

# **Grants Awarded Report**

**From:** 10/1/07 to 10/31/07

**Proposal No:** 2200708

**Principal Investigator:** Hayden Mattingly, Biology

**Co-PI's:** Daniel Combs, Biology

## **Support Personnel:**

**Project Title:** Distribution, Status and Species-Habitat Relationships of the Rare Barrens Darter, *Etheostoma forbesi*

**Activation Amount:** \$25,000.00

**Agency:** U. S. Fish and Wildlife Service

## **Abstract:**

The objectives of this project are to: 1) document the current distribution and abundance of the Barrens darter at most known historical collection localities and at additional localities within their potential range on the Barrens plateau; 2) measure stream habitat variables at all sites to identify variables significantly associated with Barrens darter presence or absence, and document land use patterns adjacent to sampled reaches for assessing potential threats to Barrens darter habitat; and 3) utilize land use data prepared by U. S. Fish and Wildlife Service, Cookeville Office, to evaluate relationship of land use at multiple scales with Barrens darter presence or absence.

**Proposal No:** 5200708

**Principal Investigator:** Sue Bailey, Human Ecology

**Co-PI's:** Betty Vaudt, Human Ecology

**Support Personnel:** Gayle Callis, Human Ecology

**Project Title:** Upper Cumberland Child Care Resource and Referral - Project REEL 2007-08

**Activation Amount:** \$23,000.00

**Agency:** Signal Centers of Chattanooga (via Department of Health and Human Services)

**Abstract:**

Project Resources for Early Educator Learning (Project REEL) is a state-wide initiative to support caregivers working in child care centers, family day care homes, and group day care homes. The project provides resources and education to promote learning and development among the children served in participating facilities. Project REEL Curriculum Specialists provide formal training and mentoring to child care providers, model proven and effective teaching strategies for participants, observe and evaluate participants for growth, and assist in establishing individual teaching plans for classroom improvement. Project REEL is a collaboration between the University of Tennessee at Chattanooga, Signal Centers, the Tennessee Child Care Resource and Referral Network, and Siskin Children's Institute.

**Proposal No:** 13200708

**Principal Investigator:** Dennis George, Water Center

**Co-PI's:**

**Support Personnel:**

**Project Title:** Center for Management, Utilization and Protection of Water Resources 2007-08

**Activation Amount:** \$54,300.00

**Agency:** State of Tennessee

**Abstract:**

**Proposal No:** 14200607

**Principal Investigator:** Jane Baker, Curriculum and Instruction

**Co-PI's:**

**Support Personnel:** Ayse Mitchell, Child Development Lab; Sloan Candice Bates, Child Development Lab

**Project Title:** Tennessee Early Childhood Education Pilot Program 2006-07

**Activation Amount:** \$79,158.00

**Agency:** Tennessee Department of Education

**Abstract:**

This grant serves children and families that are considered "at risk." It is designed to provide a safe, nurturing environment that meets all State mandated guidelines (DOE and DHS).

**Proposal No:** 16200405

**Principal Investigator:** Vincent Neary, Civil and Environmental Engineering

**Co-PI's:**

**Support Personnel:**

**Project Title:** Everglades Hydrodynamic Model Review

**Activation Amount:** \$43,204.00

**Agency:** U. S. Fish and Wildlife Service

**Abstract:**

The Arthur R. Marshall Loxahatchee National Wildlife Refuge includes one of three areas in South Florida designated to maintain water storage, provide flood control, and provide a refuge for the remnant Everglades ecosystem. In the 1950s and 1960s, the refuge was surrounded by perimeter and hydrologically isolated from its watershed by levees. Storm water runoff, primarily from the Everglades Agricultural Area, is pumped into the perimeter canal where it may flow to discharge structures or mix into the rainwater-dominated interior wetland. The refuge, through a contract with the University of Louisiana-Lafayette, is currently compiling information and planning development of a hydrodynamic and water quality model or models of the refuge. The current project will provide technical support for the modeling effort through independent technical review and recommendations for model selection.

