NC Tobacco Trust Fund Commission
11/30/11 - 9/1/13
$51,300
In order for the North Carolina sweet potato industry to grow and maintain its edge, the aim of this proposed work is to provide engineering services detailing the possible upgrades to each owner/operator who voluntarily requests it. This will be done by the faculty and engineers of Department of Biological and Agricultural Engineering at North Carolina State University and with the cooperation of the North Carolina Cooperative Extension Service and the North Carolina Sweet Potato Commission. All findings and recommendations will remain confidential with the owner/operator concerned but certain accumulated gross data may be published. Owner/operators will be encouraged to participate through Cooperative Extension newsletters and announcements at grower meetings and other industry functions.

Field Monitoring of Silva Cell Installation
Hunt, W., R. Winston
DeepRoot
11/1/11 - 7/31/13
$42,653
Street-side permeable pavement will be installed. These permeable pavement installations will be underlain by washed gravel layers to a total depth of 12 inches. Underneath the gravel, two Silva Cell decks will be employed both to structurally support the pavement and to allow for the addition of soil media mix. Two different soil media mixes will be specified by DeepRoot, one for each of the permeable pavement/Silva Cell systems. One mix will be similar to the State of NC's bioretention media mix. The NCSU stormwater group will also rely on DeepRoot engineers to aid in design of the permeable pavement/Silva Cell system, and will require their review of the designs.

On-Farm Biomass Processing Towards as Integrated High Solids Transporting/Storing/Processing System
Chinn, M., M. Veal
University of Kentucky
07/01/11 - 06/30/15
$130,617
Integration of biomass feedstock production, storage and conversion of on-farm has potential to minimize costs associated with the generation of biofuels. Crop cultivation, harvest, transporation and storage practices will be investigated for several grass species for suitability of use in on-farm microbial conversion systems. Use of biomass residues from anaerobic solid state fermentation processing in gasification will be examined and functional use of
produced syngas in the microbial conversion process will be determined.

**Carbon Sequestration and Greenhouse Gas Emissions in Restored Salt Marshes**
*Burchell, M.; F. Birgand; S. Broome*
US Geological Survey
08/01/11 - 01/31/14
$60,000
Along with the USGS Ecosystems Program and USGS LandCarbon project team we have developed a succinct, three-year study plan aimed at understanding two primary targets identified as knowledge gaps: 1) the role of salinity in determining greenhouse gas losses in restored salt marshes; and 2) how the balance of greenhouse gas losses change with age following salt marsh restoration. This research will present a good empirical assessment for informing and validating national models of greenhouse gas emissions from restored salt marshes, and for helping to test whether current assumptions of carbon sequestration models are valid along salinity, vegetation, and age trajectories.

**Sorghum Biofuels: A Route to Commercialization in North Carolina**
*Chinn, M.; Veal, M.; Heiniger, R.; Bruno-Barcena, J.*
Biofuels Center of North Carolina
06/24/11 - 09/30/13
$149,488
Specific objectives will be to:
1) Assess the effectiveness and cost associated with several harvest and transportation strategies to deliver stable sorghum materials to the biorefinery;
2) Conduct industrial-scale production trials using locally produced sorghum to supply sugars for fermentation (~1000 gallon tanks) and biomass for distillation energy.
3) Complete economics and model development for field and biorefinery operations
4) Further examine our knowledge of C. beijerinckii SA-1/ATCC 35702 to produce butanol and ethanol on various mono, oligo and polysaccharides through use of sorghum juice.

**Market @ Colonnade Field Monitoring Research Project** *Hunt, W.; Debusk, K.*
Clean Water Management Trust Fund
06/15/11 - 8/31/13
$103,330
The project site is in the Piedmont Region and drains to Mine Creek, a tributary of Crabtree Creek, and then flows into the Neuse River. Two aspects of the project will be monitored: (1) the performance of the rainwater harvesting system coupled with the infiltration network and (2) comparison of this commercial site to a nearby commercial location with a conventional stormwater treatment system. The research will be conducted by a team of BAE faculty, staff, and a graduate student. NCSU is subcontracting to the City of Raleigh on this Clean Water Management Trust Fund project.

**Water Use Efficiency of Soil-Water-Sensor-Controlled Irrigation with a Subsurface Drip Irrigation System Contrasted with Center Pivot Irrigation in a Corn-Wheat-Soybean Crop Pivot**
*Grabow, G., R. Huffman*
NC Soybean Producers Association, Inc.
03/01/2011 - 02/28/2014
$50,771
The objectives of the research are to:
1. Compare crop yields in the two irrigation systems (SDI and pivot)
2. Compare applied water and irrigation water use efficiencies of the two irrigation systems
3. Implement and evaluate sensor-controlled irrigation in an SDI system
4. Compare sensor-controlled scheduling to typical scheduling in terms of applied water and crop yield in an SDI irrigation system.
5. Measure soil-water distribution from SDI driplines in a sandy loam soil to infer potential alternative dripline spacings.

**Optimization of Southeastern Forest Biomass Crop Production: A Watershed Scale Evaluation of the Sustainability and Productivity of Dedicated Energy Crop and Woody Biomass Operations**
The overall objective of this Project is to evaluate the environmental effects of large-scale forest bioenergy crop production and utilize these results to optimize cropping systems in a manner that protects the important ecosystem services provided by forests while contributing to the development of a sustainable and economically-viable biomass industry in the southeastern U.S..

**Design and Implementation of an Innovative Integrated Water management system in Hyde County, NC: Phase I**

*Burchell, M. G. Chescheir, K. Bass, M. Youssef, Fr. Birgand, R. Evans*

North Carolina Coastal Federation

02/01/2011 - 1/31/14

$108,934.

This plan will significantly reduce pumped agricultural drainage water to the Pamlico Sound, and reroute this water through historical drainage paths that will enhance the hydrology and habitat on approximately 4,200 acres of forested wetland that have been drained (it is believed that this area formed a natural drainage way flowing northwest in the direction of the Alligator River). If this project is successful, it could signal a pivotal change in scale and acceptance of these types of projects, because our planning thus far appears to have minimized required socio-economic trade-offs between stakeholders.

**Assessment of Hydrodemolition Run-off Water Treatment Options**

*Line, D., T. Smyth, J. Spooner, J. Blackwell*

NC Department of Transportation

08/16/11 - 08/15/14

$71,880

This project will investigate the possibilities of using the wastewater in the concrete recycling industry and applying it to land in NC DOT right-of-ways. Potential use in the concrete recycling industry will be assessed by characterizing the HRW and interviewing industry personnel. Land application in NC DOT right-of-ways will be assessed by a combination of small scale greenhouse studies and field site evaluations including soil, vegetation, and topography measurements. These data will then be used to develop a protocol for NC DOT to determine when and how much HRW can be safely applied to a section of highway right-of-way.

**Production of Potential Bioenergy Crops on Swine Effluent Sprayfields in North Carolina**

*Gehl, R., M. Chinn, M. Veal*

Biofuels Center of North Carolina

03/01/11 - 02/29/16

$98,092

The primary objectives of this study are to 1) determine the yield potential and nutrient removal of potential biofuel crops in a Coastal Plain sprayfield environment, 2) establish harvest management schemes associated with the bioenergy production within sprayfields, 3) determine storage parameters for green baled, field cured, and post frost perennial grasses and sorghums harvested from sprayfield environments, and 4) assess plant composition analysis throughout the growing season to determine crop energy potential for various conversion platforms.

**North Mecklenburg Park Stormwater Retrofit and Stream Restoration**

*Hunt, W., G. Jennings*

NCDENR

03/15/2011 - 06/30/13

$48,741

The purpose is to improve ecosystem health and water quality by restoring natural stream functions and managing stormwater runoff in the Park. The project will not only address significant sources of pollution in the McDowell Creek Watershed, but also act as an environmental educational site for the citizens of the region. Similarly, the project will provide an example of maintenance and upkeep practices for retrofit BMPs and stream restoration as well as devices.
installed as a result of the Huntersville LID Ordinance.

**CWMTF Stream Restoration Performance Assessment, 2011-2012**  
Jennings, G., B. Doll  
NC DENR  
04/01/2011 - 09/30/013  
$100,000  
NC State University developed a rapid stream assessment protocol for CWMTF that includes both qualitative and quantitative sampling procedures of morphology, stream structure assessment, vegetation and macroinvertebrates. The assessment includes a scoring of each element assessed. The rapid assessment method was implemented on 29 stream restoration projects of varying ages and approaches in 2006 and 2008. The rapid assessment effort was intended to provide a snapshot of project compliance and water quality benefits in an attempt to provide CWMTF with a better understanding of the status and benefits of these type projects.