**Proposal No:** 23200708

**Principal Investigator:** Robert Owens, II, Minority Affairs

**Co-PI's:**

**Support Personnel:** Elizabeth Ojo, Minority Affairs; Marc Burnett, Student Affairs

**Project Title:** Summer Bridge Program for Ethnic Minorities and the Economically Disadvantaged

**Activation Amount:** \$37,000.00

**Agency:** Tennessee Board of Regents

**Abstract:**

This program will address the disparity in graduation rates between freshmen originating from one of the educationally underserved/underrepresented areas served by TTU (Bledsoe, Campbell, Cannon, Clay, Cumberland, DeKalb, Fentress, Grundy, Hamilton, Jackson, Macon, Marion, McMinn, Meigs, Monroe, Morgan, Overton, Pickett, Rhea, Scott, Sequatchie, Smith, Trousdale, Van Buren, Warren, White) and the total population of freshmen at TTU. The goals of the program are: 1) provide students from underserved/underrepresented areas served by TTU with exposure to college in the summer before their freshman year and help them receive credit in two, three-hour college courses; and 2) develop and enhance learning skills in terms of critical thinking, problem solving, study habits. This project will be a four-week long summer bridge program designed for 20 pre-TTU freshmen students from underserved/underrepresented counties in the TTU service areas majoring in the STEM disciplines, more specifically, students planning to major in Life Sciences, Physical Sciences, and Mathematics or Pre-Professional programs such as Dental Hygiene, Dentistry, Medical Technology, Medicine, Occupational Therapy, Optometry, Pharmacy, and Physical Therapy. This program is designed to bridge the gap between high school and college and integrate students into campus life by equipping them with focused academic instruction, learning, and critical thinking skills. Program elements include Mathematics and Chemistry courses for-credit, full-scale freshman orientation program (TTU's SOAR program), group and individual tutoring sessions, college and life success seminars and workshops, focus group sessions, and academic and career counseling sessions.

**Proposal No:** 25200708

**Principal Investigator:** Marc Burnett, Student Affairs

**Co-PI's:**

**Support Personnel:** Robert Owens, II, Minority Affairs

**Project Title:** Professional Development Opportunities: Strategies for Attracting and Retaining Underrepresented Faculty and Staff

**Activation Amount:** \$18,750.00

**Agency:** Tennessee Board of Regents

**Abstract:**

To attract and retain greater numbers of students, faculty, and administrators from underrepresented groups and to enhance the rate and diversity of participation in higher education in Tennessee by providing opportunities for faculty/staff to engage in professional development endeavors, e.g., attend professional development meetings, work toward obtaining academic degrees or professional development certificates and developing an attractive brochure which enumerates the opportunities, services, and benefits available to underrepresented faculty and staff, e.g., assistance to trailing spouse, professional development opportunities, community services, etc.

**Proposal No:** 28200708

**Principal Investigator:** Janet Whiteaker, Academic Development

**Co-PI's:**

**Support Personnel:** Lydia Kendall, Academic Development

**Project Title:** Academic Development Learning Center (ADLC) Enhancement

**Activation Amount:** \$10,000.00

**Agency:** Tennessee Board of Regents

**Abstract:**

**Proposal No:** 37200607

**Principal Investigator:** James Layzer, Cooperative Fisheries Unit

**Co-PI's:**

**Support Personnel:**

**Project Title:** Research Directed at the Recovery of Endangered Mussels

**Activation Amount:** \$18,867.00

**Agency:** U. S. Geological Survey

**Abstract:**

The objectives of this study are:

1. Determine the current status of endangered mussels in the Green River from the Green River Dam (GRD) downstream through Mammoth Cave National Park;
2. Determine whether modifications made to the discharge regime from the GRD are enhancing mussel recruitment;
3. If deemed necessary, establish captive breeding populations of ringpinks, clubshells, and northern riffleshells mussels;
4. Determine various aspects of the life histories of endangered species present; and
5. As necessary, make recommendations to the U.S. Army Corps of Engineers, and the U.S. Fish and Wildlife Service regarding further modifications to the discharge regime of the GRD, and the need to propagate endangered mussels.

**Proposal No:** 45200506

**Principal Investigator:** Mona Wells, Chemistry

**Co-PI's:**

**Support Personnel:**

**Project Title:** A Whole-Cell Biosensor Panel for Agricultural Endocrine Disruptors

**Activation Amount:** \$45,000.00

**Agency:** BARD Liaison Office via USDA

**Abstract:**

Chemical agents, such as pesticides applied at inappropriate levels, may compromise water quality or contaminate soils and hence threaten human populations. Global demographics assure that threats to agriculture will continue to grow. An emerging threat is posed by endocrine disrupting compounds (EDCs), a class of compounds compromising both human and ecosystems' reproductive health; many pesticides have been implicated as EDCs. EDCs pose a threat in proportion to their bioavailability, since that which is bioavailable or can be rendered so is a priori not a threat; bioavailability, in turn, is mediated by complex matrices such as soils. Genetically engineered biosensor bacteria hold great promise for sensing bioavailability because the sensor is a live soil- and water-compatible organism with biological response dynamics, and because its response can be generally "tailored" to report on general toxicity, on bioavailability, and on the presence of specific classes of toxicants. We propose the development of a sensor panel incorporating multiple strains of genetically engineered biosensors for the purpose of detecting different types of biological effects in tandem. Some of the biosensors used will have specific or "lights on" response--i.e., wherein response results from formation of a luminescent reporter molecule in direct proportion to the amount of exposure the biosensor has to its target analytes (e.g. pesticides or EDCs). Others will be "lights off" type biosensors wherein the organisms are engineered to be luminescent in the absence of exposure, this luminescence decreasing as a function of group-effect exposure (our panel will target endocrine disruption capacity as well as overall toxicity). The panel will consist of a matrix of spots, each spot containing a different strain of bacterial biosensor that will yield individual response information for evaluation of the biological effects of the target analytes. Additionally, algorithms suitable for small sensor arrays will be borrowed from the area of electronic nose sensing to discriminate biological effects from the cumulative panel response, constituting a type of biological multiplexing. The ultimate goal of the project is to demonstrate applicability of the sensor panel with real samples such as soil solutions, runoff, material leaching into aquifers, sewage from secondary treatment, etc., and the project will culminate in a field trial. This work relates directly to issues of water quality and soil health, but is extensible to risk-based assessment and homeland security issues as well.

**Proposal No:** 50200708

**Principal Investigator:** Kenneth Morgan, Biology

**Co-PI's:** Thomas Roberts, Biology

**Support Personnel:** Yvette Clark, Water Center

**Project Title:** Ecological Assessment of Wetland Inventory at Fort Campbell, Kentucky

**Activation Amount:** \$199,000.00

**Agency:** U. S. Army Corps of Engineers (via DOD)

**Abstract:**

Through the Cooperative Ecosystems Studies Unit (CESU), Tennessee Tech will perform a unified ecological assessment inventory to identify the presence or absence of wetlands within +/- 83,000 acres of training lands within Fort Campbell. The proposed work will consist of pre-fieldwork study of existing information related to wetland resources, an intensive survey of specified areas for indicators using resources for determining wetland abundance, development and implementation of work plans for adequate documentation of selected sites and compilation of final project reports and permanent project records.

**Proposal No:** 63200708

**Principal Investigator:** James Layzer, Cooperative Fisheries Unit

**Co-PI's:**

**Support Personnel:**

**Project Title:** Assess the Fish and Mussel Communities Associated with the Green River/Glenview Nature Preserve

**Activation Amount:** \$10,000.00

**Agency:** Green County, Kentucky

**Abstract:**

**Proposal No:** 65200708

**Principal Investigator:** Martha Wells, Water Center

**Co-PI's:**

**Support Personnel:**

**Project Title:** Evaluating Disinfectant By-Product Formation Potential in Source Water-Phase III

**Activation Amount:** \$7,564.00

**Agency:** Barge, Waggoner, Sumner & Cannon, Inc.

**Abstract:**

The objective of this research is to evaluate the potential for formation of disinfectant by-products in selected raw and treated drinking water source samples.

**Proposal No:** 69200708

**Principal Investigator:** Steven Click, Civil and Environmental Engineering

**Co-PI's:**

**Support Personnel:**

**Project Title:** Non-Traditional Interchange Improvements

**Activation Amount:** \$20,000.00

**Agency:** Tennessee Department of Transportation

**Abstract:**

The purpose of this study is to evaluate the potential costs and benefits of several traditional and non-traditional interchange improvements for use within the state, thus providing TDOT with the basic information needed to select interchange treatments which will extend the life of existing facilities, optimize operational performance, and minimize program costs. The methodology of this study will be simulation-based analysis of about three case study locations from across the state. The existing condition will be used as a baseline, and several traditional and non-traditional treatments will be evaluated to determine the expected lifespan and quality of service each would provide. Then, with the help of the Department, rough cost estimates for each of the treatments will be determined, allowing a basic cost-benefit analysis of each option for each site. The researchers will work closely with the Department to select both study sites and the treatments to be evaluated. Traditional treatments which could be considered include widening of the over- or underpass, use of the Texas 3-phase and 4-phase control schemes, and the installation of a Single Point Urban Interchange (SPUI). The selection of non-traditional treatments will focus on alternatives that reduce the need for over- or underpass widening, and could include the Teardrop (Raindrop, Double Roundabout) Interchange, the Compressed (Tight Urban) Diamond Interchange, and the Diverging Diamond Interchange.

**Proposal No:** 70200708

**Principal Investigator:** Curtis Armstrong, Decision Sciences and Management

**Co-PI's:**

**Support Personnel:**

**Project Title:** Governor's School for IT Leadership

**Activation Amount:** \$123,000.00

**Agency:** Tennessee Department of Education

**Abstract:**

The Governor's School for Information Technology Leadership gives students the opportunity to develop their knowledge of information technology and business leadership by developing a business plan for an Information Technology based business. This will include developing a viable product or service, identifying the target market, designing a marketing plan, developing the needed technology to support the business, and determining the budget and needed capital for the business. The goals of the curriculum are: to excite high school students about the rapidly growing area of information technology-based business; to add to the students' technology skills and increase the students' awareness of the potential business value of technology; to retain the best and brightest Tennessee students in Tennessee universities; and to develop the future economic development in Tennessee. Formal courses, supervised individual group projects, and experiential learning techniques will comprise the program.

**Proposal No:** 74200708

**Principal Investigator:** James Layzer, Cooperative Fisheries Unit

**Co-PI's:** Phillip Bettoli, Cooperative Fisheries Unit

**Support Personnel:**

**Project Title:** TWRA Base Funds 2007-08

**Activation Amount:** \$30,000.00

**Agency:** Tennessee Wildlife Resources Agency

**Abstract:**

**Proposal No:** 118200506

**Principal Investigator:** Robert Qiu, Manufacturing Center

**Co-PI's:** Periasamy Rajan, Electrical and Computer Engineering

**Support Personnel:**

**Project Title:** Time-Reversal Based Ultrawideband MIMO (UWB-MIMO) for Low Cost, High Data Rate Communications

**Activation Amount:** \$66,519.00

**Agency:** National Science Foundation

**Abstract:**

This proposal focuses on a novel theory and testbed for high-data-rate ultrawideband (UWB) wireless multiple-input multiple-output (MIMO) transceivers. UWB radio is a revolutionary, power-limited technology for its unprecedented system bandwidth and the potential of low-cost and low-power. The most pressing challenge is, however, how to reduce the transceiver complexity of coherent reception caused by the high sampling rate and stringent timing requirements. The proposed system paradigm uses time-reversal with noncoherent detection as an alternative to coherent reception. It exploits the hostile, rich-multipath channel as part of the receiver chain. This new method also integrates time-reversal with MIMO, the most promising approach to use spectrum and transmission power. As a result, time-reversal trades the huge bandwidth of UWB radio and the high power efficiency of MIMO for the noncoherent detection of extremely low cost. This proposed new system paradigm is to take advantages of the impulse nature of UWB signals, a new dimension of a communication channel, through time-reversed MIMO. The new dimension of impulsive time-reversal adds more degrees of freedom in exploiting the spatiotemporal dimensions. The interdisciplinary nature of the proposed research is ideal for the exposure of graduates and undergraduates to theory, simulation, hardware and software. It is particularly suitable to the international collaboration to put students in a view of global knowledge economy. The engineering and technical nature of some parts of research allows the students to understand the necessity for the conceptualization, design, and manufacture of devices and systems from a perspective of global market analysis and implementation through distributed work centers and worldwide supply chains. This research will be the first to investigate the time-reversal UWB-MIMO from a unified, coherent view. The combination of statistical communication theory, time-domain transient electromagnetics and real-life prototyping will lead us to better understand the limits of nature, by making signals more separate in some virtual mathematical spaces, a better trade-off among time, space, and frequency. If the proposed project is successful, a new theoretical framework will be created and be systematically applied to various systems, including wireless, optical, acoustic, and seismic fields. This new theory has many resemblances to the corresponding narrowband MIMO theory, but in its peculiarly transient electromagnetic parts is incomparably richer, and more difficult than the narrowband MIMO that offers no analogies to the time-reversal based UWB MIMO. The funding will be a boost to the University that serves the primarily rural and economically disadvantaged Cumberland and Appalachian areas. TTU, a major engineering school in the region, is mainly an undergraduate institute in an Appalachian area and in its transition to emphasizing more research, especially through the REU program to reach more undergraduates and motivate them into graduate schools. Most TTU students are first generation college students from rural Cumberland and Appalachian areas. If funded, this global view that will be brought back to the region by students through the hands-on experiences of their extended stay for four months in Europe and cultural significance are hard to overvalue. The proposed research will potentially lead to revolutionary breakthrough in many branches. The immediate applications include all aspects of science and engineering such as the wireless industry,

UWB radar and sensors, underwater acoustics, remote sensing, and image-guided therapy and surgery.  
The society will be benefited economically due to the technological advancement.

**Proposal No:** 156200607

**Principal Investigator:** Sue Bailey, Human Ecology

**Co-PI's:**

**Support Personnel:** Darcey Neyman, Human Ecology; Jennifer Swallows, TECTA Project

**Project Title:** Tennessee Early Education Training Alliance 2007-08

**Activation Amount:** \$226,166.00

**Agency:** Tennessee State University (via Tennessee Dept. Health and Human Services)

**Abstract:**

The TECTA program at Tennessee Tech University is sponsored and funded by the Tennessee Department of Human Services and is approved by the Tennessee Board of Regents. The Tennessee Early Childhood Training Alliance statewide training system is based on the belief that all early childhood education personnel need to acquire the recognized professional knowledge base and skills to provide appropriate care and education for young children. Research suggests that quality early childhood education plays an important role in preparing children to enter school ready to learn. TECTA training places current research into practice with a research-based curriculum to positively impact the lives of Tennessee's children. The TECTA model of training and professional development is based on the belief that the key to quality child care programs is the professional preparation of teaching and administrative personnel with whom young children spend a significant portion of their formative years. TECTA programs are based on state and national standards for the preparation of professional early childhood education personnel. TECTA offers 30 hours of free training focusing on five areas of specialization within the child care setting: Administration, Center-based, Family, Infant/Toddler, and School-age Child Care. Child care personnel may also take advantage of financial support from TECTA for those earning the AAS degree in Early Childhood Education, Bachelor's, and Master's or Doctorate degrees. TECTA is an academic gateway based in the Tennessee Board of Regents college/university system with a curriculum centered on professional core competencies. Child care personnel may also complete course work in early childhood education at the college level, work closely with a TECTA mentor, and have the opportunity to earn the Child Development Associate Credential awarded by the National Council for Professional Recognition. TECTA also supports and offers mentoring to child programs desiring accreditation through the National Association for the Education of Young Children.