**Rainwater Harvesting Research and Demonstration In Craven County, NC**  
Hunt, W., Debusk, K., Peacock, C.  
Clean Water Management Trust Fund  
2/14/2011 - 07/31/2013  
$100,000  
In light of North Carolina's emphasis on mitigating the effects of stormwater runoff, and Craven County's efforts to promote conservation of potable water, it is important to evaluate how well available technologies can support this integration. This project will evaluate tradeoffs among several methods of incorporating stormwater management into RWH design and evaluate ways for optimizing the tradeoffs. It is anticipated that the conclusions drawn from this project will facilitate the use of RWH system for not only water conservation purposes but also for stormwater management throughout North Carolina.

**Robeson Creek BMP Monitoring**  
Hall, K., Line, D., Blackwell, J., Spooner, J.  
Environmental Protection Agency (EPA)  
01/01/2011 - 12/31/2013  
$169,386  
Since 2003, numerous BMPs have been installed throughout the watershed to improve water quality and remove the creek from the 303(d) list. Monitoring for water quality and aquatic habitat since the installation of BMPS has helped to determine effectiveness of BMPS. NCSU water quality data has shown trends of decreasing TP over time in the urban stream Little Creek as well as the most downstream monitoring station on the main stem of Robeson Creek. This project proposes to continue water quality monitoring and benthic macroinvertebrate monitoring in the Robeson Creek watershed to determine if pollution reduction measures such as BMPs are improving water quality over time.

**Heath Dairy Livestock Exclusion and Stream Restoration**  
Line, D., Jennings, G., Spooner, J.  
Environmental Protection Agency (EPA)  
01/01/2011 - 09/30/2013  
$49,685  
The purpose of this project is to reinstall the monitoring stations and conduct water quality monitoring upstream and downstream of the same stream reaches for 2 years following the restoration effort. These data will then be statistically compared to the pre-exclusion and restoration monitoring data that was previously collected to assess the effectiveness of the restoration effort. In addition, these data will be compared to monitoring data for a pasture where only livestock exclusion fencing (no stream restoration) was installed in an attempt to assess the additional benefits of stream channel restoration in combination with livestock exclusion.

**Manure Belt collection system and Energy Recovery System**  
Classen, J., Kolar P., Rice J., Simmons O., Liehr S., Zering K., Van Heugten E.  
USDA
Craig Family Farms, is building three new swine housing units at their Harnett County, NC site; the farm will produce gilts for Smithfield Foods. This site is currently permitted for a 624 sow, farrow to feed operation but has been vacant for almost 12 months. The owners plan to construct new houses suitable for gilt production and populate the farm with 2,100 gilts, a steady state live weight that is equivalent to the existing permit. Documentation will be developed of the project with photos and videos from groundbreaking through belt installation and startup to operation and maintenance.

**Peace College Rainwater Harvesting System**

*Hunt, W.*

Clean Water Management Trust Fund 12/10/09-03-31-14

$750,000

Peace College currently has on-going research of the biological integrity of Pigeon House Branch. The entire concept of the project is germinated from significant experience and application of the NCSU BAE Rain Harvest Model. When completed the project will provide for significant water quality improvements to a contributing sub watershed of Pigeon House Branch; an impaired stream on the States 303d list by reducing the volume of stormwater runoff from the Campus of Peace College by 50%. In addition the project will reduce nitrogen loading to the Neuse River Basin currently listed as nutrient sensitive water (NSW).

**Assessment of Thermal Pollution Associated with Riparian Canopy Clearing RP 2011-14**

*Line, D., Spooner, J.*

NCDOT 08/16/10 - 08/15/13

$88,000

This project is designed to monitor stream temperatures at 10 sites (5 intensive monitoring and 5 less intensive) that will include several combinations of the factors listed above. The intensive monitoring will include continuous measurement of stream temperature, stage, air temperature, and solar radiation and frequent measurements of discharge and stream velocity. Less intensive monitoring at 5 sites will include continuous measurement of temperature along with occasional measurement of velocity and discharge.

**CAREER: Fate and Transport of Aerosols from Animal Feeding Operations**

*Wang, L.*

*NSF* 02/01/10 - 01/31/2015

$403,172

The objectives of the proposed work are to (1) quantify the impact of particle size distribution (PSD) on the federal reference method (FRM) PM10 sampler's measurements such that it will lead to improvements of the FRM PM sampler measurements for broader applications; (2) characterize the spatial and temporal variations in the physical, chemical, and biological properties of aerosols emitted from AFO facilities such that it will result in improved understanding of the mechanism of generation, fate and transport of those aerosols; and (3) develop an interactive simulation model to predict the fate and transport of bioaerosols emitted from AFO facilities.

**Feedback Controlled-Drainage Subroutine Incorporated in DRAINMOD-N2 Model to Predict Nitrate Loss in Drainage Water**

*Skaggs, R., Youssef, M.*

*USDA* 04/01/10 - 03/31/2015

$25,000

This work will modify existing models (methods) for predicting impacts of drainage management (controlled drainage or subirrigation) to include scenarios for automatically controlling weir outlet elevations based on feedback from field water table measurements, rainfall, or both. The algorithms for automatic feedback control were developed by ARS scientist J.
Fouss. the models for predicting effects of drainage water management on hydrology and nitrogen loss in drainage water were developed at NCSU. This cooperative project will result in a model that will allow assessment of various control scenarios for improving the performance of drainage water management in the South, Southeast, and Midwest.

**Effects of Silvicultural Practices on Hydrology and Water Quality of Drained Forested Lands**  
*Skaggs, R., G. Chescheir*  
Weyerhaeuser NR Company  
$175,000  
10/1/2008-12/31/13

A forest hydrology and water management study was initiated at three experimental loblolly pine forests in early 1988 to quantify the potential impacts of both silvicultural and water management practices on hydrology and water quality. Loblolly’s planted in 1974 was 14 years old when the watersheds were instrumented in 1988. Continuous hydrologic monitoring on these watersheds has provided a database for quantifying the water and nutrient budgets and evaluating impacts of management practices using a paired watershed approach.

**Career: Fate and Transport of Aerosols from Animal Feeding operations**  
*Wang, L*  
National Science Foundation  
$403,172  
02/01/10 - 01/31/15

The objectives of the proposed work are to (1) quantify the impact of particle size distribution (PSD) on the federal reference method (FRM) PM10 sampler’s measurements such that it will lead to improvements of the FRM PM sampler measurements for broader applications; (2) characterize the spatial and temporal variations in the physical, chemical, and biological properties of aerosols emitted from AFO facilities such that it will result in improved understanding of the mechanism of generation, fate and transport of those aerosols; and (3) develop an interactive simulation model to predict the fate and transport of bioaerosols emitted from AFO facilities.

**Level Spreader - Vegetated Filter Strip Demonstration and Evaluation**  
*Hunt, W., Winston, R.*  
Clean Water Management Trust Fund  
$190,000  
11/25/09 - 09/30/2013

The upper coastal plain is considered one of the most likely places for potential widespread adoption of LS-VFS systems due to the variable water table conditions present. Four LS-VFS systems will be examined for at least one year and data from these studies will be used to validate an existing vegetated filter strip model (VFSMOD). If the model is found to successfully predict LS-VFS performance, it can be used as a design tool for the design and regulatory community.

*Youssef, M., Chescheir, G., Skaggs, R., Poole, C.*  
NCDENR  
$179,671  
01/01/2010 -09/30/2013

The first practice is controlled drainage (CD), a best management practice (BMP) that has been proven to be effective in reducing nutrient export from drained agricultural land to surface waters. It involves the use of a water control structure to raise the water level in the drainage outlet during periods when intensive drainage is unnecessary. The second practice involves the use of bio-reactors to treat drainage water. A bio-reactor is a
subsurface trench filled with a carbon source through which drainage water flows before it enters the receiving surface water body.

**Robeson Creek Water Quality Outreach Initiative**
*Hall, K., Spooner, J., Line, D., Perrin, C., Blackwell, J.*  
*USDA*
$s228,000$
*09/01/2009 - 08/31/2013*

Strengthen the Town of Pittsboro’s stormwater ordinances. 2. Work with youth in local school system and other programs including 4-H, boy scouts and girl scouts to implement a rain garden and use it as an on-going outdoor laboratory for educational programs on water quality. 3. Work with businesses in the watershed to develop a water quality leadership challenge program. 4. Increase water quality awareness through educational signs and programs developed around existing water quality projects throughout the watershed. 5. Evaluate changes in stakeholder attitudes about improving and protecting water quality as a result of Extension programs funded under this USDA NIWQP project and other projects throughout the watershed.

**EFRI-HyBi Preliminary Proposal: Algal Oils to ‘Drop-in' Replacements for Petroleum Transportation Fuels**
*Roberts W, Burkholder, Sederoff, Stikeleather, Lamb*  
*National Science Foundation*  
$55,961$
*8/1/09 - 7/31/13*

This NSF EFRI HyBi will develop the technical feasibility and demonstrate scalability of a unique, multi-step catalytic process to convert a wide range of fats/oils/lipids into replacement transportation fuels that are chemically and physically similar to their petroleum counterparts, thus dramatically reducing infrastructure complications. Algal oils are an ideal feedstock for biofuels production, offering very high production density and the ability to use marginal water (municipal waste, brackish water, etc) and reuse CO2 emitted from coal-fired power plants.

**Demonstrating Water Conservation in the community: Fire Station Rainwater Harvesting, WRRI Urban Water consortium Enhancement Project**
*Hunt, W*  
*WRRI*  
$115,256$
*06/01/09 - 01/31/14*

The purpose is to install rainwater harvesting systems at twelve different locations within the City of Raleigh. The objectives are. 1. Measure water volume within the cisterns to document the water use and in turn, water volume prevented from entering the stormwater system during rain events. 2. Measure nutrient concentrations from the rainwater harvesting systems to document the nutrient load removed from the storm drainage network. 3. Document that wash water either drains to a vegetated area, or a Best Management Practice, thus improving water quality of that runoff. 4. Document the potable water use before and after implementation of the rainwater harvesting systems to demonstrate any reduced water use.

**Optimizing Cultivation and Conversion Parameters for Efficient Sweet Sorghum Bioethanol**
*Veal, M, M. Chinn, L. Stikeleather*  
*Biofuels Center of North Carolina*  
$183,468$
*5/22/09 - 8/31/13*

Sweet sorghum is an attractive bioenergy crop because it requires less crop inputs than corn or soybeans, and the juice provides a source of aqueous sugar that is easier to convert into ethanol than starch or cellulose. The development of a sweet sorghum conversion industry would allow marginal lands in North Carolina to be placed in agricultural production
and create a bioenergy resource that is sustainable, does not compete with food or feed resources, and provides economic security for rural communities.

**Southern Regional Water Program**


USDA - Texas A & M

$710,428

9/01/2008 - 08/31/2013

The objectives of this project are to: 1. Provide leadership for capacity development and partnerships in North Carolina, the Southern Region, and nation to implement effective integrated water educational and research programs; 2. Provide co-leadership for the Watershed Education and Restoration Program Team in the Southern Region; 3. Provide co-leadership for the Nutrient Management Program Team in the Southern Region; 4. Represent the Southern Region on the CSREES Committee for Shared Leadership at the request of the National Program Leader for Water Resources.

**Simmons Street (New Bern, NC) Stormwater Wetland Design. Construction Supervision, and Monitoring**

*W. Hunt, K. Bass, C. Humphrey*

NC DENR

$384,209

05/01/2008 - 05/31/2015

A large stormwater wetland is to be designed and monitored for two years in New Bern, NC. In the submitters combined 20 years of experience, this is an outstanding project that would have a tremendous impact at a relatively low unit construction cost. This wetland, which would be the largest stormwater wetland in NC, would have a surface area of approximately 27 acres. The wetland would be located within 1 mile of the Neuse River and would be expected to have a direct impact on the estuay's health. It is a unique project that NCSU strongly believes should be constructed.

**Harvesting and Curing Mechanization for Modified Leaf Flue-Cured Tobacco**

*J. Young*

*Ag Foundation*

$67,367

Not listed in 2012/2013 -10 proposals less than $20,000 each which total $ 129,955.

(556412), $18,500, 01/01/13-12-31-13; (555955), $9332., 10/01/12 - 08/31/13; (556045), $17,000, 10/1/12 - 09/30/13; (556006), $10,982., 10/1/12 - 09/30/13; (556011), $10,282, 10/1/12 - 09/30/14; (556086), $16,000, 10/1/12-09/30/14; (555751), $19,814, 09/01/12 - 08/31/13; (556771), $10,250, 1/1/13 - 12/31/13, (556929), $17,795, 05/15/13 - 11/30/13,

Not listed in 2011/2012 - 1 proposals less than $20,000 each which total $_5,000_.

(554890), $5,000., 01/01/12 - 07/31/13;

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**CONTACT INFORMATION**

For more information about the BAE department and its research activities, visit this website:

http://www.bae.ncsu.edu/ or contact the head of the department: