

**SAVANNAH RIVER
ECOLOGY LABORATORY**

**ANNUAL TECHNICAL PROGRESS REPORT
OF ECOLOGICAL RESEARCH FOR FY2012**

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for the period of
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Director

Prepared by
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SECTION I: Savannah River Ecology Laboratory – FY12 Overview of Achievements

The Savannah River Ecology Laboratory (SREL) is a research unit of The University of Georgia (UGA) that has been conducting ecological research on the Savannah River Site (SRS) near Aiken, South Carolina for over 60 years. The overall mission of the Laboratory is to enhance our understanding of the environment by acquiring and communicating knowledge of ecological processes and principles that contribute to sound environmental stewardship. In addition, as directed in the Cooperative Agreement with the U.S. Department of Energy (DOE), SREL will provide the public with an independent evaluation of the ecological effects of SRS operations on the environment. Toward these goals, SREL conducts fundamental and applied ecological research, as well as education and outreach programs.

The Laboratory's research mission during the 2012 fiscal year was fulfilled with the publication of 49 journal articles and book chapters by faculty, technical staff, students, and visiting scientists. One book was also authored by SREL faculty and staff members. Additional journal articles and books have been submitted or are in press. Significantly, SREL outreach activities reached over 36,000 people of all ages. Other noteworthy events took place as faculty members, staff, and graduate students received awards for the quality of their research. These are described in Section IX 'Special Accomplishments'.

The vision, structure, and operations of SREL continue to evolve since changes in funding structure were instituted in FY07. However, the Cooperative Agreement between the University of Georgia's Research Foundation and the Department of Energy for support of the Savannah River Ecology Laboratory was renewed in FY12 and funding received from the DOE and other SRS tenants through this agreement reflects the specific needs of EM and NNSA on the Savannah River Site. The current funding model for SREL is entrepreneurial and interdisciplinary, and seeks to pursue funding strategies that are competitive, responsive to sponsors' requirements, and based on a diverse and sustainable foundation. This model has required restructuring of research and supporting infrastructure at the laboratory.

Today, a reduced, but robust SREL presence continues to operate on the SRS. Currently, SREL's total employment is approximately 60 faculty, technicians, students, and support staff. The number of employees and level of funding is lean but ensures continued progress toward stated objectives and does not compromise safety and security. New partnerships and collaborations with the Athens campus and other agencies continue to be explored and developed in order to maximize the use of SREL assets. Graduate student programs have continued with funding provided by external grants, UGA, or the student's host university.

SREL faculty have responded to the revised funding structure for the laboratory and have sought financial support from multiple external funding agencies, DOE-EM, DOE-NNSA (National Nuclear Security Administration), and SRNS-ACP (Savannah River Nuclear Solutions-Area Closure Projects), and UGA has provided temporary infrastructure support to SREL. The current Cooperative Agreement with DOE allows SREL/UGA access to the SRS through 30 November 2016. The SREL continues to work closely with local community groups, local schools, and other area stakeholders on a number of research, environmental monitoring, education, and outreach activities.

Many challenges remain for SREL including reorganizing research programs to address DOE and SRS-specific concerns, maintaining current research staff, and attracting new personnel. SREL researchers are also vigorously pursuing additional funding sources to leverage existing research funds, while continuing to focus the laboratory's research efforts on projects of interest to the SRS. In addition, personnel from SREL have been actively engaged in ongoing Strategic Initiatives associated with the Enterprise SRS Vision, including roles as a Champion for the strategic initiative in Radioecology and participation on SRNS vision and pursuit teams in the areas of Next Generation Cleanup Technologies and Renewable Energy.

Researchers at SREL had funding from 20 new and continuing external grants during FY12. Sources of grant awards range from private foundations to federal and state agencies such as the U.S. Department of Interior, the National Science Foundation, and the Department of Defense.

SREL faculty members hold positions in varied departments at the University of Georgia. In addition, several SREL faculty members (and emeritus faculty) have adjunct status at other colleges and universities. Faculty, staff, and students also are active in providing outreach and service to the scientific community. Representatives from SREL hold editorial or committee positions in national groups and organizations and also serve on several UGA academic and administrative committees. SREL faculty members continue to make scientific presentations, contribute posters to scientific meetings, and present seminars at colleges and universities.

Participants in the SREL Education Program during FY11 included 7 undergraduate students and 27 graduate students from numerous colleges and universities in the United States.

The SREL Outreach Program communicates scientific awareness to area schools and the general public, an audience which differs from science professionals. During the past year, SREL presented 318 talks, 53 tours, 20 exhibits, and 42 'Ecologist for a Day' Programs reaching a total of over 36,000 people. Topics for these presentations included ecological studies of reptiles and amphibians, southeastern plants and habitats, long-term research, safety, biodiversity, local wetlands and watersheds, conservation, and careers in ecology and research. In the past year, SREL has participated in the SRS public tour program (~two tours per month of 30-40 citizens). SREL participates by providing presentations on the history and research of the lab as well as a "show and tell" session featuring research animals native to the SRS.

The UGA Conference Center has continued to be a valuable asset to SREL and other groups on the SRS. SREL used the facility to host numerous meetings and environmental education programs for students, teachers, and other groups this past year. The facility is also used by DOE, the USDA Forest Service, and other site tenants when it is available.

During FY12, the UGA Vice President for Research, Dr. David C. Lee, approved the hire of Dr. O. E. (Gene) Rhodes, Jr. as the new Director of the Savannah River Ecology Laboratory. Subsequent to Dr. Rhodes' arrival at the lab, a search was held for a new Assistant Director and Mr. William C. McBride was hired as the new Assistant Director for Budget and Administration at SREL.

SECTION II. Cooperative Agreement Key Tasks

TASK 1. SREL will assess the impact of Site operations on the environment, and will continue to provide the public and DOE with an independent view of the environmental management of the SRS

Through a Cooperative Agreement between the Department of Energy and the University of Georgia Research Foundation, SREL provides an independent evaluation of the ecological effects of SRS operations through a program of ecological research, education, and public outreach. This program involves basic and applied environmental research, with emphasis upon expanding the understanding of ecological processes and principles, and upon evaluating the impacts of industrial and land use activities on the environment.

This is accomplished through a broad-based program of field and laboratory research conducted on the SRS and published in the peer-reviewed scientific literature; by providing education and research training for undergraduate and graduate students from colleges and universities throughout the United States and abroad; and by engaging in community outreach activities and service to professional organizations.

The quality of research conducted by SREL scientists is facilitated by their unique expertise in environmental sciences and ecology, the unparalleled field research opportunities at the SRS, and the long-term data sets, research tools, and capabilities that SREL has developed over the last 60 years.

The FY12 SREL research plan can be divided into three critical research areas:

Environmental Characterization

Characterization is a necessary first step in determining environmental and health risks and in devising appropriate remediation and restoration strategies. Environmental information is also needed to make informed decisions about long-term stewardship and land management, and is a critical component of NEPA (National Environmental Policy Act) reports, Records of Decision (ROD), and other regulatory documents. Environmental characterization is more than simply measuring contaminant concentrations in biota or other media, or reporting the presence of organisms at various locations. It includes developing an understanding of the processes that control distributions of contaminants, chemical forms, and their bioavailability. Characterization is also necessary to construct models of how natural and engineered systems function, both in the presence and absence of environmental contamination.

Ecological Risks and Effects

Estimated risks and effects determine the need for remediation and restoration efforts, while perceived risks and effects determine the public's acceptance and support of DOE policies and actions. Estimating ecological risks and effects on the basis of sound science helps to ensure that good decisions are made by reducing uncertainties associated with complex environmental processes. A 1999 report from the National Academy of Sciences stated that "*Ecological risks are better characterized at the Savannah River Site than at any other DOE installation, due in part to the designation of the site as a National Environmental Research Park and the presence of the Savannah River Ecology Laboratory.*"

Remediation and Restoration

The knowledge and expertise based at SREL are ideally suited to address the remediation and restoration of large land areas contaminated with relatively low levels of metals, organics, and radionuclides. SREL conducts multidisciplinary research designed to assist in the development, evaluation and stakeholder acceptance of remediation and restoration efforts that protect human and ecosystem health. Fundamental to the success of various bioremediation, natural attenuation, and *in situ* remediation applications is an understanding of the underlying scientific principles on which they are based.

TASK 2. SREL will continue basic and applied environmental research with emphasis upon expanding the understanding of ecological processes and principles, and upon evaluating the impacts of site activities, new mission, and land use practices on the environment

In FY12 the Savannah River Ecology Laboratory received approximately 4 million dollars in total funding from a variety of sources (Figure 2.1). These funds supported around 60 research faculty, staff, and students conducting basic and applied environmental research for at least some portion of FY12 (Table 2.1). In total, University of Georgia funding (both direct and indirect funds returned to the lab) and external dollars received from non-SRS sources were responsible for approximately 57% of the laboratories budget. Laboratory personnel were productive, successful in attracting external funding to the site, and very active in graduate student education and service to their communities and professions (Table 2.2). Despite funding challenges, SREL continues to be a productive, independent partner to DOE on the SRS and an excellent value to both stakeholders on the SRS and taxpayers.

Figure 2.1. Overview of funding received by SREL in FY12. Acronyms are as follows: University of Georgia (UGA), Savannah River Site Office of Department of Energy (DOE-SR), all combined sources of funding received from sources external to the Savannah River Site (External), Department of Energy National Nuclear Security Administration’s Mixed Oxide Fuel Production Facility (NNSA-MOX), Savannah River Nuclear Solutions Area Closures Project (ACP), Savannah River National Laboratory (SRNL), and Savannah River Nuclear Solutions (SRNS).

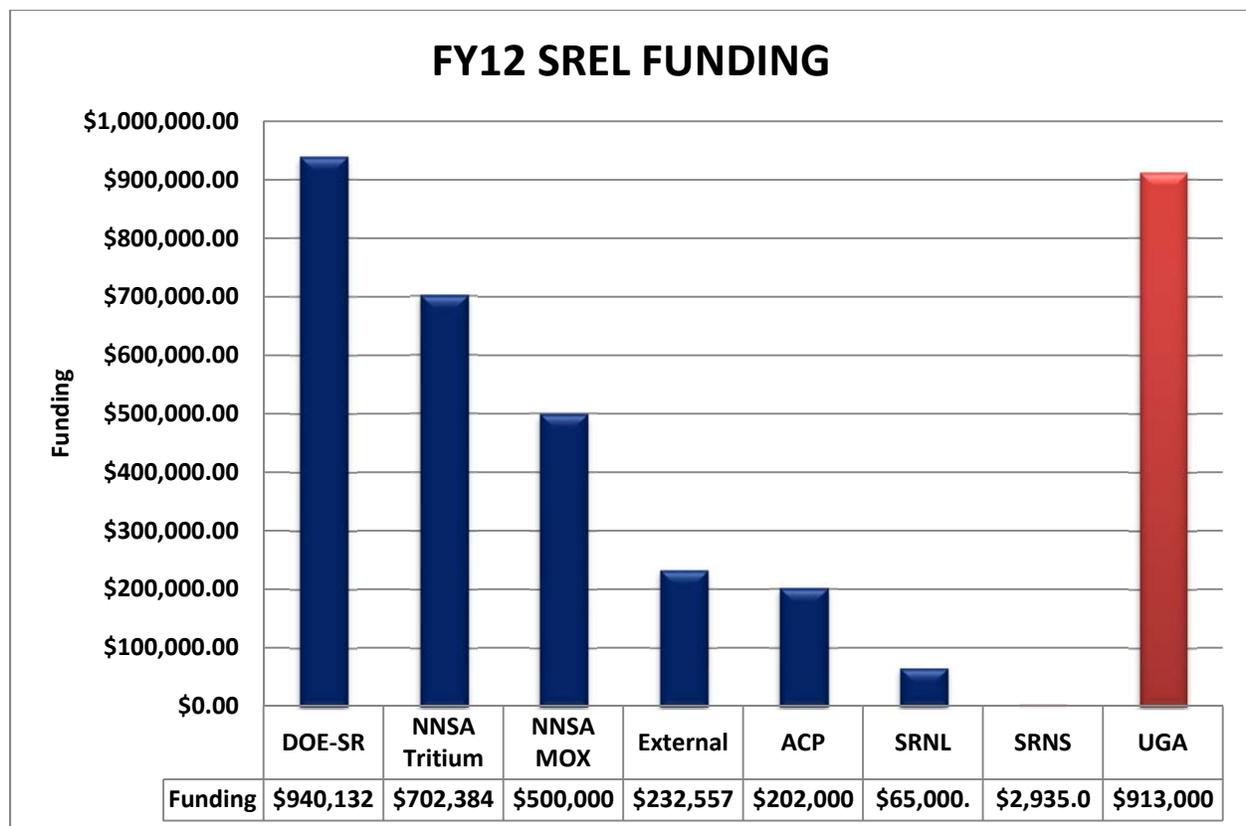


Table 2.1. SREL organizational structure for FY12. This table includes all research faculty, classified staff and Emeritus faculty in residence at the Savannah River Ecology Laboratory for any portion of the FY12 fiscal year.

SREL ORGANIZATIONAL CHART – FY12	
Director Dr. Olin E. Rhodes, Jr.	
<p><u>Assistant Director Research</u> Dr. J. Seaman</p> <p><u>Research Faculty</u> Dr. J. Beasley Dr. K. Buhlmann Dr. S. Lance Dr. J. Vaun McArthur Dr. G. Mills Dr. J. Seaman Dr. T. Tuberville Dr. C. Tuckfield</p> <p><u>Emeritus Faculty in Residence</u> Dr. D. Adriano Dr. I. Brisbin, Jr. Dr. J.W. Gibbons (Head Outreach) Dr. K. McLeod Dr. R. Sharitz</p> <p><u>Post Docs</u> Dr., H. Chang Dr. E. Burgess</p> <p><u>Research Professionals</u> R. Beasley L. Bryan D. Fletcher R. Kennamer L. Lee A. Lindell B. Metts D. Scott J. Singer P. Stankus</p> <p><u>Research Technicians</u> W. Flynn C. Hagen C. Love B. Moyer S. Nunziata D. Soteropoulos</p>	<p><u>Assistant Director Budget and Facilities</u> C. McBride</p> <p><u>Safety and Environmental Manager</u> D. Mosser</p> <p><u>Computer Service and GIS Lab Manager</u> W. Finney, Jr.</p> <p><u>Outreach Program Staff</u> Dr. K. Andrews C. Eldridge J. Green-McLeod S. Poppy A. Tucker</p> <p><u>Research and Facilities Technical Services</u> R. Christie M. Edwards D. Kling M. Squires</p> <p><u>Administrative Services</u> M. Roberts V. McFarland C. Summer V. Taylor L. Zweifel M. Wead</p>
(As of 10/1/2012)	

Table 2.2. Summary of professional activities and accomplishments by Savannah River Ecology Laboratory research faculty, research professionals, postdocs and students in FY12.

Publications and Reviews	Total
Peer Reviewed Journal Articles	49
Book Chapters	4
Books	2
Proceedings Articles	2
Primer Notes	10
Non-Peer Reviewed Articles	4
Articles In Press	24
Articles In Review	42
Peer Review of Manuscripts Conducted	65
External Funding	Total
External Grants Submitted ¹	32
External Grant Funding Submitted	\$4,074,614.00
External Grants Funded ¹	20
External Grant Funding Received	\$789,406.00
Graduate Education and Postdocs	Total
Master of Science Students Chaired	2
Master of Science Students Completed	2
Doctoral Students Chaired	4
Doctoral Students Completed	3
Graduate Student Committee Memberships	26
Postdoctoral Scientists Supervised	2
Presentations	Total
Professional Oral Presentations	39
Professional Poster Presentations	16
Invited Presentations	53
Extension Presentations	63
Extension Publications	6
Other	Total
Awards or Honors	11
Professional Society Committee Memberships	25
Courses Taught at UGA	1

¹ – includes new grants and contracts as well as renewals and continuations associated with funding sources external to DOE

TASK 3. SREL will use the information collected in the environmental research to develop and test hypotheses that will contribute to the scientific foundation necessary to conduct meaningful ecological risk assessments and to understand the environmental consequences of energy technologies, remediation efforts, and other SRS activities

In FY12 SREL faculty, staff, and students conducted and completed a diversity of environmental research projects on the SRS in support of the missions of SRNS, SRNL and DOE-SR, specifically in the areas of risk assessment and elucidation of the environmental consequences of energy technologies, legacy contamination, and remediation activities on the SRS. Much of this work was funded through support to the SRNS Area Closures Project, through subcontracts from SRNL to perform specialized sampling or analyses, and through commitment of funds received through SREL's Cooperative Agreement with the Department of Energy to address research topics of importance to the continuing missions of DOE on the SRS. The details of these projects are outlined below:

Research Support to SRNS Area Closure Projects, SRNL, and DOE-SR

Trace element concentrations of aquatic biota from selected SRS aquatic systems – Support of the SRS trophic transfer modeling effort: Phase 2

Funding Entity

SRNS Area Closures Projects

Start Date and Funding Amount

November 2010; \$115,000.00

PI and co-PI's

Larry Bryan - SREL

Objectives

The objective of the project was to collect biota from selected aquatic habitats on the SRS, analyze them for a suite of metals, and provide the data to ACP for eventual use in ecological risk assessments.

Summary of Research Activities

We collected > 500 individual biological samples, primarily fish and crayfish, from 7 locations on SRS: Pond A/R-Canal, Pond 2, upper Steel Creek, Castor Creek, Pen Branch (upper, middle and lower), Indian Grave Branch, and lower Meyers Branch. All contaminant analyses were conducted at SREL using ICP-MS (As, Cd, Cr, Cu, Hg, Ni, Pb, Se, Sr, U, & Zn). For quality assurance, samples were analyzed in batches containing a blank and standard reference material of known concentration and all concentrations reported as $\mu\text{g/g}$ dry weight.

Conclusions

1) Concentrations of the various metals/metalloids varied by location and species.

Major Impact(s) of Research

1) We provided contaminant/elemental data to ACP for use in their ecological risk assessments.

Other Project Personnel

David Kling, Research Technician - SREL

External Collaborators

None

Products (Publications, Presentations, Technical Reports)

Bryan, L. 2012. Trace element concentrations of aquatic biota from selected SRS aquatic systems – Support of the SRS trophic transfer modeling effort: Phase 2. Final project report to the Area Closures Project, Savannah River Nuclear Solutions, Savannah River Site, Aiken, SC.

Preliminary Contaminant Analyses in Selected Game Species on the Savannah River Site

Funding Entity

SRNS Area Closures Projects

Start Date and Funding Amount

November 2012; \$19,500.00

PI and co-PI's

Larry Bryan, Dr. Jim Beasley, Bobby Kennamer and Dr. Gary Mills – SREL

Objectives

We are conducting a preliminary study to document levels of radiocesium, mercury, and a suite of metals in tissues of gray squirrels (*Sciurus carolinensis*), waterfowl, and feral hogs (*Sus scrofa*) from various regions on the SRS, over a two-year period.

Summary of Research Activities

We are collecting tissue samples from up to 80 individuals of each species over the two-year study. Squirrels will be captured in live traps and euthanized by established methods (UGA Animal Use Protocols; Sikes 2011). Waterfowl will be collected by shooting and/or trapping. Hog tissue will be collected at check stations from SRS hunters as well as from SRS contract hunters. To the extent possible, spatial data will be collected with each game sample to examine potential associations of contaminant concentration/prevalence with specific sites (e.g.; D-area).

Tissue samples collected will include muscle, liver, and hair/feathers although the primary analyses will focus on muscle as it is the typical tissue consumed by the public. Depending on the concentrations found in muscle, and if time and funding allow, we may also examine correlations between muscle and liver tissues and non-lethal/more easily attained tissues such as hair/feathers. If such correlations are strong, it would allow the estimation of contaminants in non-lethal samples collected during further studies and may allow the estimation of contaminants in off-site harvests (e.g.; getting hair/feather samples from off-site hunts/hunters....more likely/simple to provide hair/feather sample than muscle or liver, etc.).

All contaminant analyses will be conducted at SREL. Radiocesium (Bq/g dry wt) will be determined with a Packard 5003 Cobra II Automated Gamma Counter. Mercury concentrations ($\mu\text{g/g}$ dry wt) will be determined with a Milestone DMA 80 by cold vapor atomic absorption spectroscopy and metal/metalloid concentrations ($\mu\text{g/g}$ dry wt for As, Cd, Cr, Cu, Ni, Pb, Se, Sr, U, & Zn) will be determined using ICP-MS. For quality assurance, samples will be analyzed in batches containing a blank and standard reference material of known concentration.

Conclusions

1) This research has just begun, thus there are no conclusions at this time.

Major Impact(s) of Research

- 1) We will verify the occurrence (or lack thereof) and concentrations of selected contaminants in three game species collected on the SRS
- 2) We will determine the likelihood of public exposure to contaminants through these sources.

Other Project Personnel

Sarah Webster, Temp. Research Technician - SREL

External Collaborators

None

Products (Publications, Presentations, Technical Reports)

No publications, presentations, or reports have been prepared yet.

A comprehensive risk assessment model for the Tim's Branch-Steed's Pond system.

Funding Entity

SRNS Area Closures Projects

Start Date and Funding Amount

September 2009; \$312,000.00

PI and co-PI's

Larry Bryan - SREL

Dr. Karen Gaines, Dr. Jim Novak, and Paul Edwards - Eastern Illinois University,

Objectives

The objectives of the project were to examine contaminant uptake and accumulation in the lower trophic levels of the Tims Branch system and, including data from upper trophic levels collected in earlier studies, to assess ecological risk.

Summary of Research Activities

Lower trophic levels (biofilms, tadpoles, aquatic insect larvae) were collected from beaver ponds along the Tims Branch gradient in 2010/2011. All were analyzed for metals by ICP-MS at SREL, with particular interest in Ni, U, and Hg. Trophic position of the biota were confirmed via stable isotope analyses (nitrogen and carbon) at UGA. For quality assurance, samples were analyzed in batches containing a blank and standard reference material of known concentration and all concentrations reported as *ug/g* dry weight. Data from this study were combined with 2006 data on metal concentration/stable isotopes for fish from this stream system for overall biomagnification assessment and risk analysis.

Conclusions

- 1) Most metals/elements, other than Hg, did not biomagnify through the trophic levels, although some elements appeared to biomagnify within levels (species).
- 2) System inputs (of Nitrogen) may have influenced trophic values (isotopic) along the gradient, resulting in the need to assess trophic position within individual sites rather than among sites.

Major Impact(s) of Research

- 1) Given that there was a lack of biomagnification by U and Ni, it suggests the likelihood of these elements posing a risk to upper level predators and/or humans is low, although additional studies of other species (feral hogs) may be warranted.

Other Project Personnel

David Kling, Research Technician - SREL

External Collaborators

None

Products

Gaines, K.F., A.L. Bryan, Jr., P.G. Edwards, and J.M. Novak. 2012. Bioavailability, bioaccumulation, and trophic transfer of trace metals within the Tims Branch-Steed Pond tributary. SRNS-STI-2012-00669. Final Project Report to the Area Closure Project, Savannah River Nuclear Solutions, Savannah River Site, Aiken, SC.

Edwards, P.G. 2012. Bioavailability, bioaccumulation, and trophic transfer of trace metals within the Tims Branch-Steed Pond tributary. M.S. Thesis, Department of Biology, Eastern Illinois University.

Edwards, P.G., K.F. Gaines, A.L. Bryan, Jr., J.M. Novak, and S.A. Blas. Is U, Ni, and Hg an environmental risk in a CERCLA unit on the Department of Energy's Savannah River Site? *Human & Ecological Risk Assessment (Submitted)*

Edwards, P.G., K.F. Gaines, A.L. Bryan, Jr., J.M. Novak, and S.A. Blas. Using biofilms to better understand trophic dynamics of COPC's on the Department of Energy's Savannah River Site. *The Science of the Total Environment (Submitted)*

P-Area wetland studies of soils and biota

Funding Entity

SRNS Area Closures Projects

Start Date and Funding Amount

April, 2011; \$82,265

PI and co-PI's

Dr. Stacey L. Lance, David E. Scott, Dr. John C. Seaman, A. Lawrence Bryan Jr. - SREL

Objectives

Our overall objective in this project was to examine the distribution of trace elements in soils and biota at a portion of Dunbarton Bay, a wetland complex on the SRS that experienced an historic release of coal combustion wastes from the P-Area ash basin.

Summary of Research Activities

Contaminants of potential concern (COPC) to aquatic receptor species had been identified in preliminary P-Area wetland surveys and SRS ecological risk models. We determined COPC levels in soil cores and biota from the affected area of Bay 96, as well as from a nearby uncontaminated wetland reference site (Bay 100). Soil cores were collected from ten sampling locations, seven within the ash depositional area and three outside the ash deposition zone, as well as two additional background wetland sampling locations within Bay 100. The metal levels in the seven sites impacted by ash deposition were elevated when compared to the three sites outside the ash deposition zone and background metal concentration for SRS upland soils. We monitored biota at Bay 96 and the reference site (Bay 100) from April to November 2011. We also conducted limited concurrent sampling at the D-Area Primary Settling Basin and the DAPW for direct comparison to the P-Area results. We used standard amphibian capture and processing techniques at Bay 96 and Bay 100 to collect samples from target taxonomic groups for trace element analyses. We installed three 30-m long drift fences with paired pitfall traps at both P-Area sites. Fences at Bay 96 were placed within the known ash plume, and fences at Bay 100 were installed around the margin of the wetland. We collected target species of amphibians, reptiles, small mammals, insects, spiders, millipedes, and centipedes for metal analysis. For each taxon we determined mean trace element concentrations for the most abundant species, with a target of 10 samples per species per location.

Conclusions

- 1) In Bay 96 soils, the levels of arsenic (As), copper (Cu), nickel (Ni), selenium (Se), and strontium (Sr) were elevated relative to the reference wetland and the soil levels of arsenic (As), barium (Ba), beryllium (Be), cadmium (Cd), cobalt (Co), Cu, Pb, Ni, Se, and zinc (Zn) were elevated for the ash-impacted sampling sites compared to the three non-ash-impacted sites.
- 2) Across taxa As, Se, and Sr were significantly elevated in biota from Bay 96 relative to Bay 100.
- 3) Bay 96 soil concentrations were generally lower than levels at ash-impacted sites in D-Area.

Major Impact(s) of Research

- 1) Biological survey and body burden data required for site remediation decision making.
- 2) Soil contamination levels allow risk assessment to determine if remedial action is required to prevent contaminant migration.
- 3) Inclusion of D-Area in our study is one of the first comparisons of impacts of different coal-combustion waste sites; for some trace elements (e.g., As, Sr) and taxa (e.g., spiders), soil concentrations are a good predictor of tissue concentrations.

Other Project Personnel

Julian Singer, Research Professional - SREL

David Kling, Research Professional - SREL

External Collaborators

NA

Products (Publications, Presentations, Technical Reports)

Lance, S. L., J. C. Seaman, D. E. Scott, A. L. Bryan, Jr., and J. H. Singer. 2012. P-Area wetland studies: soils and biota. Final report submitted to SRNS-ACP 51 pp.

Reptiles as long-lived receptors for ecological risk assessment on the SRS

Funding Entity

SRNS Area Closures Projects

Start Date and Funding Amount

June 2010; \$265,000.00

PI and co-PI's

David Scott and Tracey Tuberville – SREL

Objectives

- 1) Review the ecotoxicology literature and summarize tissue burdens of radiological, metal and trace element contaminants in reptiles.
- 2) Review the ecotoxicology literature and synthesize information on documented biological effects of these contaminants in reptiles.
- 3) Quantify contemporary body burdens of radiological and trace element contaminants in alligators and aquatic turtles at sites on the SRS with known contaminant issues.
- 4) Compare body burdens in alligators and aquatic turtles between contaminated and uncontaminated reference sites on the SRS.

Summary of Research Activities

We conducted broad-based field surveys to document current body burdens of metals and radiological contaminants in alligators and freshwater turtles across the SRS. Field sampling began in April 2010 and we sampled turtles—primarily yellow-bellied sliders—and alligators from a series of aquatic sampling sites that differed in their contaminant types, levels and spatial scales, including reference sites not known to be contaminated. Alligators were captured using Murphy traps and by hand; turtles were captured using baited aquatic hoop net traps. We permanently and uniquely marked all animals, took standard morphometric measurements, and measured gamma radiation to determine ^{137}Cs total body burden in subsamples of turtles and alligators from each location. The count data were corrected for background radiation, and these data were used to determine tissue concentrations of radioisotopes (after adjusting for the physical decay of the ^{137}Cs phantoms and animal geometry effects on counting efficiency). In addition, we collected whole blood, nail, and scute (alligators only) samples for analysis for a suite of metals.

From March 2010 – April 2011, we captured 176 alligators from metal-contaminated, radiologically-contaminated, and uncontaminated reference sites across the SRS. From alligators, we collected 165 tissue samples and 127 blood samples. We also collected 106 blood samples from yellow-bellied sliders and analyzed them for trace elements. Finally, we conducted a comprehensive literature review of body burdens of trace elements and radiological contaminants and their biological effects reported for reptiles in the literature.

Conclusions

- 1) Our preliminary data suggest that ^{137}Cs is elevated in yellow-bellied sliders and alligators from Pond B and Par Pond, with the highest levels documented at Pond B. In addition, we also documented elevated gamma counts in turtles from a site not previously known to us to be contaminated – the Upper A01 Wetland. Our preliminary identification of the spectrum is a thorium isotope present at above background levels due to SRS operations. The primary finding in regards to trace element analysis were the extremely high body burdens of selenium in yellow-bellied sliders and alligators from the D-Area ash basin. Even though some trace element and radionuclide analyses documented elevated levels, most captured animals appeared to be physically healthy. Very little is known about biological effects of these contaminants at the body burden levels observed for alligators and aquatic turtles and further research is warranted in order to evaluate effects of these contaminants at individual and population-levels.

Major Impact(s) of Research

- 1) We conducted a contemporary survey of body burdens of trace element and radiological contaminants for turtles and alligators
- 2) Comprehensive literature review, including database of references and reported body burden levels (2000+ entries) for reptiles from studies around the world that is now available to ACP and to future SREL graduate students working on the project.

Other Project Personnel

Brian Metts, Research Professional - SREL

External Collaborators

Dr. Michael Yabsley - University of Georgia

Dr. Andy Davis - University of Georgia

Products (Publications, Presentations, Technical Reports)

Davis, A.K., R.V. Horan III, A.M. Grosse, B.B. Harris, B.S. Metts, D.E. Scott, and T.D. Tuberville.

2011. Gender differences in haemogregarine infections in American alligators (*Alligator mississippiensis*) at Savannah River, South Carolina. *Journal of Wildlife Diseases* 47:1047-1049.

Tuberville, T.D. 2012. Long-lived reptiles as environmental sentinels – Lessons learned from the Savannah River Site. Young Generation in Nuclear, Aiken, SC. (*Presentation*)

Harris, B.B., A.M. Grosse, R.V. Horan III, D.E. Scott, B.S. Metts, and T.D. Tuberville. 2012. Alligators and freshwater turtles as long-lived bioindicators in aquatic ecosystems of the southeastern U.S. Society for Integrative and Comparative Biology, Charleston, SC, (*Presentation*)

Contaminant Bioaccumulation and Trophic Relationships in Beaver Dam Creek Biota from the D-Area Coal Combustion Waste Plume

Funding Entity

SRNS Area Closures Projects

Start Date and Funding Amount

September 2009; \$290,000

PI and co-PI's (and Affiliations)

Dean E. Fletcher, Angela H. Lindell, Dr. Gary Mills, and Dr. J Vaun McArthur – SREL

Objectives

We proposed to establish how and to what extent aquatic organisms in Beaver Dam Creek on the SRS are at risk from contaminant bioaccumulation by documenting inter- and intra-specific variation of levels of a suite of metals and metalloids in species ranging from herbivorous invertebrates (< 2 cm in length) to large predatory fishes (> 1 m in length). We also completed an annotated bibliography of ecological work done in the D Area and Beaver Dam Creek system.

Summary of Research Activities (1-3 PARAGRAPHS MAX)

On the Savannah River Site, coal combustion waste (CCW) had been produced by the D Area Power Plant since the early 1950's and stored in basins that discharge into Beaver Dam Creek (BDC). Beaver Dam Creek is a highly modified system. The headwaters were channelized during the early infrastructure construction of the SRS between 1951 and 1956 to transport effluents from the D Area Power plant and associated ash and coal pile runoff basins to the Savannah River. Flow patterns in the upper three km of BDC were established with field reconnaissance and GIS resources. Stable isotope analyses ($\delta^{13}\text{C}$ and $\delta^{15}\text{N}$) were employed to establish trophic relationships among study organisms. Trace element analyses (As, Ba, Be, Cd, Cr, Cu, Hg, Ni, Pb, Sb, Se, TI, V, Zn, Cs and Sr) assessed contaminant bioaccumulation. Over 500 trace element samples and nearly 400 stable isotope samples were analyzed. Field collections were made at two sites in Beaver Dam Creek headwaters that differ in hydrologic regimes.

We are comparing taxa that differ in trophic position, feeding habits, habitat use, size, and longevity. Within taxa, the influence of size and ontogenetic trophic shifts are being accounted for. Inclusion of two invertebrate herbivores that differ significantly in habitat use and feeding behavior is exploring a baseline of the introduction of materials into the food web from primary producers and is a critical component of stable isotope studies. Further movement through or introduction of contaminants into the food web is being addressed in a comparison of eight dragonfly genera that differ in habitat use, particularly in reference to their exposure to sediments. Additionally detailed studies are comparing three species of bullhead catfish (*Ameiurus sp.*) that also differ in morphology and habitat use. Inclusion of four top level predatory fish is allowing comparison of elements entering the food web with those in the top predators. Large predatory fish included channel catfish (*Ictalurus punctatus*), largemouth bass (*Micropterus salmoides*), longnose gar (*Lepisosteus osseus*) and bowfin (*Amia calva*). Muscle tissue was analyzed for all fish, and liver and gonad tissues were analyzed from a subset of individuals. Data from exploratory contaminant assays, conducted on biofilm and sediments, will be analyzed in FY13.

Trace element analysis was performed at SREL by inductively coupled plasma mass spectroscopy (NexIon 300X ICP-MS; Perkin Elmer, Norwalk, CT). Total C and N content and C and N stable isotope signatures were determined for the tissue samples at the Stable Isotope/ Soil Biology Lab at the Odum School of Ecology, University of Georgia with a Finnigan Delta Plus mass spectrometer (Thermo-Finnigan, Bremen, Germany). For quality assurance, samples were analyzed in batches containing a blank and standard reference material of known concentration.

Conclusions

- 1) Contaminants are entering and moving through the food web in species and element specific patterns.
- 2) Some contaminants are accumulating at levels sufficient to be of ecological and possibly human health concern, although source of contaminants has not been confirmed.

- 3) Fish livers effectively sequester some elements preventing accumulation in muscle, whereas others bioaccumulate in muscle.

Major Impact(s) of Research

- 1) Our detailed comparisons between and within species are establishing an information base that can aid in the design of future studies, interpret existing data and support site-wide risk models.

Other Project Personnel

Garrett Stillings, Research Professional - SREL

David Kling, Research Professional - SREL

External Collaborators

None

Products (Publications, Presentations, Technical Reports)

Fletcher, D. E., A. H. Lindell, G. K. Stillings, and J V. McArthur. 2011. Contaminant bioaccumulation and trophic relationships in Beaver Dam Creek, Savannah River Site. Phase I Final report submitted to SRNS-ACP 177 pp.

Lindell, A. H., C. Tant, D. E. Fletcher, and J V. McArthur. 2011. Annotated bibliography for the Savannah River Site's Beaver Dam Creek. Report to Area Completion Projects, SRNL.

Lindell, A. H., G. L. Mills, G. K. Stillings, J V. McArthur, and D.E. Fletcher. 2011. Contaminant Bioaccumulation and Trophic Characterization of Top-Level Predatory Fishes. Annual Meeting of the Southeastern Fishes Council. Chattanooga TN, (*Presentation*)

Stillings, G. K., A. H Lindell, G. L. Mills, J V. McArthur, and D. E Fletcher. 2011. Contaminant Bioaccumulation and Trophic Characterization of Two Herbivorous Invertebrates. Annual Meeting of the Southeastern Fishes Council. Chattanooga TN, (*Presentation*)

Stream System Field Condition Survey

Funding Entity

SRNS Area Closures Projects

Start Date and Funding Amount

September 2009; \$315,000

PI and co-PI's (and Affiliations)

Dean Fletcher – SREL

Dr. Christopher Barton - University of Kentucky

Objectives

We proposed to hydrologically characterize select stream basins, identify stream alterations and place them in temporal context, identify drainages where large contiguous high-quality watersheds could be established, identify streams where remediation may be warranted, and identify potential reference sites.

Summary of Research Activities

This project expanded upon collaborative work initiated by SREL, the University of Kentucky, and the USDA Forest Service-SR. Our Level 1 stream assessments included a broad scale survey of potential stream disturbances and hydrological characterization. This effort required examining aerial photos (1938-2010), LiDAR imagery, existing GIS data, and maps (1943 to current), as well as a field survey taken by walking entire stream drainages to identify disturbances such as flow impediments, erosion, or channelization. Documented flow impediments included active and abandoned dams, road and railroad crossings, and utilities cuts. Severe erosion, incision, and sedimentation from historical and present land use, outfalls, roads, railroads, utilities cuts, and abandoned borrow pits were recorded. Pathways of outfalls and runoff from industrial areas reaching perennial or intermittent streams were mapped. Disturbances were placed into a temporal context to establish whether they were of pre-SRS or SRS origin.

Perennial and intermittent streams were field delineated and detailed maps created. Basin and valley characteristics were measured for each tributary. Accuracy of stream mapping and basin characterizations were enhanced using 2009 LiDAR imagery. Disturbed stream reaches potentially suitable for restoration or enhancement were identified. We summarized our data in GIS layers, text descriptions, and detailed tables.

Conclusions

- 1) Existing stream maps are often highly inaccurate and disturbance data were lacking to plan a broad scale stream assessment program.

Major Impact(s) of Research

- 1) We have provided improved stream basin characteristics, hydrological information, disturbance data and potential contaminant routes and linked these data to GIS layers.
- 2) Information and accurate maps will enhance future assessments by improving reference site or background selection as well as sample placement determination and justification.
- 3) We provided a foundation upon which a restoration program can be built.

Other Project Personnel

Garrett Stillings, Research Professional - SREL

External Collaborators

Susan Blas, SRNS-ACP

Dr. John Blake, USDA Forest Service-SR

Products (Publications, Presentations, Technical Reports)

Fletcher, D. E., G. K. Stillings, and C. D. Barton. 2012. Stream system field condition assessments-level I surveys. Final report submitted to SRNS-ACP and USDA Forest Service-SR. 219pp.

Fletcher, D. E., G. K. Stillings, M. H. Paller, and C. D. Barton. Legacy Disturbances and Restoration Potential of Coastal Plain Streams. Annual Meeting of the Southeastern Fishes Council. Chattanooga TN, (*Presentation*)

Assessing potential impacts of stannous chloride based mercury treatment on a receiving stream using real-world data from Tim's Branch, Savannah River Site.

Funding Entity

SRNL

Start Date and Funding Amount

December 2010; \$30,000.00

PI and co-PI's

Dr. B. Looney, D. Jackson, M. Millings, M. Paller, N. Halverson - SRNL

L. Bryan, Dr. J. Seaman, Dr. G. Mills - SREL

T. Matthews, J. Smith, M. Peterson, C. Miller - ORNL

Objectives

The objective of the project was to assess the impact of a stannous-chloride mercury treatment system on aquatic biota in Tims Branch, specifically to determine if (1) Hg concentrations in biota were dropping due to the treatment and (2) Sn concentrations in biota were increasing due to the treatment system.

Summary of Research Activities

We first determined the Sn concentrations in archived (2006) fish samples (whole fish) from Tims Branch. Hg concentrations for these samples were already archived. New fish samples were then collected in 2010 for Hg and Sn analyses for comparison with the archived data. Also, additional samples were collected in 2011, and included different biota (aquatic insect larva, etc.) as well as specific tissues (e.g., fish gills). To date, all samples have been analyzed for the specific metals and summation and analysis of the findings are on-going.

Conclusions

- 1) Hg concentrations in fish decreased after the stannous-chloride treatment was employed.
- 2) Sn concentrations generally increased in fish after the stannous-chloride treatment was employed.
- 3) Levels of Sn in specific biota types and/or tissues, and potential risks, have yet to be determined.

Major Impact(s) of Research

- 1) The stannous-chloride mercury treatment system reduced Hg inputs into Tims Branch, resulting in lower concentrations in biota.

Other Project Personnel

David Kling, Research Technician - SREL

External Collaborators

See PI/Co-PIs

Products (Publications, Presentations, Technical Reports)

Looney, B.B., L. Bryan, and T.J. Matthews (eds). 2012. Interim results from a study of the impacts of Tin (II) based mercury treatment in a small stream ecosystem: Tims Branch, Savannah River Site. SRNS-STI-2012-00202. Interim Project Report to the U.S. DOE Environmental management Office (EM-12), Washington, DC.

Biogeochemical Fate and Transport of Uranium in a Varying Saturated Wetland Environment

Funding Entity

SRNL

Start Date and Funding Amount

November 2011 \$65K

PI and co-PI's (and Affiliations)

Dr. H. Chang and Dr. John Seaman - SREL

Objectives

The objective of this research is to gain fundamental new scientific understandings of the coupled physical, chemical and biological processes affecting uranium (U) fate and transport in wetland sediments. More specifically, this research will provide new insights on how plant-induced alterations to the sediment biogeochemical processes affect the key uranium reducing microorganisms, the uranium reduction, its spatial distribution, the speciation of the immobilized uranium, and its long-term stability.

Summary of Research Activities

To achieve the objectives, we have formulated the following three hypotheses. (1) U(VI) discharged from ground- to surface-waters can be immobilized effectively as U(IV) in the sediments at the groundwater-surface water interface. The electron donor required to stimulate the microorganisms capable of reducing U(VI) is provided by wetland plants via their root exudates and root turnover; (2) Oxygen released into the sediments by plants reoxidizes Fe(II), forming iron oxy(hydroxi)des, which provide the bioavailable Fe(III) for long-term bacterial iron-reducing activity, which is key for sustaining biological uranium reduction; and (3) Because wetland sediments are anaerobic and wetlands are usually nitrogen limiting, U immobilized as U(IV), which is readily oxidized in the presence of nitrates, will remain stable in the sediments for extended time periods.

To confirm these hypotheses, a series of greenhouse microcosm studies was conducted with a native plant collected from SRS wetlands (*Sparganium americanum*). Initially, in order to develop Fe plaque on the root surface and a desired microbial community (i.e. *Geobacter spp.*) in the system, a nutrient solution containing a high concentration of Fe(II) was provided for about three months prior to the introduction of U(VI). All the solutions were prepared in the glove box with deoxygenated water, and the influent reservoir was kept in a N₂ atmosphere glove bag to prevent O₂ contact. At the end of the initial Fe plaque formation period, several selected microcosms were dismantled to examine the dominant microbial community in the rhizosphere using q-PCR. During the cultivation, pH and Eh were monitored and the concentrations of Fe(II), Fe_{total}, PO₄-P, and total U in pore water samples were analyzed. Currently, all mesocosms are dismantled for further analysis of separated roots and rhizosphere soil. Details of mineralogical changes and the U and Fe speciation following U introduction will be investigated along with the simulation of possible analogous scenarios occurring in the natural environment using geochemical models.

Conclusions

- 1) Based on the formation of Fe plaque around roots (readily observed as reddish mineral deposit) and the q-PCR results, the greatest microbial populations were generally identified on or near the roots when compared to the bulk soil.
- 2) *Methanogens* were the most abundant microorganisms. Target microorganisms (*Geobacter spp.* and *Anaeromyxobacter spp.*) were only identified in the soil with the plant, not in the plant-free control mesocosm. The results indicate that the target Fe/U reducing microorganisms were active with the plant root system and that the presence of plant roots was critical in sustaining the microorganism communities.
- 3) Preliminary batch experiments in the lab showed a significant effect of phosphorus on the behavior of U(VI) in aqueous system. The effect will be further examined when the final rhizosphere soil analysis data are available.

Major Impact(s) of Research

- 1) This research is required for decision making pertaining to environmental remediation and long-term stewardship at many DOE sites where U contaminated groundwater discharges to surface waters via a groundwater-surface water interface at which the sediment biogeochemistry may be affected by the presence of plants.

Other Project Personnel

Shea Buettner, MS Student – UGA

External Collaborators

Dr. Dan Kaplan - SRNL

P. Jaffe and P. Koster van Groos - Princeton University

Products (Publications, Presentations, Technical Reports)

Jaffe, P.R., P. Koster van Groos, D.I. Kaplan, D. Li, A.D. Peacock, K. Scheckel, H.S. Chang, and J.C. Seaman. 2012. Fate of Uranium During Transport Across the Groundwater-Surface Water Interface. 2012 DOE Subsurface Biogeochemical Research Programmatic Review. (*Presentation*)

Preliminary assessment of the prevalence of two amphibian diseases, ranavirus and chytrid, in contaminated and uncontaminated sites on the SRS

Funding Entity

DOE-SR

Start Date and Funding Amount

June 2012; \$6,000.00

PI and co-PI's

Dr. Stacey Lance, David Scott, Larry Bryan, and Dr. Olin Rhodes - SREL

Objectives

To conduct a pilot study to determine if there is a relationship between metal contamination and amphibian disease prevalence on the SRS.

Summary of Research Activities

There are many putative causes of amphibian declines, but exposure to environmental contaminants and emerging infectious diseases are among the most often cited. Disease associated with both the chytrid fungus, *Batrachochytrium dendrobatidis*, and viruses within the genus *Ranavirus* have been implicated in mass mortality events. Currently, there have been no studies examining the effects of metal contamination on ranavirus or chytrid ecology. From previous surveys, it is known that chytrid has been present on the SRS from the late 1970's but at very low prevalence. In the A-01 treatment wetlands, 64% of bullfrog tadpoles (*Lithobates catesbeianus*) were positive for the chytrid fungus. Ranavirus also occurs in the Southeast, and has been attributed to population die-offs in North Carolina, Tennessee, and Florida. In 2012, bullfrog tadpoles inhabiting the Tim's Branch system that were collected for metals analysis in spring/summer 2011 showed symptoms of ranavirus, which was diagnostically confirmed in one tadpole. Given that the A-01 wetlands--where chytrid occurrence is high--and Tim's Branch system are linked hydrologically it raises the concern that the metal contamination in that system is directly or indirectly increasing the susceptibility of amphibians to disease. We undertook a pilot study to determine how widespread ranavirus and chytrid are within three contaminated and two uncontaminated sites on the SRS. Of the 63 samples from reference sites none tested positive for chytrid or ranavirus; of 135 samples from contaminated sites, 68 (50%) and 4 (3%) were positive for chytrid and ranavirus, respectively. Prior to our sampling no toad species in South Carolina have ever tested positive for chytrid. We have begun sampling more widely across the SRS and are recruiting a graduate student to further examine amphibian diseases on the SRS.

Conclusions

1. Our preliminary assessment of chytrid and ranavirus on the SRS suggests a possible relationship between disease prevalence and metal contamination.

Major Impact(s) of Research

1. Because ranavirus and chytrid can cause serious die-offs and the SRS is home to more than 40 species of amphibians--including two at-risk species-- it is important from a stewardship perspective to safeguard our amphibian populations.
2. There are recommended decontamination procedures for areas with ranavirus and chytrid that could substantially affect all field workers on the SRS through increased time and cost.
3. The finding of chytrid in species other than bullfrogs in the A-01 wetlands is novel and the overall prevalence of chytrid there is both higher than has been the case for previous studies on the SRS as well as the highest recorded prevalence ever reported in the southeastern U.S.

Other Project Personnel

Schyler Nunziata and Cara Love - SREL

External Collaborators (and Affiliations)

NA

Products (Publications, Presentations, Technical Reports)

No publications, presentations, or reports have been prepared yet.

TASK 4. SREL public outreach and communication programs will focus on the SRS environment and ecological research to increase the public's understanding of scientific issues affecting the Site and to increase general ecological awareness

SREL Outreach Activities in FY12

The primary mission of the SREL Environmental Outreach Program is to educate the public about ecological research and environmental issues. The SREL also works with the Citizens Advisory Board, SRS organizations, regulatory authorities, and other stakeholder groups to raise awareness of site and regional ecological issues and opportunities. The program emphasizes SREL research on the SRS through oral presentations and exhibits, tours and various electronic media, through student, teacher, and organization training programs, and by communicating information to the popular press. To accomplish these goals, we focus on the following specific objectives:

- A. Publish articles on environmental issues and ecological research in popular press outlets including newspaper columns, popular magazines, University of Georgia publications, Department of Energy publications, encyclopedias, special publications such as alumni magazines and ancillary publications of scientific societies.
- B. Provide news releases, to newspapers and other appropriate media that relate to environmental activities of SREL, with particular emphasis on the SRS.
- C. Develop an on-site tour program that focuses on the environments of the SRS and the ecological projects of SREL.
- D. Give presentations to the public, including schools, civic groups, and other organizations that focus on environments of the SRS region and on SREL ecological projects.
- E. Develop portable and permanent exhibits appropriate for use at special presentations at SREL, schools, other organizations, and at special events.
- F. Develop video and slide shows for presentations to groups or for use by onsite organizations, emphasizing SREL environmental programs and projects on the SRS.
- G. Investigate opportunities for radio and television programs that focus on environmental issues, SREL ecological research, and ecological projects on the SRS.
- H. Develop and distribute brochures and other in-house publications that are informative about SREL's ecological research and environments on the SRS.
- I. Organize display presentations of SREL research projects in appropriate areas of the SREL facilities.
- J. Publish an SREL newsletter (the Grape Vine) as a means of internal communication.
- K. Develop the UGA conference center as a focal site for environmental education.
- L. Establish a photographic collection of slides and prints that documents the history of the SREL research programs, is informative about the plants, animals and habitats of the SRS region, and that emphasize current ecological projects of SREL.

- M. Maintain a collection of live plants and animals that can be used to educate the public about environmental issues and the conduct of ecological research.
- N. Maintain an educational website of wildlife native to the SRS with emphasis on identification of regional species and wildlife safety

In accomplishing the goal of communicating ecological information to non-scientists, we have provided on-site training and services to demonstrate the potential sources of injury from animals and plants found on the SRS and the CSRA that could occur to remote workers engaged in field activities or to employees and their families at home. We have conducted workshops and training sessions and have attended site monthly safety meetings where we delivered live animal and PowerPoint presentations. We also developed and distributed safety materials (protocol badge cards, safety fact sheets, and a website). While the primary focus of most of these wildlife safety programs has been on snakes and alligators, we are also able to provide information on plants, insects, spiders, snapping turtles, and mammals of concern.

The Outreach Program has participated in SRS outreach to the general public via the SRNS Public Tours program, with SREL providing a 45-60 minute presentation to an average of three tours each month year-round (40+ scheduled and impromptu presentations). Our presentations provide a general introduction about the history and ongoing mission of SREL and the lab's involvement with research, teaching, and community service. We conclude these programs by fielding questions from participants on wildlife identification, site environmental research programs, safety, and other ecological matters of public interest.

SREL also hosts a seminar program, which is open to SRS employees, on a variety of research and educational topics which are pertinent to the SRS mission. Speakers include SREL research scientists, invited scientists from other university or agency programs, and graduate students who are conducting research on the SRS.

Other programs in which Outreach personnel participate include: *Ecotalks*, an opportunity for students to have nature brought into their classroom for a face-to-face lesson on a variety of live animals found in local habitats; the *Ecologist for a Day* program allow students to spend the day in the field gaining hands-on knowledge of the plants and animals of the unique Upper Three Runs Creek area at the UGA Conference Center; civic group presentations; and ecological tours. All school programs incorporate science standards and curricula for particular school districts. In many of these programs participants get an opportunity to work with SREL staff as they catch, mark, and measure various species of reptiles, amphibians, fish, small mammals, and invertebrates. In addition, we offer an annual free program, *Touch an Animal Day*, to the CSRA community at the UGA Conference Center, which allows the public of all ages to interact with live animal and plant species, to meet site researchers, and to learn more about SRS efforts. Lastly, the Outreach Program offers tours of SREL facilities, as well as exhibits and workshops for the general public as well as onsite personnel.

The main SREL Outreach website receives numerous hits, as it has links to the popular *Ecologist for a Day* program, Outreach fact sheets and products, the *Ecoviews* weekly newspaper column, and also invites questions about SRS wildlife that are answered by Outreach personnel. This website is frequented by teachers from throughout the country who use the materials in their own classes. SREL distributes thousands of copies of educational products and materials nationwide to schools, organizations, and the general public.

TASK 5. SREL will maintain ecological data bases for use by the public, SRS, governmental, academic, and private organizations. These databases incorporate more than 6050 years of data collection on the SRS and provide a resource for understanding changes impacting ecosystems on the SRS and elsewhere in the southeastern United States

SREL Data Management Activities in FY12

Responsible management of research data plays an important role in preserving SREL's institutional memory. SREL has built a centralized repository of research data files and associated "metadata" necessary to make these data fully accessible. Goals of SREL's Research Data Archive activity are to avoid the inadvertent loss of data and to use advanced electronic computer/communication technology, including the use of computer networks and the Internet, to provide access to important data as efficiently as possible. A web-based SREL data archive system allows users to upload metadata information and actual data files directly from their office desktop computers. Anyone at SREL or on the SRS can search for data using this web-based system; however, decisions about releasing original data to third parties are retained by the principal investigators.

Loss of access to a secure SREL server due to security concerns in 2007 reduced our ability to interactively access this system. While the computer files still exist, they are not as conveniently linked and searchable as before and retrieval of these data would be quite time consuming. SREL has begun to return these data archive files to their previous condition. It is anticipated that this effort will assist SRS site tenants with accomplishing various missions on the SRS, interacting with relevant state and federal regulators, and collaborating with researchers from other universities in the preparation of funding proposals and manuscripts.

Currently, the recovered archive exists as a MS Access database. Linkages from the Access database to the accompanying data files were restored in FY11. In FY12, an assessment was conducted of the recovered data files. Since data have been archived over a long period of time, and technology continues to evolve, an analysis was conducted on file formats, using the file extensions. The vast majority are tagged with widely recognized extensions that are still supported. Files with custom extensions were found to be plain text files. A handful of files (14) were found in a proprietary format that is less widely supported than it used to be (Lotus). We may consider converting these files since some common software vendors have dropped support for this format. The overall number of projects and data files were also tallied, both from within the database, and from the external files. A total of 483/516 projects have both data and metadata at this time. If future funding levels allow, SREL would move to hire a data manager to complete the task of restoring archived files to full accessibility and development of a platform for archiving of recent and future data collected by SREL researchers.

TASK 6. SREL will serve as the point-of-contact for the “DOE Research Set-Aside” areas that are protected from Site impacts so that they are available for environmental research and can serve to establish representative standards for comparison to impacted areas on the SRS. Currently SRS has 30 ‘set-aside’ areas. SREL will also continue to promote the role of the SRS as a National Environmental Research Park

SREL Set Aside and National Environmental Research Park Activities in FY12

The SRS’s Set-Aside Program began in the 1960s when the Atomic Energy Commission (AEC) established 10 relatively small *SREL Reserve Areas* to represent the various habitats on the SRP and to secure study sites for conducting long term ecological research. The Program was expanded in the 1980s to 30 *DOE Research Set-Aside Areas* to better protect sensitive species habitats, preserve the biological integrity of Upper Three Runs Creek, and to buffer SREL’s long term research from encroaching forest management activities. These Areas are a significant component of the SRS landscape (7% of SRS totaling 14,560 acres/5,892 ha) and are found in 43 of the Site’s 89 timber resource compartments. There are approximately 275 miles (443 km) of posted boundary line.

Set-Aside Areas are critical to the DOE’s Environmental Stewardship mission: they provide for long term study sites as well as sanctuary and protection to much of the SRS’s sensitive flora and fauna, including many archaeological sites. They also serve as benchmarks or baseline controls for conducting ecological risk assessments, contaminant transport studies, and site remediation and restoration work. They exist today in strong support of the SRS being a National Environmental Research Park.

Administration and Management of the Set-Aside Areas -- Under the existing Cooperative Agreement with the DOE, SREL serves as the point of contact for the 30 Set-Asides and provides custodial oversight of the SRS Set-Aside Program. SREL chairs the DOE’s Set-Aside Task Group which approves management prescriptions, evaluates proposed ecological research, and ensures protection from onsite land use activities.

Currently, SREL performs critical, day-to-day functions such as SRS site use permit application reviews, research coordination, and leadership in addressing basic management issues. If future funding allows, additional functions such as boundary maintenance and the development and implementation of stewardship management plans, which are needed to maintain ecological integrity and future research value of the Set-Aside Areas will be addressed.

Set-Aside Oversight -- Management activities in FY 2012 focused primarily on Mona and Woodward Bays SA and Thunder Bay Set Asides. Prescribed fires were conducted in both of these Set Asides in response to loblolly pine invasion in the wetlands. Results were impressive. The fire at Mona killed most of the invading pines (some as much as 7-8 m tall) without any significant mortality in the surrounding uplands. The burn at Thunder Bay was also a success, although the site was less problematic to begin with. The Set Aside Task Group agreed that in the future both of these areas will be burned during regular prescribed burning of the surrounding timber compartments, to prevent future problems. The Set Aside Task Group also authorized first a thin on 8 acres at Thunder Bay for forest health and habitat improvement, and laid the groundwork with USFS-SR for restoration of Woodward Bay through timber removal. Pine invasion has been a longstanding problem in Woodward Bay, and can no longer be addressed by fire. The Set Aside Task Group also recommended thinning in the surrounding uplands for habitat improvement. It is projected that these activities would take place in FY 2013 or 2014.

SREL also reviewed effects of dormant-season fire along a portion of the E.P. Odum wetland SA, and the Set Aside Task Group approved growing season fire for this part of the Set Aside on a trial basis. SREL

visited the area again to observe baseline conditions and to survey for sensitive plant species that may have some vulnerability to fire.

National Environmental Research Park Support - SREL serves as the official SRS point of contact for the DOE National Environmental Research Park System. In its role as a point of contact, SREL conducts a variety of functions, one of which is the improvement and archiving of critical historical research data on the SRS. For example, SREL began developing a spatial component to the long-term turtle data that has been collected over several decades on the SRS. Existing GIS data from other sources have been cross-walked with the turtle database to fill in all previously documented locations. The resulting geographic data set has been mapped to provide an easy reference point for digitizing the remaining missing locations. Capturing the spatial component will greatly enhance the value of this important long-term dataset.

SREL also began reviewing its collection of site use permit files generated by previous personnel, to ensure data continuity and determine best steps to move the program forward.

As the representative for the Set-Aside program, SREL continued to participate in stakeholder meetings regarding military training activities on the SRS.

Current research on SRS Set Asides

- Archaeologists with the USC-Savannah River Archaeologist Research Program (SRARP) continued their investigations at Flamingo Bay. Human use of this site is now known to span ~13,000 years. Their current work is yielding important insights into both bay formation processes, and patterns of human activity in the early Holocene.
- Researchers at SREL and a collaborating institution are examining predator-prey interactions between snakes and songbirds in Field 3-412. The research includes using videography to document nest predators and radio telemetry to explore links between snake movement patterns and predation rates of songbird nests.
- A mark-recapture population analysis of greater sirens and two-toed amphiumas continues in Dry Bay. This study examined the distribution of species and individuals among microhabitats and depth levels in the bay and focused on the ability of these species to sense and respond to chemical cues from predators.
- Research on habitat use of state-endangered gopher frogs continues at Craig's Pond and Sarracenia Bay SA. Data will be useful in management of this Set-Aside as well as Mona Bay, which is also gopher frog habitat.
- Mark-recapture studies of black swamp snakes continue at Ellenton Bay. Long-term monitoring of these aquatic snake populations and their community dynamics will aid in understanding their response to environmental variation (drought) and amphibian prey availability.
- Tick ecology research at Dry Bay was completed in FY 2012, and manuscripts are in preparation. The work was part of a NSF-funded initiative to understand drivers of geographic variation in Lyme disease.
- UGA graduate researchers continue to sample zooplankton assemblages in several Set-Asides containing seasonal wetlands. Comparison with existing scientific literature indicates that the SRS

zooplankton community is the most species-rich of any comparable system yet studied. Their research attempts to uncover the reasons behind this remarkable diversity.

- A series of temporary mesocosms have been placed in the Ellenton Bay Set-Aside to assess zooplankton dispersal from the bay. This work is part of a UGA student's dissertation research.
- Pre- and post-burn soil samples were collected from Mona and Woodward bays in order to examine possible effects of fire on aestivating zooplankton. Little information is currently available on this subject.
- Researchers continue to maintain duck boxes at Ellenton Bay, Steel Creek Bay, and Flamingo Bay, as part of a long-term (since the 1970s) study of the breeding ecology of wood ducks on the SRS.
- Rainbow Bay, Ellenton Bay, Ginger's Bay, and Flamingo Bay continue to serve as reference sites for several amphibian ecotoxicology studies, including effects of copper in the Tritium Facility's H-02 Treatment Wetlands and metals uptake in the P-Area ash plume.
- The amphibian community at the Rainbow Bay Amphibian Reserve Set Aside has been monitored for 33 consecutive years, during which time dramatic changes in species composition and population sizes have occurred. Researchers are also investigating genetic changes over time for mole and marbled salamanders to better understand how population size relates to genetic diversity, which is important for conservation efforts.
- Intensive studies of marbled salamanders, the species most ecologically similar to the federally endangered flatwoods salamander, have been conducted at Ginger's Bay since 1986. Recent modeling of pond-breeding salamanders at Ginger's Bay showed that a large proportion of the population utilizes habitat well beyond the Set Aside boundary. Researchers are also using molecular techniques to examine mating behavior and reproductive success.
- SREL researchers continue collecting amphibian tissue samples to gather pilot data for future studies of amphibian landscape genetics and effects of future climate change. Samples from eight species have been collected from ~35 isolated wetlands across the SRS, including the following Set Asides: Rainbow Bay Amphibian Reserve, Dry Bay, Ellenton Bay, Mona and Woodward Bays, Flamingo Bay, Thunder Bay, Craig's Pond and Sarracenia Bay, Ginger's Bay, and Road 6 Bay.
- SREL's Outreach Program continues to use the E.P. Odum Wetland Set-Aside as an outdoor classroom during its enormously popular "Ecologist for a Day" programs. These programs give K-12 students hands-on experiences in ecological research, foster understanding of environmental issues, promote environmental stewardship, and encourage students to consider careers in science.
- Researchers from SREL and SRNL are using Set-Aside streams in a SERDP-funded project to develop ecological reference models and an assessment framework for other southeastern coastal plain stream systems common to the DOD's military reservations.
- Researchers from SREL, USFS-SR, and University of Kentucky continue stream characterization in the UTRC/Tinker Creek and Meyers Branch set-asides. This research, part of the ACP Stream Restoration Baseline Project, will be used to inform future DOE restoration and mitigation efforts.

TASK 7. Through general research and public outreach programs, SREL will increase scientific understanding in the general areas of environmental characterization, ecological risk assessment, and environmental remediation and restoration. This will require research on topics such as terrestrial and aquatic ecology, environmental chemistry, molecular ecology and genetics, microbial ecology, radiation ecology, and ecotoxicology. SREL will also continue to communicate and coordinate with SRS contractors and the public on these issues

In FY12 SREL faculty, staff, and students conducted and completed a diversity of outreach and education programs for the public and environmental research projects on the SRS in support of the missions of DOE-NNSA on the site. Specifically, outreach programs were conducted for local community residents on behalf of DOE as part of ongoing community education programs to increase environmental awareness of citizens and provide independent information to community residents relative to the activities of site tenants. In addition, specific research programs were conducted for NNSA to assess the environmental consequences of the Mixed Oxide Fuel Fabrication Facility on local stream quality and function as well as to assess the function, performance, and environmental consequences of constructed wetland treatment systems for metal sequestration associated with the NNSA Tritium facility on the SRS. These programs were funded by NNSA and the details of these projects are outlined below:

Research Support to DOE National Nuclear Security Agency

H-02 Constructed Wetland Studies: Amphibians

Funding Entity

NNSA - Tritium

Start Date and Funding Amount

November 2011; \$306,149.00

PI and co-PI's

Dr. Stacey Lance and David Scott – SREL

Objectives

Our research at the H-02 constructed wetland complex focuses primarily on four questions related to these treatment wetlands: 1) Over time, what amphibians, reptiles, and plants have become established in the wetlands? 2) Is there any evidence that elevated trace metal levels (e.g., copper and zinc) in the wetlands affect amphibian reproductive and recruitment success? 3) How do the amphibian diversity and numbers compare to other, more natural, wetlands? 4) As the constructed wetlands age, how will the amphibian community respond?

Summary of Research Activities

This report summarizes our amphibian studies related to the H-02 treatment wetlands from October 2011 to September 2012. We used aquatic trapping and adjacent drift fence arrays with pitfall traps to characterize biota of the treatment wetlands. We estimated the tissue concentrations of Cu, Zn, and lead (Pb) of amphibians inhabiting the wetlands, and conducted field and laboratory tests on effects of Cu concentration on amphibian development in four species (the southern toad, *Anaxyrus (Bufo) terrestris*, the eastern narrowmouth toad, *Gastrophryne carolinensis*, the southern leopard frog, *Lithobates (Rana) sphenocephalus*), and the marbled salamander, *Ambystoma opacum*). In our laboratory studies, we added dietary Cu exposure in addition to aqueous exposure to better mimic conditions in the H-02 wetlands (i.e., make the laboratory experiments more realistic). We are also developing a protocol that will enable us to manipulate metal concentrations, and keep them relatively stable, in artificial mesocosms.

Our lab and field experiments continue to focus on individual- and population-level variation in responses to contaminant exposure; our long-term goal is to identify potential underlying genetic components of tolerance to metal stressors. We have observed among clutch and among location differences in tolerance to elevated Cu levels in several species, which suggests the potential for amphibian species to adapt to

elevated levels of metals. Rainbow Bay and other isolated wetlands serve as comparison sites for the H-02 amphibian studies. We completed the 34th year of monitoring at Rainbow Bay, and have begun analyzing these data in the context of community shifts in response to environmental change and altered hydrology.

Conclusions

- 1) Larvae and metamorphs from our controlled laboratory experiments have Cu body burdens comparable to those in metamorphs from the H-02 wetlands, suggesting our lab conditions accurately approximate field exposures. Embryo and early hatchling survival is reduced by Cu exposure in *L. sphenoccephalus*, *A. terrestris*, *G. carolinensis*, and *A. opacum*, but sensitivities differ among species, individuals, and populations.
- 2) Among population differences in tolerance to elevated metal concentrations suggest that there may be the potential for some species to adapt to elevated levels of metals.
- 3) The amphibian community at Rainbow Bay had shifted from long- to short-hydroperiod species over three decades in response to drought and associated shortened wetland hydroperiods. The Rainbow Bay data are useful for building conceptual models of the impact of climate change on southeastern isolated wetlands.

Major Impact(s) of Research

- 1) Our time series of metal concentrations in the H-02 system (in sediments, water, and biota) will enable informed assessment of how this type of constructed treatment wetland functions, and whether it provides suitable wildlife habitat in addition to enhancing water quality.
- 2) Our focus on variation in tolerance to metals, as well as underlying differences in gene expression profiles, will provide a better understanding of whether, and how, a species can adapt to elevated environmental contaminant loads.
- 3) Our understanding of the factors that drive the population dynamics of amphibians in natural systems, based on the long-term RB study, will allow predictions of the effects of climate change, and insights to land managers who may need to design protective measures for rare species.

Other Project Personnel

Wes Flynn, PhD student - UGA

Diana Soteropoulos, Research Technician - SREL

External Collaborators

Dr. Wendy Kuhne - SRNL

Schyler Nunziata - University of Kentucky

Susan Walls - USGS

Products

Lance SL, Erickson MR, Flynn RW, Mills GL, Tuberville TD, and Scott DE. 2012. Effects of chronic copper exposure on development and survival in the southern leopard frog [*Lithobates (Rana) sphenoccephalus*]. *Environmental Toxicology and Chemistry* 31:1587-1594.

Lance SL, Erickson MR, Flynn RW, and Scott DE. (2013). Individual and Population Level Differences in Tolerance to Chronic Copper Exposure in Southern Toads, *Anaxyrus terrestris*. *Environmental Pollution* 177:135-142. (*Submitted*)

Scott, DE, Komoroski MJ, Croshaw DA, and Dixon PM. Terrestrial distribution of ambystomatids around an isolated wetland. *Ecology*. (*Submitted*)

Walls, SC, Barichivich WJ, Brown ME, and Scott DE. Influence of drought on salamander occupancy of isolated wetlands on the southeastern Coastal Plain of the United States. *Wetlands*. (*Submitted*)

Lance SL, Flynn RW, Jones KL, Erickson M, and Scott DE. 2012. Amphibians living in a contaminated environment: Individual, population, and species level differences in response to chronic copper exposure. Odum School of Ecology, University of Georgia. (*Presentation*)

Lance SL, Flynn RW, Jones KL, Erickson M, and Scott DE. 2012 Amphibians living in a contaminated environment: Individual, population, and species level differences in response to chronic copper exposure. The Institute of Environmental and Human Health, Texas Tech Univ. (*Presentation*)

- Scott DE, and Metts BS. 2012. Shifts in the amphibian community over 30 years at an isolated wetland: Has climate change altered wetland hydrology? Annual meeting of the Society for Integrative and Comparative Biology. Charleston, SC. (*Presentation*)
- Nunziata SO, Scott DE, and Lance SL. 2012. Genetic and demographic patterns of populations of *Ambystoma opacum*. Annual meeting of the Society for Integrative and Comparative Biology. Charleston, SC. (*Presentation*)
- Lance SL, Flynn RW, Scott DE, and Jones KL. 2012. Chronic copper exposure in southern toads, *Anaxyrus terrestris*: lethal, sublethal, and gene expression effects. Annual meeting of the Society for Integrative and Comparative Biology. Charleston, SC. (*Presentation*)
- Flynn RW, Scott DE, and Lance SL. 2012. The lethal and sublethal consequences of copper exposure for *Lithobates sphenoccephalus* and *Gastrophryne carolinensis*. Annual meeting of the Society for Integrative and Comparative Biology. Charleston, SC. (*Presentation*)
- Lance SL, Flynn RW, Jones KL, and Scott DE. 2012. Individual and population level differences in response to copper in the southern toad, *Anaxyrus terrestris*. Society for Environmental Toxicology and Chemistry North America 33rd Annual Meeting, Long Beach, CA. (*Presentation*)
- Flynn RW, Scott DE, and Lance SL. 2012. An examination of maternal and paternal contributions to responses of embryonic and larval southern toads, *Anaxyrus terrestris*, to copper. Society for Environ.Tox. and Chemistry North America 33rd Annual Meeting, Long Beach, CA. (*Presentation*)
- Soteropoulos DL, Flynn RW, Lance SL, Seaman J, and Scott DE. 2012. Zinc does not ameliorate the negative effects of copper in southern leopard frog embryo survival. Annual meeting of the Carolinas Chapter of the Society for Environ. Tox. and Chemistry. Aiken, SC. (*Presentation*)
- Flynn RW, Scott DE, and Lance SL. 2012. Intra- and inter-population variation in response to copper in two pond-breeding amphibian species. Annual meeting of the Carolinas Chapter of the Society for Environmental Toxicology and Chemistry. Aiken, SC. (*Presentation*)
- Soteropoulos DL, Flynn RW, Lance SL, and Scott DE. 2012. Effects of copper exposure on hatching success and early larval survival in marbled salamanders, *Ambystoma opacum*. Annual meeting of the Southeastern Population Ecology and Evol. Genetics group, Clemson, SC. (*Presentation*)

H-02 Constructed Wetland Studies—Metal Biogeochemistry

Funding Entity

NNSA - Tritium

Start Date and Funding Amount

September 2011; \$\$436,522

PI and co-PI's

Dr. Gary Mills - SREL

Objectives

This research seeks to support, assess and improve operations of the tritium constructed wetlands. Constructed wetlands play an important role in the SRS environmental plan to achieve both federal and state regulatory compliance for the discharge of effluent waters. A fundamental understanding of the biogeochemical processes underlying metal sequestration and the reduction of toxicity in effluent waters will serve to better predict the seasonal variability in metal dynamics and potential impacts to receiving streams. In addition, this research will improve the database, including biogeochemical markers, for predicting the temporal evolution of a newly constructed wetland to a mature, functioning steady-state system.

Summary of Research Activities

Data from water samples taken biweekly at several sites within the wetland system and upstream and downstream reference locations in Upper Three Runs Creek (UTR) include total and dissolved metals, and standard water quality constituents including dissolved organic carbon, pH, temperature and redox potential. These data indicate that significant quantities of Cu and Zn discharged from the Tritium Facility are removed from the water in the wetland. Since the beginning of the study, the mean influent Cu concentration was 31.5 ± 12.1 ppb and the mean effluent concentration was 11.9 ± 7.3 ppb, corresponding to an average Cu removal of 64%. Zn concentrations were more variable, averaging 39.2 ± 13.8 ppb in the influent and 25.7 ± 21.3 ppb in the effluent. Average Zn removal was 52%. In addition, the wetland ameliorated high pH values associated with the influent water, occasionally greater than 10, to values similar to those measured at reference sites in Upper Three Runs Creek. Water sample data have also been used to support amphibian bioaccumulation and toxicity studies at SREL.

Seasonal variations in dissolved organic carbon concentration corresponded to seasonal variations in Cu and Zn removal efficiency. Water samples were also collected seasonally for standard EPA toxicity assays using *Ceriodaphnia dubia*. The results of these assays demonstrated that toxicity of Cu was reduced in wetland effluent waters as compared to standard laboratory water, and that constituents in both particulate and dissolved phases played a role in reduction of toxicity.

The water chemistry data were used in parameterizing the biotic ligand model (BLM) to predict the bioavailable forms of Cu and Zn and assess the toxicity to receptor organisms. The model predictions were compared with the EPA water effects ratio calculated using results from the *C. dubia* assays. It was concluded that the water effects ratio is a better predictor of toxicity in the H-02 wetland system, because the BLM results overestimated the toxicity of the water as compared to results from the *C. dubia* assays. This is likely due to the acidic pH and low hardness values of the blackwater streams of the SRS. Sediment core samples have been collected approximately biannually since wetland construction to monitor changes in trace metals, sulfides, and organic C and N. The concentration of Cu and Zn in the surface layer of the sediments has increased over the lifetime of the wetland and, like removal efficiency, demonstrated seasonal variation. By design, sulfate-reduction in the wetland should contribute to mineralization of Cu as copper sulfides within the sediments over time. We measured sulfide in vertical profiles in sediment cores to determine potential for this process and the depth at which it occurs. Black layers within sediment cores, indicating sulfide formation, were observed with increasing frequency since wetland construction. Reduced sulfur concentrations in the sediments ranged from below detection limits (<200 ppm) to 1,480 ppm; however, the highest concentrations did not necessarily correspond to

sediment depth or color. Determination of organic C and N provides an estimate of the nutrient quality of the sediment organic matter. C and N did not vary considerably in the H-02 samples analyzed thus far, but comparison with A-01 suggested some additional changes to be expected in the wetland over time which are being examined more closely with recently collected sediment samples.

Conclusions

- 1) The H-02 constructed wetland effectively reduces Cu and Zn concentrations in the Tritium Facility discharge waste water to achieve SCDEHC regulatory limits
- 2) The high biological productivity of the wetland also generates high concentrations of dissolved organic matter which complexes the metal discharged from the wetland which reduces the metal bioavailability and, consequently, the toxicity of the waste water entering Upper Three Runs stream.

Major Impacts of Research

- 1) This research supports the use of cost effective constructed wetlands for the treatment of metal contaminated waste water and supports DOE goal of employing “green technologies” for waste cleanup and remediation.
- 2) Results of our studies will support the EPA’s goal of advancing our understanding of metal speciation in natural waters and developing better tools for predicting the fate and effects of metals aquatic ecosystems

Other Project Personnel

Dr. Elizabeth Burgess, Postdoctoral Associate - SREL
Angela Lindell, Research Professional - SREL
Shelby Weathersbee, Undergraduate - USC-Aiken
Aubrey Danielson, Undergraduate - USC-Aiken
Jonathon Josephson, Undergraduate - Clemson University

External Collaborators

Dr. Michele Harmon - USC-Aiken

Products

- Burgess, E.A., G.L. Mills, S.M. Harmon, R. Sharitz, and E.A. Nelson. 2012. Development and functioning of a wetland constructed for copper and zinc removal. *Science of the Total Environment (submitted)*.
- Mills, G.L. E.A. Burgess, A. Lindell, and S.M. Harmon. 2012. Biogeochemical processes in a treatment wetland mitigating metal discharge into Savannah River tributary. SETAC North America 33rd Annual Meeting. (*Presentation*)
- Burgess, E.A., A. Whitley, V. Samarkin, R. Sharitz, M. Harmon, E. Nelson, G.L. Mills. 2012. Biogeochemistry in a wetland constructed for removal of Cu and Zn. 2012 Carolinas SETAC Annual Meeting, (*Presentation*)

Environmental Outreach Programs

Funding Entity

NNSA - MOX

Start Date and Funding Amount

March 2011; \$280,000

PI and co-PI's

Dr. J Whitfield Gibbons - SREL

Objectives

SREL will assist the SRS NNSA mission and MOX Project by educating the public through community outreach activities that include organizing tours and exhibits featuring the local ecology and associated research; conducting environmental education workshops for teachers, students and the general public as well as for site personnel; development of a variety of environmental education materials for diverse audiences; increasing internet accessibility of information ; distributing ecological information; presentation of data and reports on the local and regional environment; and assisting in educational efforts about the importance of environmental stewardship and National Environmental Research Park programs at the SRS. Accomplishments relative to these tasks will be summarized in an annual report.

Summary of Program Activities

The SREL Environmental Outreach Program uses information from SREL research that is ongoing currently as well as from long-term research efforts to provide training and services to MOX and other SRS employees and to educate the public locally, regionally, and nationally about ecological research findings associated with onsite activities.

NNSA has provided critical funding that has allowed SREL to accomplish the goal of maintaining SRS and public outreach programs in order to enhance the understanding of environmental issues affecting the SRS and to increase general ecological awareness. Consistent with the goals of DOE and NNSA, SREL this past year provided information and presentations to schools and programs in addition to resource materials to demonstrate the ecological health of the SRS, and the importance of environmental stewardship and National Environmental Research Park (NERP) programs on the SRS. Accordingly, the Outreach program remained available to conduct Lunch and Learn presentations to site personnel at the MOX facility and provide tours for DOE site interns and new MOX employees. SREL produced and distributed literature on native SRS plants and animals and on specific research programs, and maintained the MOX Conservation Garden at the facility.

The SREL Outreach Program is designed to enhance SREL's overall mission of acquiring and communicating environmental knowledge and to highlight NNSA's and DOE's focus on environmental issues on the SRS. We accomplish these goals via education initiatives that include 1) Environmental safety on the SRS, 2) On-site outreach to the general public and site personnel, and 3) Off-site outreach activities at schools and community events. Issues as diverse as wildlife safety in the field, wildlife population declines, potential responses of organisms to contamination, distribution and abundance of sensitive species, wetland dynamics and remediation, water quality, and dispersal of organisms from radioactively or chemically contaminated sites all are important to onsite personnel and the general public.

Major Impact(s) of Program

- 1) SREL has been heavily involved in assisting the MOX project by facilitating the environmental component of the LEED (Leadership in Energy and Environmental Design) certification requirements.
- 2) SREL's Outreach program has communicated information about environmental activities on the SRS for more than two decades based on ecological research conducted onsite by SREL scientists. The Outreach programs communication efforts through numerous presentations and exhibits annually, coupled with SREL's credibility with the general public, have greatly aided in raising awareness of

the rich ecological diversity of the MOX area on the SRS and the region in general in order to encourage people to appreciate their setting, engage in environmental stewardship, and protect environmental integrity on and off the site.

Other Project Personnel

Sean Poppy, Program Specialist - SREL

Angela Tucker, Animal Caretaker

Judy Green-McLeod, Research Professional - SREL

Chris Hagen, Research Technician - SREL

Jennifer Gibbons, Public Relations Specialist - SREL

External Collaborators

Dr. Kimberly Andrews - Georgia Sea Turtle Center

Products

- 1) Conducted 53 scheduled Public Tours and tours for onsite personnel; estimated number of attendees - 1,290.
- 2) Provided 6 Wildlife safety talks for SRS employees; estimated number of attendees - 275.
- 3) Presented 233 classroom education programs for elementary and secondary students; estimated number of attendees - 12,956.
- 4) Provided 36 environmental outreach presentations to college, civic, and professional groups; estimated attendees - 2,321.
- 5) Provided 20 Exhibits at local and regional events; estimated number of attendees - 16,303. [includes 2 safety exhibits (estimated 700 attendees); 3 career exhibits at schools (estimated 825 attendees); 5 science night exhibits at schools (estimated 1,354 attendees)].
- 6) Hosted 2 training workshops for organizations; (South Carolina Conservation District Employees Association; CSRA Geocachers) - estimated number of attendees – 51.
- 7) Conducted 42 Ecologist for a Day Programs (school field trips to SREL’s Conference Center); estimated number of attendees - 880.
- 8) Conducted 1 Touch an Animal Day (August 25, 2012, at UGA Conference Center - estimated number of attendees - 693.
- 9) Provided 17 presentations at regional library summer reading programs - estimated 1,774 attendees
- 10) Facilitated 3 high school job shadows (2 from Midland Valley High, 1 from West Ashley High, Charleston, SC)

***Total Outreach events: 433; Total estimated attendance: 36,546**

Microbial antibiotic resistance characterization of the MOX stream (U8)

Funding Entity

NNSA - MOX

Start Date and Funding Amount

March 2011; \$220,000

PI and co-PI's

Dr. J Vaun McArthur – SREL

Objectives

- 1) Determine whether the MOX stream (U8) is acting as a gene nursery for antibiotic resistance genes.
- 2) Determine whether any resistant bacteria or resistance genes are being transported into Upper Three Runs Creek which flows directly into the Savannah River.
- 3) Characterize the bacteria and antibiotic resistance genes found in this stream and monitor the bacteria and antibiotic resistance genes being transported out of the stream.
- 4) Recommend possible remediation strategies for consideration.

Summary of Research Activities

Pathogenic/Non-Pathogenic Differences – We expect ash basins to behave as a kind-of bioreactor or “gene nursery”, a site for cultivating increased abundance of resistance traits in bacterioplankton. It is not known whether these increases occur due to vertical or horizontal processes. To address these unknowns we determined the relationship among resistance traits in environmental bacteria and those found in water-borne pathogens.

AR Traits and Downstream Distance – We have collected over 3,000 isolates from eleven locations on eight streams including the MOX stream (U8) and Upper Three Runs Creek. From these samples we have isolated and screened over 3,000 *E. coli* for resistance profiles. From these analyses we have found that the bacteria from the MOX stream (U8) and from U4 (F-area) were resistant to nearly twice as many antibiotics as the other streams sampled. Both U4 and the MOX stream (U8) have been heavily impacted by site operations. In the headwaters of the MOX stream (U8) is an active coal ash basin which is not on the MOX property. However during storm flows water percolating through this basin transports leached metals into the flowing section of the MOX stream (U8). It is not clear what the selective pressure on the U4 bacteria is at this time but these results suggest the need for additional studies.

Conclusions

- 1) *E. coli* isolated from the MOX stream (U8) and U4 harbor more antibiotic resistance traits than similar isolates collected at other SRS streams

Major Impact(s) of Research

- 1) Knowing whether anthropogenic effects on freshwater ecosystems can affect the ability of environmental bacteria to transfer resistance traits to water-borne pathogens is of significant evolutionary and ecological importance.
- 2) Results from this aspect of the study will greatly increase our knowledge about the role of environmental stresses in the maintenance and dissemination of antibiotic resistance traits.

Other Project Personnel

Paul Stankus, Research Professional - SREL

External Collaborators

Dr. R. Cary Tuckfield - Ecostatys, LLC

Products (Publications, Presentations, Technical Reports)

No publications, presentations, or reports have been prepared yet.

Restoration of the MOX stream (U8): Initial efforts

Funding Entity

NNSA - MOX

Start Date and Funding Amount

July 2012; \$220,000

PI and co-PI's

Dr. J Vaun McArthur and Dean Fletcher – SREL

Objectives

The overarching goal of this study is to begin a systematic restoration of the MOX stream (U8). During this budget year we will obtain a more detailed profile of the hydrology during base and storm flows and begin collections and analysis of stream invertebrates to determine levels of bioaccumulation of toxic metals.

Summary of Research Activities

We have collected crayfish and dragonfly nymphs from the MOX stream (U8) as well as four other streams that will be used for comparisons. In addition we have collected sediment samples from each of these five streams. Mercury concentrations ($\mu\text{g/g}$ dry wt) will be determined with a Milestone DMA 80 by cold vapor atomic absorption spectroscopy and metal/metalloid concentrations ($\mu\text{g/g}$ dry wt for As, Cd, Cr, Cu, Ni, Pb, Se, Sr, U, & Zn) will be determined on an ICP-MS. For quality assurance, samples will be analyzed in batches containing a blank and standard reference material of known concentration.

Conclusions

1) This research has just begun, thus there are no conclusions at this time.

Major Impact(s) of Research

- 1) SREL will assist the SRS NNSA mission and MOX Project by beginning a restoration of the stream that drains the MOX complex. This stream prior to MOX construction harbored a healthy stream invertebrate assemblage.
- 2) We will enable the determination of possible effects caused by MOX operation in the future and meet the expectation of the Environmental Impact assessment for no impacts.

Other Project Personnel

Paul Stankus, Research Professional - SREL

Angela Lindell, Research Professional - SREL

External Collaborators

None

Products (Publications, Presentations, Technical Reports)

No publications, presentations, or reports have been prepared yet.

TASK 8. SREL will continue to serve as a regional resource for scientific expertise and environmental research. SREL staff scientists will continue to provide special technical assistance to other site contractors, area stakeholders, other researchers, and the public. SREL will also continue to collaborate with scientist from other institutions

In FY12 SREL faculty, staff, and students conducted a diversity of environmental research projects both on and off of the SRS in support of their mission to pursue collaborations and funding to serve as a region source of scientific expertise and to provide technical assistance to other site contractors, stakeholders, other researchers, and the public. Due to both the specific technical expertise represented by research faculty and staff at SREL and the unique opportunities for scientific research represented on the Savannah River Site, SREL scientists are often sought out as potential collaborators by researchers across the globe. SREL staff served as collaborators on both funded and non-funded research involving environmental remediation, ecotoxicology and environmental stewardship and, as Principal Investigators or co-Investigators on funded research all over the United States and Internationally. In addition, SREL faculty, staff and students served as hosts for over 124 researchers from other universities, federal and state agencies, and non-governmental organizations to discuss and conduct collaborative research and funding. Research, external funding, and requests for technical assistance conducted in support of this task are outlined below:

Collaborations and Externally Funded Research on the SRS

Reassessing the Use of ANCOVA in Ecotoxicological Studies

Funding Entity

NNSA via DOE CA

SREL Collaborators

David Scott, Dr. Stacey Lance, Dr. Brian Metts

Objectives

Many ecological and ecotoxicological studies that examine the effects of dependent variables on response variables such as body size often use analysis of covariance (ANCOVA) inappropriately, because the covariate itself is affected by the experimental treatment. We are working with statistical collaborators to review these methods, and present alternatives such as path analysis that would be a better analytical tool in ecotox studies.

Summary of Research Activities

To date we have located numerous studies that illustrate the inappropriate use of ANCOVA.

Conclusions

- 1) Because the covariate itself is affected by experimental treatments in many ecotoxicology studies, the assumptions underlying ANCOVA are violated—other analyses, such as structural equation modeling or path analysis, are more appropriate.

Major Impact(s) of Research

- 1) Our review should result in a revised method for analyzing data from ecotoxicology experiments when survivorship differs among treatment groups of organisms that are exposed to contaminants, and when resulting density effects need to be teased apart from the treatment effects on other response variables.

Other Project Personnel

None

External Collaborators

Dr. Stephanie Hampton - UC Santa Barbara

Dr. Jim Novak - Eastern Illinois University

Products (Publications, Presentations, Technical Reports)

No publications, presentations, or reports have been prepared yet.

Using Stable Isotope Spikes to Determine Amphibian Dispersal: A Pilot Study

Funding Entity

SREL

SREL Collaborators

David Scott

Objectives

We conducted a pilot study using ^{15}N enrichment of the aquatic habitat, thereby “marking” metamorphic amphibians. Because newly metamorphosed amphibians may not be recaptured until adulthood one or more years later, we sought to determine whether ^{15}N enrichment would persist to sexual maturity.

Summary of Research Activities

Marbled salamanders (*Ambystoma opacum*) were reared in artificial mesocosms enriched with $^{15}\text{NH}_4\text{Cl}$. Initial doses to larvae resulted in $\delta^{15}\text{N}$ levels in metamorphs elevated >1,000 times above controls ($4.76 \pm 0.45 \text{ ‰}$). Metamorphs were held in the laboratory for up to seven months and fed on non-enriched crickets; juvenile ^{15}N levels were determined at 1 mo and 7 mo post-metamorphosis to estimate the biological half-life (BHL) of ^{15}N .

Conclusions

- 1) Seven months after metamorphosis, $\delta^{15}\text{N}$ remained high (1,800 ‰) in salamanders from the spiked treatment, approximately 225 times controls.
- 2) The mean BHL for $\delta^{15}\text{N}$ in the ^{15}N -added treatment was 3.67 ± 0.19 months.

Major Impact(s) of Research

- 1) Our BHL estimates suggest that the enrichment technique is feasible for amphibians, as metamorphs will leave isotopically enriched sites with a stable isotope signature that persists for at least two years.
- 2) Using stable isotopes to study amphibian metapopulation dynamics should be fruitful research.

Other Project Personnel

None

External Collaborators

Yurena Yanes - University of Cincinnati

Betsie Rothermel - Archbold Biological Station

Dr. Melissa Pilgrim - University of South Carolina-Upstate

Dr. Chris Romanek - University of Kentucky

Products (Publications, Presentations, Technical Reports)

No publications, presentations, or reports have been prepared yet.

Amphibian Research at the Low Dose Irradiation Facility (LoDIF)

Funding Entity

SREL

SREL Collaborators

David Scott

Objectives

In parallel with a renaissance for nuclear power in North America and Europe, a new environmental radiation protection system calls for environmental indicators of radiological stress. We conducted several studies at SREL's Low Dose Radiation Facility to better understand the effects of low-dose chronic gamma radiation on amphibian development.

Summary of Research Activities

Because environmental stressors seldom occur alone, we investigated the combined effects of an ecological stressor (larval density) and an anthropogenic stressor (ionizing radiation) on amphibians. Spadefoot toad (*Scaphiopus holbrookii*) tadpoles reared at different larval densities were exposed to four low irradiation dose rates from ^{137}Cs during the sensitive period prior to and throughout metamorphosis. Body size at metamorphosis and development rate served as fitness correlates related to population dynamics. We also assessed the radiosensitivity of embryos, larvae, and metamorphs at multi-level endpoints in *Bufo terrestris* (Southern Toad). Toads were exposed to low dose rates of ^{137}Cs of 0.13, 2.4, 21, and 222 mGy d⁻¹ and total doses up to 15.8 Gy.

Conclusions

- 1) Radiation exposures did not result in significant effects on hatching success of eggs, larval survival, or length of development.
- 2) An ecological stressor, in the form of high larval densities, affected developing *S. holbrookii* tadpoles (late-stage 37-39) to a greater extent than exposure to low dose rates (up to 222 mGy d⁻¹) of ionizing radiation from ^{137}Cs .

Major Impact(s) of Research

- 1) Because radiation had no impacts on our measured response variables, our study supports the IAEA guideline of 10 mGy d⁻¹ for aquatic biota.
- 2) These data are an important contribution to the radiation-effects database because they involve studies on amphibians (for which many radioecological data gaps exist).

Other Project Personnel

None

External Collaborators

Dr. Karolina Stark - Stockholm University

Dr. Tom Hinton - IRSN

Dr. Olga Tsyusko - University of Kentucky

Products (Publications, Presentations, Technical Reports)

Stark, K, Scott DE, Tsyusko O, Coughlin DP, and Hinton TG. 2012. Effects of two stressors on amphibian larval development. *Ecotoxicology and Environmental Safety* 79:283-287.

Stark K, Scott DE, Tsyusko O, Coughlin DP, and Hinton TG. Multi-level effects on amphibian egg and larval development exposed to low dose rates of ^{137}Cs . *Aquatic Toxicology (Submitted)*

Changes in vertebrate stoichiometry across ontogeny when complex life-histories present stage-specific demands

Funding Entity

SREL

SREL Collaborators

David Scott, Dr. Gary Mills, Diana Soteropoulos

Objectives

We used pond-breeding amphibians with complex life-histories to investigate the influences of life-stage-specific demands on body stoichiometry (the relative abundance of 17 elements examined at various life stages) during a major life transition (metamorphosis).

Summary of Research Activities

In the case of amphibians with varying life-history strategies, few patterns in ontogenetic stoichiometry were universal. The strongest and most consistent changes in body composition were a decrease in carbon and an increase in calcium from ova to metamorphosis. An increase in Ca from ova to metamorphosis would be consistent with increased ossification in a developing body preparing for the rigors of a terrestrial environment. The source of this Ca, however, likely differs between the larvae of carnivorous caudates and omnivorous anurans.

Conclusions

- 1) Female anurans contribute to the stoichiometric configuration of their ova, perhaps in response to the selective pressures of the larval environment.
- 2) The higher amount of phosphorus and magnesium in faster-developing ova suggests that larval environments select for element-specific investments which facilitate fast biosynthesis of a metamorph from an ova.
- 3) Elements that appear to be carry-overs from the aquatic environment in metamorphs (e.g., aluminum) decrease in their prevalence in adults, whereas elements associated with bone formation (Ca, Mg, P) all increase from metamorphosis to maturation.

Major Impact(s) of Research

- 1) We will have a better understanding of the elemental requirements of, and ecosystem transfer by, amphibians throughout their life cycle.

Other Project Personnel

None

External Collaborators

Dr. Tom Luhring - University of Missouri

Dr. Ray Semlitsch - University of Missouri

Products (Publications, Presentations, Technical Reports)

No publications, presentations, or reports have been prepared yet.

Comparison of uptake of different flavors of ONRAB placebo sachets by rabies hosts

Funding Entity

USDA-APHIS-WS-National Wildlife Research Center

SREL Collaborators

Dr. James Beasley

Objectives

- 1) Quantify uptake of various flavors of placebo baits by rabies hosts to determine if alternative bait flavors result in higher uptake of vaccine baits than those currently used by the oral rabies vaccine program
- 2) Rank uptake of flavors by species to determine which flavor(s) will optimize uptake, and ultimately vaccination rates, of free-ranging mesopredators.

Summary of Research Activities

During the fall 2012 we performed 540 bait selection trials (108 per flavor) throughout various habitats of the SRS in which a single bait was deployed at a random location within the field and monitored for two consecutive nights using a remote camera. Bait flavors evaluated included marshmallow, fish, egg, cheese, and unflavored, and were based on those flavors currently used as attractants for the target species. Baits consisted of 1.8 ml of water encapsulated in a vegetable shortening blister pack coated with one of the 5 flavor attractants, and were purchased from a commercial bait manufacturer. For each trial we quantified all individuals visiting and consuming baits, as well as the time of visitation for raccoons, coyotes, gray fox, and skunks. These data currently are being analyzed to determine if differences bait flavor preference exist among rabies vectors in the southeastern U.S.

Conclusions

- 1) Data are currently being analyzed and thus no conclusions are available at this time.

Major Impact(s) of Research

- 1) Elucidate bait flavor preference among primary terrestrial rabies vectors in the U.S. to determine if alternative bait flavors result in higher uptake of vaccine baits than those currently used.
- 2) Data will be used to inform licensing of the ONRAB vaccine to determine whether an appropriate bait flavor exists that can be used across multiple target species, or the most appropriate flavors that should be developed to target individual species.
- 3) Provide baseline data for more in-depth studies evaluating bait preference and distribution strategies prior to the licensing of ONRAB vaccine baits in the U.S.

Other Project Personnel

Sarah Webster, Research Technician – SREL

Zak Smith, Research Technician – SREL

External Collaborators

Dr. Kurt VerCauteren - USDA-APHIS-WS-NWRC

Shylo Johnson - USDA-APHIS-WS-NWRC

Products (Publications, Presentations, Technical Reports)

No publications, presentations, or reports have been prepared yet.

Effects of contaminant exposure on amphibian skin secretions

Funding Entity

SREL

SREL Collaborators

Dr. Stacey Lance and David E. Scott

Objectives

The overall objective in this project is to determine if exposure to heavy metal contamination affects the quantity or composition of skin secretions in two species of amphibians.

Summary of Research Activities

In the spring of 2012, we collected toads from Carolina bay isolated wetlands on the United States Department of Energy Savannah River Site (SRS) in the Upper Coastal Plain of South Carolina. On March 16, 2012 we collected 24 adult *A. terrestris* by hand at Castor Bay, and on March 26, 2012 we collected 18 adult *S. holbrookii* in pit fall traps at Ellenton Bay. We brought all specimens to the University of Georgia Savannah River Ecology Lab (SREL) facilities where they were housed in individual 1.2-L plastic containers with moist paper towels. We sexed each individual, weighed them within 0.01 g, and swabbed each animal for the chytrid fungus, *Batrachochytrium dendrobatidis*, before collecting secretions (see below). We collected initial secretion samples from all southern toads four days after capture and from spadefoot toads two days after capture.

After we collected secretions from each toad, we moved all animals to individual 19-L buckets containing one of three soil treatments. Treatments included reference soil, coal combustion wastes from a settling basin, attenuated coal combustion wastes. We held southern toads and spadefoot toads for 10 weeks before taking a second set of secretion samples. Throughout the study we provided all animals live crickets at weekly intervals. Currently all secretions have been collected and freeze dried and are awaiting analysis on a mass spectrometer.

Conclusions

1) Data are still being collected, thus there are no conclusions at this time.

Major Impact(s) of Research

- 1) Examine the interaction of the contaminants and disease on amphibian declines
- 2) Examine effects of exposure to metals on immune response of amphibians.

Other Project Personnel

Cara Love, Research Technician - SREL

External Collaborators

Dr. Catherine Bevier - Colby College

Products (Publications, Presentations, Technical Reports)

No publications, presentations, or reports have been prepared yet.

Effects of Mosquitofish on Biota of Isolated Wetlands

Funding Entity

SREL

SREL Collaborators

David Scott and Rochelle Beasley

Objectives

Mosquitofish (*Gambusia holbrooki*) are commonly used for mosquito control in some ponds and isolated wetlands, yet they may negatively affect some native species of amphibians. We are conducting a multi-year study in collaboration with Augusta State University to examine the direct and indirect effects of mosquitofish on two species of pond-breeding salamanders and their prey.

Summary of Research Activities

We have completed two artificial mesocosm studies with *Gambusia* and *Ambystoma opacum*, in which we examined direct effects on larval salamander survival and indirect impacts on the zooplankton community. We are currently completing the final experiment on the impacts on *A. talpoideum*.

Conclusions

- 1) *Gambusia* are able to prey on eggs and small hatchlings of pond-breeding salamanders, thereby significantly reducing larval survival.
- 2) *Gambusia* significantly reduce zooplankton numbers and species composition, which reduces food availability for remaining amphibian larvae, causing reduced size at metamorphosis.

Major Impact(s) of Research

- 1) Recognition that the introduction of mosquitofish to aquatic habitats has deleterious consequences for native amphibians may promote new strategies for mosquito control.

Other Project Personnel

None

External Collaborators

Donna Wear - Augusta State University

Robert Thornhill – Augusta State University

Richard Lupo – Augusta State University

Products (Publications, Presentations, Technical Reports)

No publications, presentations, or reports have been prepared yet.

Modeling Isolated Wetland Hydroperiods under Current and Altered Climate Scenarios

Funding Entity

SREL

SREL Collaborators

David Scott and Dr. Stacey Lance

Objectives

For the last five years we have attempted to secure funding [in collaboration with SRNL (Atmospheric Technologies Center), the USGS, and the University of Florida] to develop a hydrologic model that can be used to predict isolated wetland hydroperiod categories that roughly correspond to the average duration of wetland flooding. Earlier attempts at NSF, SERDP, and NASA funding have failed in part because we have not proven our ability to develop such a model. Using Robert Lide's and Becky Sharitz's long-term database of SRS bay hydrology, we are working to develop a predictive model that can be validated at other locales throughout the Southeast. Once developed, the model can be coupled with regional and local climate downscaling efforts to predict impacts of climate change on bay hydrology, distribution, and biotic communities.

Summary of Research Activities

In NSF LTREB proposals in 2006 and 2007 we outlined procedures for building bay hydrologic models that relate precipitation to bay hydrology. For example, on the SRS ~70 isolated wetlands were monitored by Lide & Sharitz for 10 years, including El Niño events to 100-yr droughts. We will use these known hydroperiod sites to develop a classification model based on easily acquired (often remotely sensed) variables—wetland area, maximum depth, soil type and landscape position, vegetation type, rainfall (annual and seasonal), and potential evapotranspiration. Relatively simple regression models have been developed for isolated wetlands that succeed in predicting hydroperiod at a gross level. In a 2010 SERDP proposal we added a LiDAR component to the modeling, and in our NASA ROSES proposal with SRNL we proposed using historic LandSat imagery to identify wetland approximate filling and drying dates. LandSat-based satellite imagery can be used to detect changes in surface water over time—in our study we will use it to examine hydrologic differences between image dates to determine approximate filling and drying times of each wetland for time spans up to 20 years.

Conclusions

- 1) A preliminary logistic regression model for 30 SRS wetlands based on five variables explains 57% of the variance in hydroperiod classification, and we expect the model will be improved in future iterations that include potential evapotranspiration, basin volume, catchment area, soil type, and pond elevation data.

Major Impact(s) of Research

- 1) We will use this statistical model to generate average hydroperiods for all 300+ SRS wetlands, and compare these classifications to those obtained from the imagery analysis. This model will be used to acquire funding on future climate-change related calls for proposals.

Other Project Personnel

Dr. Becky Sharitz – Emeritus Faculty - SREL

External Collaborators

Traci Castellon - Archbold Biological Station

Robert Lide - Florida Water Management District

Products (Publications, Presentations, Technical Reports)

No publications, presentations, or reports have been prepared yet.

Costs of Incubation: Linking Incubation-Induced Alterations in Phenotype to Changes in Fitness

Funding Entity

National Science Foundation

SREL Collaborator

Robert A. Kenamer

Objectives

Our overall goals have been to examine the importance of incubation temperature during early development, and to provide a better understanding of how reproductive tradeoffs made by females influence their fitness.

Summary of Research Activities

This research project has been a multi-year investigation. In this last of 6 study years, we further investigated parental incubation costs by altering the thermal properties of naturally-incubated wood duck nests on the Savannah River Site. We manipulated the amount of down insulation in wood duck nests and then examined trade-offs between female self-maintenance and nest incubation temperature. In the manipulations we used reduced insulation (0.5 g of down) versus typical insulation (4.0 g of down) and predicted that nests with reduced insulation would cool faster during incubation recesses and produce changes in female behavior. Because we know from earlier work that low incubation temperature in wood ducks lengthens the incubation period and influences offspring quality, we predicted that females with reduced insulation would attempt to maintain optimal incubation temperature by taking shorter incubation recesses and spending more time on the nest. However, investment decisions of incubating females should be condition-dependent. Therefore, we also predicted that females starting incubation at relatively low body mass would be more likely to invest in self-maintenance than in maintaining proper egg temperatures.

Conclusions

- 1) Incubating females increased incubation effort when faced with faster egg cooling rates in nests with reduced down, leading to an increase in incubation constancy.
- 2) This increase in incubation constancy was sufficient to maintain proper thermal environment so that there was no effect of reduced down on average nest temperatures or duckling quality.
- 3) While effort was apparently increased, it may not have been sufficient to challenge the energetic demands of females.

Major Impacts of Research

- 1) Novel approach to altering bird nest temperatures by manipulating insulating down amounts.
- 2) Forces incubating parents to make decisions potentially affecting current versus future reproduction.
- 3) Illustrates the importance of nest micro-climate in studies of incubation costs.

Other Project Personnel

Maureen McClintock, MS Student - Auburn University

External Collaborators

Dr. Gary Hepp - Auburn University

Dr. Bill Hopkins - Virginia Tech University

Products (Publications, Presentations, Technical Reports)

McClintock, M. E., G. R. Hepp, and R. A. Kenamer. Plasticity of incubation behavior: using nest microclimate to understand energetic tradeoffs of female wood ducks (*Aix sponsa*). 6th North American Duck Symposium and Workshop. Memphis TN, (*Poster*)

Distribution and prevalence of zoonotic and infectious diseases in wild pigs on the SRS

Funding Entity

SREL

SREL Collaborators

Dr. Stacey Lance and Dr. James Beasley

Objectives

The overall goal of this research is to quantify the prevalence and distribution of zoonotic and infectious diseases in wild pigs on SRS and determine whether pigs from contaminated sites have altered prevalence of disease.

Summary of Research Activities

From November-December 2012, samples (blood, muscle, liver, feces, buccal swabs) were collected from wild pigs trapped throughout the SRS as pilot data to be used in preparation of research proposals to be submitted to external funding agencies in 2013. Samples were collected from pigs live-trapped and euthanized by USFS-SR personnel. Upon collection, samples were frozen or shipped to Dr. Samantha Wisely at the University of Florida. Samples sent to Dr. Wisely currently are being screened for a suite of 15,000 human pathogens to quantify prevalence of zoonotic diseases. In addition, Dr. Wisely sent us 10 blood samples from each of four locations in Florida. In the spring of 2013 we will use polymerase chain reaction to screen the Florida and SRS samples for *Brucella* and Pseudorabies.

Results from these initial disease screening tests will then be used as pilot data to write proposals for future research investigating the prevalence and distribution of zoonotic and infectious diseases in wild pigs in the southeast and elucidate whether pigs from contaminated areas have elevated prevalence of disease, particularly zoonotic diseases representing significant human health concerns. These data will be used to better understand the sub-lethal effects of environmental contamination on wildlife and parameterize risk models for the transfer of zoonotic pathogens between hogs and humans or other wildlife.

Conclusions

1) This research has just begun, thus there are no conclusions at this time.

Major Impact(s) of Research

- 1) Quantify prevalence of zoonotic and infectious pathogens in wild pigs
- 2) Determine the sub-lethal impacts of environmental contamination on wild pigs through quantification of disease prevalence in pigs from contaminated and reference sites
- 3) Collect data for parameterization of risk assessment models for transfer of zoonotic pathogens between wild pigs and humans or other wildlife

Other Project Personnel

Sarah Webster, Research Technician - SREL

Rochelle Beasley, Research Professional - SREL

External Collaborators (and Affiliations)

Dr. Samantha Wisely - University of Florida

S. Andrew Satterlee - University of Florida

Products (Publications, Presentations, Technical Reports)

No publications, presentations, or reports have been prepared yet.

Contaminant uptake by hatchling alligators via dietary exposure

Funding Entity

SREL

SREL Collaborators

Dr. Brian Metts, Dr. Stacey Lance and David Scott

Objectives

- 1) Determine the biological effects of dietary uptake of coal combustion wastes on juvenile alligators experimentally exposed to one of four diet treatments
- 2) Determine the feasibility of using non-destructively collected tissue samples (i.e., blood, scutes) to predict tissue concentrations in organs (i.e., liver).
- 3) Identify potential useful biological endpoints for assessing individual-level effects of contaminants on reptiles.

Summary of Research Activities

We initiated diet exposure treatments in June 2011 and will continue them through June 2013. At the beginning of the study, we collected pre-exposure samples for each alligator and collected serial samples from the same individuals every 3 months once diet exposures were initiated. Samples include whole blood for metals analysis, blood for RNA extraction, plasma, and small volume blood samples for analysis of packed cell volume. Additionally, alligators are weighed and measured monthly to monitor growth. Finally, at the conclusion of the study, alligators will be euthanized and we will collect additional organ and other tissue samples to determine the distribution of contaminants across tissues and determine if values among tissues are correlated.

Conclusions

- 1) This experiment is ongoing and samples have not yet been analyzed, thus there are no conclusions at this time.

Major Impact(s) of Research

- 1) Develop much needed biological endpoints for assessing the effects of contaminants on reptiles.
- 2) Evaluate whether experimental dietary exposure is a feasible approach for examining the effects of contaminants on long-lived species such as alligators and turtles.
- 3) Determine whether non-destructively sampled tissues can be used as a proxy for tissues requiring euthanasia of experimental animals.

Other Project Personnel

Caitlin Kubar, undergraduate – University of Georgia

External Collaborators

N/A

Products (Publications, Presentations, Technical Reports)

No publications, presentations, or reports have been prepared yet.

Can We Measure And Achieve Functional Restoration Objectives And Regulatory Standards By Applying Specific Treatments To SRS Streams?

Funding Entity

USDA Forest Service-Savannah River

SREL Collaborators

Dean Fletcher

Objectives

Our overall goal is to provide assessments of legacy and current stream disturbances to enable Savannah River Site management organizations and regulatory oversight agencies to move forward, if appropriate, with specific treatments and a monitoring plan for a stream restoration-mitigation project.

Summary of Research Activities

We are examining the effects of stream alterations in a subset of those identified in Level I surveys. In our Level 2 assessments, stream hydrology, geomorphology, and habitat availability at the reach level are being assessed. Over 50 sites ranging from the least disturbed to severely altered are included. The temporal disturbance gradient ranges from pre-SRS to current. Our protocol draws upon field observations and measurements as well as GIS data. In addition to the Level I basin characteristics, features such as reach sinuosity, gradient, valley width, and valley depth are being measured. Water quality parameters are being measured at each site. Data such as canopy coverage, stream and channel dimensions, bank stability, bank vegetation coverage, substrate composition, bottom firmness, and water velocities are collected across transects. Additionally, habitat structure such as root masses, bank under cuts, aquatic macrophyte coverage, and coarse woody debris are being quantified.

Level 3 assessments are further evaluating a select subset of stream reaches by measuring additional hydrology, physicochemistry, geomorphology and biological features of each study reach. A thorough stream evaluation will allow us to prescribe, implement and monitor enhancement and restoration efforts. Additional channel characterization will include standard topographic surveying procedures to determine the rate of incision/filling. Litter decay and invertebrate colonization is being determined using a standard litter bag technique. Additional macroinvertebrate community surveys are being conducted. To evaluate stream discharge patterns, monitoring stations have been established in each study reach. Monitoring stations are simultaneously and continuously recording stream temperature and stage height with the latter converted to discharge via stage-discharge rating curve. Water chemistry and suspended sediment samples are being collected at each monitoring station for select storm water events. Water quality parameters such as temperature, pH, dissolved oxygen, electric conductivity, and turbidity are measured in the field. Automatic water samplers equipped with a flow actuator (programmed to begin sampling in response to a rain event) have been installed to provide samples for laboratory evaluations. Samples will be analyzed for alkalinity, major nutrients, total organic carbon, dissolved organic carbon, and trace elements. Turbidity and total suspended solids will be used to characterize suspended sediment levels. Mineralogical and elemental characterization of sediment cores will provide insight into the source of sediments and potential contamination.

Conclusions

- 1) Analyses are in progress for Level 2 assessments and will begin next year for the Level 3 Assessments.

Major Impact(s) of Research

- 1) We will verify the effects of legacy and current disturbances on stream chemistry, hydrology, geomorphology and biology on select SRS streams.
- 2) We will provide stream restoration alternatives and post restoration monitoring plans.

Other Project Personnel

Garrett Stillings, Research Professional - SREL

Hannah Angel, Temp Research Technician - USDA Forest Service-SR

External Collaborators

Dr. Christopher Barton - University of Kentucky

Dr. Richard Biemiller - University of Kentucky

Dr. John Blake - USDA Forest Service-SR

Dr. Michael Paller - SRNL

Products (Publications, Presentations, Technical Reports)

Fletcher, D.E., G.K. Stillings, and C.D. Barton. 2012. Can we measure and achieve functional restoration objectives and regulatory standards by applying specific treatments to SRS streams? Task 1. Stream Basin and Valley Characterization, Establishing a Framework. Annual report submitted to USDA Forest Service-Savannah River.

Barton C., D. Fletcher, R. Biemiller, and G. Stillings. 2012. Assessment of Structure, Function and Stability in a Gradient of Disturbed SRS Streams - Phase III. Annual report submitted to USDA Forest Service-Savannah River.

Collaborations and Externally Funded Research Non - SRS

Experimental Evaluation of Trophic Transfer of Toxicants Used for Insular Rodents

Funding Entity

USDA – Wildlife Services – National Wildlife Research Center

SREL Collaborators

Dr. Olin Rhodes, Jr. and Dr. James Beasley

Objectives

The overall goal of this research is to elucidate the transfer of toxicants/contaminants through the food chain as scavenging occurs on rodent carcasses resulting from island rodent eradication programs.

Summary of Research Activities

Rodent species commonly targeted for island eradication programs will be placed in conjunction with camera traps to experimentally evaluate the influence of temperature, precipitation, and climatic zone on the time to removal and diversity of species associated with carcass scavenging events on Hilo, HI. In each of two years, 2013 and 2014, two trials of two weeks in duration will be conducted. Each trial will utilize 25 camera traps (13 *Rattus* sp. and 12 *Mus* sp.) which will be deployed in a specific climate zone in a particular seasonal period of the annual cycle (e.g., wet vs dry season). In total, two climate zones will be evaluated for each of two seasonal periods over the course of this experiment. Rodents used for each of the four trials will be obtained as donations from ongoing trapping programs for rats and mice in the agricultural production areas of Hilo, HI. No live animals or active trapping of live animals will be conducted by the personnel associated with this research project.

During the experiment, the following data will be recorded for each camera trap trial: Climatic zone, average temperature during the trial, total precipitation during the trial, elevation, GPS coordinate, species of carcass, time to removal of carcass, species of scavenger to remove carcass, camera or trial failure due to missed detection or equipment failure. Subsequent to the collection of this information, data will be analyzed using logistic regression and categorical data modeling to evaluate the influence of climatic zone, temperature, and precipitation on the time to removal and the diversity of scavengers utilizing rodent carcasses. In addition, data will be evaluated relative to the proportional frequency of utilization of rodent carcasses by scavenger species under differing climatic zone and environmental conditions to develop contaminant transfer factors for each species of scavenger encountered during the experiment. These data can be used to parameterize risk models for trophic transfer of contaminants and toxicants associated with island rodent eradication programs in the pacific region.

Conclusions

1) This research has just begun, thus there are no conclusions at this time.

Major Impact(s) of Research

- 1) Novel data on scavenging community structure for an island ecosystem
- 2) Experimental evaluation of competition between invasive and native scavengers in island ecosystems
- 3) Data for parameterization of transfer factors for toxicants through trophic pathways

Other Project Personnel

Erin Abernathy, MS Student - UGA

External Collaborators

Dr. Will Pitt - USDA-APHIS-WS-NWRC

Dr. Travis DeVault - USDA-APHIS-WS-NWRC

Products (Publications, Presentations, Technical Reports)

No publications, presentations, or reports have been prepared yet.

The effect of lead (Pb) on the incidence of antibiotic resistance in E. coli isolated from the intestines of chicks

Funding Entity

SREL

SREL Collaborators

Dr. J Vaun McArthur

Objectives

The overall goal of this research is to demonstrate whether Pb found in drinking water or commercially prepared chicken feeds affects the incidence of antibiotic resistance in bacteria obtained from cloacal swabs or the intestines of chickens.

Summary of Research Activities

Chickens are a potentially important zoonotic species because of close interactions with humans through handling during meat and egg production, and through food processing and consumption. For instance, a recent evaluation of zoonotic transfer of *Salmonella enteritidis* from chicken layers to handlers showed that flocks with >60% infection were a high risk for handlers to contract infection. The possibility has not been investigated that these bacteria may show elevated antibiotic resistance if isolated from chickens that were exposed to Pb. Should this occur, efficacy of antimicrobial therapies may be reduced and disease threat to humans exacerbated. The present study was conducted to determine if Pb exposure in chickens may enhance microbial antibiotic resistance in normal intestinal microbial flora of the chicken.

Fifty, 2-week-old SPF Leghorn chickens, a common breed for egg production, were purchased from Merial Select and placed on *ad libitum* broiler grower medicated diet that contained non-detectable Pb. Chickens were exposed to Pb acetate through the drinking water, at levels intended to expose enteric bacteria to a concentration range that produced no overt toxicity in the birds. Concentrations of Pb in water were 0.0, 0.01, 0.1, 1.0, or 10.0 mM Pb acetate beginning Day 0 of the study. Cloacal swabs were taken on three dates over a two week period and an intestinal slurry obtained after sacrificing the birds. From these samples over 3,000 isolates were obtained and screened against six antibiotics. As results were not definitive 300 commercially prepared antibiotic resistance plates that screen for 26 antibiotics were obtained and 300 randomly selected isolates from the last two sampling bouts screened.

Conclusions

- 1) Resistance profiles obtained from the initial study were suggestive but not conclusive.
- 2) We are waiting for the results from the commercially prepared plates.

Major Impact(s) of Research

- 1) Pb greatly affects the overall condition of the chickens
- 2) Pb in the water does select for resistance in enterobacteria but few clear patterns emerged as a function of concentration
- 3) Preliminary results from the new plates indicate significant patterns

Other Project Personnel

Paul Stankus, Research Professional - SREL

Mandana Nisanian, Graduate Student - UGA Vet Medicine

External Collaborators

Dr. Robert Gogal – University of Georgia

Dr. Stephen Holladay - University of Georgia

Dr. Cary Tuckfield - Ecostatys, LLC

Products (Publications, Presentations, Technical Reports)

No publications, presentations, or reports have been prepared yet.

Occurrence of Avian Malaria in Wading Bird Species of the South Atlantic Region: Prevalence and Assessment of Potential Links to Mercury Uptake

Funding Entity

US Fish & Wildlife Service

SREL Collaborators

Larry Bryan, Dr. Stacey Lance and Dr. Gary Mills

Objectives

The overall goals of this research are to establish a baseline of occurrence/prevalence of avian malaria in wading bird nestlings in GA and SC, document mercury levels in wading bird nestlings, and assess whether malaria occurrence is linked to mercury uptake.

Summary of Research Activities

We collected blood and feather samples from > 130 individual wading bird nestlings and 9 adult birds. These included 8 different species from 8 different colonies (all adult birds were captured at a single site). All blood samples have been analyzed for malaria. Approximately 50% of the wading bird samples have been analyzed for mercury. We will likely extend this project through 2013 in an attempt to collect additional samples of selected species and/or locations.

Conclusions

- 1) Only 8 of the 9 adult birds, and no nestlings, tested positive for malaria.
- 2) Mercury analysis to date follows general expectations, with the more piscivorous species having higher mercury concentrations.

Major Impact(s) of Research

- 1) Occurrence of malaria only in the older birds suggests that the longer exposure time of the adults may be necessary for infection by malaria or possibly that one location/region may have problems.

Other Project Personnel

David Kling, Research Professional – SREL

Cara Love, Research Technician – SREL

Angela Lindell – Research Technician - SREL

External Collaborators

None

Products (Publications, Presentations, Technical Reports)

No publications, presentations, or reports have been prepared yet.

Foraging Ecology of Coastal-breeding Wood Storks in the Northern Portion of Their Range

Funding Entity

US Fish & Wildlife Service

Start Date and Funding Amount

September 2012; \$78,910.00

SREL Collaborators

Larry Bryan

Objectives

The overall goals of this research were to 1) document foraging range and habitat use by Wood Storks nesting in North Carolina and 2) characterize tidal stork foraging habitats in coastal Georgia.

Summary of Research Activities

An observer in an airplane followed 34 storks from the Lay Lake colony in NC to foraging locations in eastern NC and SC. Average foraging range was approximately 11km in direct distance (47 km max distance), which is fairly typical for storks, and they utilized forested wetlands more so than expected, possibly due to climatic (rainfall) conditions.

We sampled 17 known stork salt marsh foraging sites in near the Harris Neck NWR and 20 randomly selected marsh sites as alternate sites/controls. Both types of sites were dominated by Mummichogs (*Fundulus*) and shrimp as potential prey. Prey densities did not vary between site types and were quite high (averaged >150 prey items/m²) when compared to reported inland prey densities (<10 prey-items/m²)

Conclusions

- 1) Foraging travel by breeding storks in NC was fairly typical for storks in this part of their range.
- 2) Potential prey densities in the tidal salt marsh habitats were quite high, and indicate why storks nesting in this region are generally more successful than inland nesters.

Major Impact(s) of Research

- 1) This was the first study of foraging ecology of the NC storks, who reside on the northern extremity of their range.
- 2) This is the 1st ground-level characterization of salt marsh wetlands as stork foraging.

Other Project Personnel

David Kling, Research Professional - SREL

External Collaborators

Dr. Rena Borkhataria -University of Florida

Products (Publications, Presentations, Technical Reports)

No publications, presentations, or reports have been prepared during this period.

Analysis of wood stork satellite telemetry location data relative to regulatory guidelines: The core foraging area concept.

Funding Entity

US Fish & Wildlife Service

SREL Collaborators

Larry Bryan

Objectives

The overall goal of this research is examine archived satellite telemetry data for Wood Storks during the breeding season relative to listed regulatory guidelines (foraging range and associated habitat protection) and also compare the findings to existing follow flight data.

Summary of Research Activities

This project is on-going. We are using archived Wood Stork satellite telemetry data to compare to the foraging ranges employed in the Core Foraging Area (CFA) regulatory guidelines, which were based primarily of follow flight data (using an airplane to follow nesting birds from their colony to foraging sites). We will also directly compare selected portions of the archived data with follow flight data.

Conclusions

1) This analyses/research is on-going.

Major Impact(s) of Research

1) Core foraging areas (CFA) are a regulatory tool that has employed follow flight data to determine foraging ranges, and essentially define habitats to be protected for endangered Wood Storks and other wading birds. This study will utilize existing satellite telemetry data to assess the accuracy of the follow flight data and the current CFA guidelines.

Other Project Personnel

None

External Collaborators

Dr. Rena Borkhataria - University of Florida

Products (Publications, Presentations, Technical Reports)

No publications, presentations, or reports have been prepared during this period.

Washo Preserve Wood Stork Telemetry Study

Funding Entity

USFWS / University of Florida

SREL Collaborators

Larry Bryan

Objectives

The overall goal of this research is document the movements of breeding storks in response to management activities in their breeding site. Movement data will be provided by satellite telemetry.

Summary of Research Activities

The Washo Preserve Wood Stork colony in Charleston County, SC is located in an ageing impoundment in need of repair/maintenance. Of concern is the impact of the needed maintenance, which could require months, on the storks that nest there. In May/June of 2012, we captured 9 adult Wood Storks via rocket netting and attached satellite transmitters to them to document their annual movements for the next 3-4 years. Maintenance activities at the colony site have begun.

Conclusions

1) This research is on-going.

Major Impact(s) of Research

- 1) We will determine the maintenance activities result in storks shifting to other locations.
- 2) If so, we will determine if they return to the Washo site in future years.
- 3) We will collect data on movement patterns of storks in a relatively un-studied portion of their range.

Other Project Personnel

David Kling, Research Professional - SREL

External Collaborators

Dr. Rena Borkhataria - University of Florida

Products (Publications, Presentations, Technical Reports)

No publications, presentations, or reports have been prepared yet.

Kings Bay Rare, Threatened, and Endangered Wildlife Surveys: Aquatic Avifauna and Marsh Hammocks

Funding Entity

DoD-Navy/USFWS

SREL Collaborators

Larry Bryan

Objectives

The overall goal of this research is to document the year-round avian community utilizing aquatic habitats on the Kings Bay Submarine Base (southeastern Georgia) and to characterize the vegetative characteristics of marsh hammocks, which are unique landscape features within the salt marshes of the base.

Summary of Research Activities

The avifauna surveys of aquatic habitats were the 2nd stage of monitoring at Kings Bay (terrestrial habitats were monitored in the previous year). We conducted timed, pedestrian surveys of aquatic habitats, including the marsh hammocks, during the winter period and point counts during the spring/summer (breeding) period. In addition, we characterized the vegetation on the marsh using line transects and 10-m² plots.

Conclusions

- 1) Over both years, we documented 175 total avian species as residents or migratory species on the Kings Bay installation, including 56 listed as species of concern on state or regional (USFWS, SAMBI) lists.
- 2) We characterized four on-site marsh hammocks and one (Drum Point) island on the base facility and four marsh hammocks on the Harris Neck National Wildlife Refuge. Canopy coverages were dominated by live oak, eastern red cedar and pine, with saw palmetto as the primary low cover/mid-story species

Major Impact(s) of Research

- 1) Kings Bay, due to its geospatial location and diverse habitats, supports a wide variety of avifauna, including many listed species.
- 2) Live Oak maritime forest habitat on the Kings Bay mainland and fragmented parcels on the marsh hammocks provide habitat for many Neotropical migrants.

Other Project Personnel

Chris Depkin, Research Technician - UGA

External Collaborators

Dr. Susan Wilde – University of Georgia

Products (Publications, Presentations, Technical Reports)

No publications, presentations, or reports have been prepared yet.

The Ecological Study of Birds in the Vicinity of Augusta Regional Airport at Bush Field

Funding Entity

City of Augusta, GA

SREL Collaborator

Robert Kennamer and Dr. Lehr Brisbin, Jr.

Objectives

Our overall goals have been to conduct bird hazard research associated with the placement of a wastewater treatment wetland system adjacent to a commercial airport and to provide wildlife hazard consultation to airport operations personnel and wastewater treatment plant personnel.

Summary of Research Activities

This research project has been a multi-year investigation. Since December 2001, we have been monitoring temporal and spatial activities of all birds around Augusta Regional Airport. Within 2 years of the 2001 completion, the 360-acre wastewater treatment wetlands served as a nighttime roost for millions of migratory blackbirds that crossed the airfield in massive flocks daily at sunrise and sunset during each fall/winter period. We have been investigating the efficacy of habitat alteration techniques to displace the blackbirds, including the use of airboats since 2008 to mechanically crush wetland vegetation in the treatment wetlands each fall. The results of this method have been highly significant, with long-term post-crush bird monitoring indicating that blackbird roosting within the wetlands became almost non-existent and blackbird activity around the airport was reduced. The ability of the wetland vegetation to process wastewater effluent was not negatively affected by vegetation alteration; evidence in fact suggested that fall vegetation crushing actually improved wetland wastewater treatment performance.

Conclusions

- 1) Long-term bird monitoring indicated a reduction in blackbird activity around the airport by about 2 orders of magnitude.
- 2) Remnant flocks of migrant blackbirds still utilize the Savannah River drainage as a movement corridor, but the bird-strike hazard has been significantly diminished.
- 3) Fall crushing of the wastewater treatment wetlands vegetation did not harm regrowth the following spring.

Major Impacts of Research

- 1) This work demonstrated that with thoughtful wildlife hazard management, including the use of novel techniques, it is possible to mitigate large-scale undesirable wildlife attraction associated with certain land-use activities.
- 2) Successful reduction of the bird-aircraft strike hazard was accomplished through non-lethal means, using a relatively simplistic habitat altering technique.
- 3) Wastewater effluent concentrations of TSS, NH₃-N, and BOD₅ were reduced (improved) as a result of the vegetation crushing (i.e., vegetation crushing contributed an added benefit).

Other Project Personnel

Carol Eldridge, Research Technician - SREL

External Collaborators

Allen Saxon, Jr. - Augusta, GA Utilities Department

Products (Publications, Presentations, Technical Reports)

Kennamer, R.A., I.L. Brisbin, Jr., and C.S. Eldridge. 2012. Abundance, Distribution, and Movement Patterns of Avifauna in the Vicinity of Bush Field Airport. 2011–2012 Report

Population genetic analysis of two snake species at their northern range limits

Funding Entity

Multiple Canadian Agencies

SREL Collaborators

Dr. Stacey L. Lance

Objectives

The overall objective in this project was to define management units for the eastern yellow-bellied racer and bullsnakes in Saskatchewan, Canada.

Summary of Research Activities

The study sites for this project included three large river valleys in southwestern Saskatchewan. These river valleys represent the entire Canadian range for both eastern yellow-bellied racers (*Coluber constrictor flaviventris*) and bullsnakes (*Pituophis catenifer sayi*). We captured snakes at hibernacula and drew blood for DNA analysis. A total of 150 racers and 70 bullsnakes were then genotyped across a panel of 10 microsatellite loci. We examined population structure, relatedness among individuals, and the relationship between geographic and genetic distance.

Conclusions

- 1) River valleys contain discrete populations of each species
- 2) Inbreeding is occurring within den sites due to either site fidelity and/or lack of suitable habitat for dispersal to neighboring den sites
- 3) Populations at the northern limit of the range (Canada) have less genetic diversity than those in the core of the range

Major Impact(s) of Research

- 1) Eastern yellow-bellied racers are considered Threatened in Canada and are the subject of active conservation planning. Our findings suggest two of the river valleys should be considered designatable units.
- 2) It is possible that racers in the northern extent of their range have locally adapted
- 3) Bullsnakes are considered "Data Deficient" in Canada. Our data indicate strong population structuring among river valleys and limited dispersal among hibernacula. These data should be considered when their conservation status is reassessed.

Other Project Personnel

None

External Collaborators

Dr. Christopher Somers - University of Regina

Jessica Martino - University of Regina

Dr. Timothy Frasier - Saint Mary's University

Dr. Ray Poulin - Royal Saskatchewan Museum

Laura Gardiner - University of Regina

Products (Publications, Presentations, Technical Reports)

Martino JA, Poulin RG, Frasier TR, Lance SL, Gardiner LE, Somers CM. Subdivision among snake populations at northern range limits: river valleys contain genetically discrete groups. Submitted to Canadian Journal of Zoology (*Submitted*)

Genetic assessment of gopher frog populations throughout its range

Funding Entity

SREL

SREL Collaborators

Dr. Stacey Lance and David Scott

Objectives

The U.S. Fish and Wildlife Service is currently evaluating the gopher frog to determine if it warrants listing as a threatened species. The overall objective in this project is to examine the population genetics of gopher frogs throughout its range and fill data gaps identified as a key conservation challenge.

Summary of Research Activities

David Scott has been monitoring the gopher frog populations on the SRS for over a decade. The SRS represents a majority of the remaining SC population. Stephen Richter has been conducting phylogenetic studies on the gopher frog for the past five years. Now, in conjunction with the Georgia, South Carolina, North Carolina, and Alabama Department of Natural Resources and Florida Fish and Wildlife Conservation Commission we are aiming to assess the genetics of populations throughout the gopher frog's remaining range. Florida represents the stronghold for gopher frogs but they are now experiencing declines. We have submitted a Florida State Wildlife Grant with two major objectives: 1) Determine the amount of gene flow and degree of genetic variation among gopher frog populations in 15 different regions in Florida. 2) Examine the rates of gene flow and genetic variation among breeding ponds within the same region. That proposal has been selected as one of 24 the state is recommending that the USFWS funds. In addition we have submitted proposals to GA and AL DNR and expect those to be funded to cover the cost of genetic analysis. Samples have been collected during the 2013 breeding season from SC, FL, GA, and AL.

Conclusions

1) Data are still being collected, thus there are no conclusions at this time.

Major Impact(s) of Research

- 1) Accurately assess the levels of genetic variation in areas with remnant isolated populations (SC, GA, AL, NC).
- 2) Fill data gaps needed to determine if Florida's listing of "Species of Special Concern" is adequate.

Other Project Personnel

None

External Collaborators

Dr. Stephen Richter - Eastern Kentucky University.

Dr. Anna Farmer - Florida FWC

Dr. Kevin Enge - Florida FWC

Dr. Thomas Devitt - Florida Museum of Natural History

Products (Publications, Presentations, Technical Reports)

No publications, presentations, or reports have been prepared yet.

Effects of contaminant exposure on the mating system of reproductive success of American alligators

Funding Entity

Yawkey Wildlife Center, SC DNR

SREL Collaborators

Dr. Stacey Lance

Objectives

The overall objective in this project is to determine if contaminant loads influence reproductive success in American alligators.

Summary of Research Activities

Lou Guillette, Ben Parrott, and Thomas Rainwater from the Medical University of South Carolina have been collecting samples from adult alligators and nests at Yawkey Wildlife Refuge in conjunction with the SC DNR. To date they have sampled eggs from 19 clutches. In addition they have sampled females at nests over several nesting seasons in Yawkey. Together, at SREL we are now analyzing the microsatellite genotypes of over 400 individuals across a panel of loci. Initial screens have indicated very low genetic diversity and currently we are testing additional loci to increase our power for analyses. The goals of the project include identifying maternity, quantifying levels of multiple paternity, and determining whether paternity relates to male phenotype, including contaminant load. Similar studies will be undertaken and sites with higher and lower levels of environmental contamination.

Conclusions

1) Data are still being collected, thus there are no conclusions at this time.

Major Impact(s) of Research

1) Examine reproductive success in males and females of a long-lived species as a function of contaminant loads.

Other Project Personnel

Cara Love, Research Technician - SREL

External Collaborators

Dr. Lou Guillette - Medical University of South Carolina

Dr. Ben Parrott - Medical University of South Carolina

Dr. Thomas Rainwater - Medical University of South Carolina

Products (Publications, Presentations, Technical Reports)

No publications, presentations, or reports have been prepared yet.

Extra-pair paternity, breeding synchrony, and nesting density in Blue-footed boobies

Funding Entity

Contract with Universidad Nacional Autónoma de México

SREL Collaborators

Dr. Stacey Lance

Objectives

The main objective of the research is to examine how extra-pair paternity varies with breeding synchrony and nesting density in neighborhoods of blue-footed boobies.

Summary of Research Activities

Collaborators in Mexico sampled tissue and extracted DNA from adult and nestling Blue-footed boobies (BFBs) representing roughly 500 families from an 11,500 m² study area on Isla Isabel off the coast of Mexico. BFBs in this study area have been banded and observed since 1989. At SREL all 1,693 (444 adult males, 432 adult females, 817 nestlings) DNA samples were genotyped across a panel of 10 microsatellite loci. All parentage analyses were conducted using a likelihood-based approach in CERVUS 2.0. Individuals genotyped at fewer than 6 loci were excluded from analyses. We used 10,000 tests, and assumed 90% of both males and females were sampled from the population. Assignment levels were set to a relaxed value of 80% and a strict value of 95%. We have written up the methods and results of the study and currently our collaborators in Mexico are analyzing the nesting synchrony data and putting together a manuscript.

Conclusions

- 1) We found evidence suggestive of egg dumping by female BFBs
- 2) We found 7% extra-pair paternity
- 3) We are waiting for remaining data to be analyzed.

Major Impact(s) of Research

- 1) Until the nesting synchrony and nearest neighbor data are analyzed the impacts will not be fully known.

Other Project Personnel

Schyler Nunziata, Research Technician - SREL

External Collaborators

Dr. Hugh Drummond - Instituto de Ecología, Universidad Nacional Autónoma de México

Alejandra Ramos - Instituto de Ecología, Universidad Nacional Autónoma de México

Products (Publications, Presentations, Technical Reports)

No publications, presentations, or reports have been prepared yet.

Sub-lethal effects of chronic exposure to radiation in gray wolves (*Canis lupus*) at Chernobyl

Funding Entity

SREL

SREL Collaborators

Dr. James C. Beasley and Dr. Stacey L. Lance

Objectives

The overall objective in this project is to measure the spatial and temporal variation in radiation dose that individual wolves experience throughout the Chernobyl exclusion zone (CEZ) and quantify the relationship between dose and sub-lethal effects.

Summary of Research Activities

During the summer of 2012 we established initial hypotheses and research plans. In October, we participated in a workshop at the Polesye State Radioecological Reserve (PSRER) in Belarus. The purpose of this workshop was to identify common research interests between SREL, IRSN, and Belarus scientists and develop proposals to submit to funding agencies to begin collaborative research in the Belarus portion of the CEZ. While in Belarus we met with leadership from Minsk, several scientists that work at the PSRER, and a scientist from Minsk in the National Academy of Sciences and were given permission by the Ministry for Emergency Situations to move forward with submitting proposals to work in Belarus. This is a huge step as no western scientists have been permitted to conduct research on the Belarusian side of the Chernobyl Exclusion Zone. Since this workshop 3 proposals have been submitted to various organizations and foundations and if funded research projects are expected to begin at Chernobyl in fall 2013 or spring 2014.

Conclusions

1) This research has just begun, thus there are no conclusions at this time.

Major Impact(s) of Research

- 1) For the first time coupled GPS-dosimetry will be used to directly measure radiation dose rates for free-ranging animals in the CEZ as they move through habitats with heterogeneous levels of contamination.
- 2) Use our telemetry/dosimetry data to directly examine the relationship between sub-lethal effects (e.g., disease, immunosuppression, stress) and exposure.
- 3) Use our telemetry/dosimetry data to directly examine the relationship between exposure and movement rates, home range/core area size and shape, and resource selection.

Other Project Personnel

None

External Collaborators

Dr. Thomas Hinton, IRSN

Dr. Brant Ulsh, MH Chew Corporation

Dr. Yuri Bondar, Polesye State Radioecological Reserve

Dr. Vadim Sidorovich, Belarus National Academy of Science

Products (Publications, Presentations, Technical Reports)

No publications, presentations, or reports have been prepared yet.

Assessing vulnerability of priority sandhills fauna to climate and landscape changes

Funding Entity

US Department of Army, ERDC-CERL

SREL Collaborators

Dr. Tracey Tuberville and Dr. Kimberly Andrews

Objectives

Assess herpetofauna in sandhills ecoregion in terms of their relative vulnerability to climate change

Summary of Research Activities

- 1) Evaluate the relative vulnerability of reptiles and amphibians in the Sandhills Ecoregion to predict climate change.
- 2) Develop ecological models to identify environmental thresholds to species persistence for at least three species of reptiles and amphibians predicted to be vulnerable to climate change.
- 3) Conduct SRS-wide sampling of amphibians for chytrid.
- 4) Assist with laboratory experiments to investigate the effects of temperature on foraging behavior of an obligate diurnal forager (black racer) and facultative diurnal forager (rat snake).

Conclusions

Of the 113 reptiles and amphibians occurring in the Sandhills Ecoregion, more amphibians than reptiles are predicted to be vulnerable to anticipated climate change scenarios. Most of the species deemed vulnerable are associated with isolated ephemeral wetlands, thus wetland hydrology (and the environmental and landscape factors influencing hydrology) will play a major role in species persistence and should be incorporated into ecological models. Information gaps identified during vulnerability analysis and that limit ability to assess vulnerability include how environmental variation influences breeding phenology and genetic variability of species within assessment area.

Major Impact(s) of Research

- 1) First study to rank a large suite of reptile and amphibian species in terms of predicted climate change vulnerability using the NatureServe Climate Change Vulnerability Assessment Tool.
- 2) We will develop ecological models to identify environmental thresholds for species in terms of their persistence in the landscape to inform management of natural resources on military installations throughout the Southeastern U.S.

Other Project Personnel

Bess Harris, MS Student - UGA

Dr. Brian Metts, Research Professional - SREL

Dean Fletcher, Research Professional - SREL

External Collaborators

Dr. Nathan Nibbelink – University of Georgia

Dr. James Westervelt - ERDC-CERL

Dr. Tim Hayden - ERDC-CERL

Dr. Jinelle Sperry - ERDC-CERL

Dr. Irene MacAllister - ERDC-CERL

Dr. Chris Phillips - Illinois Museum Natural History Survey

Dr. Pat Weatherhead - University of Illinois

Brett DeGregorio - University of Illinois

Products (Publications, Presentations, Technical Reports)

Andrews, K.M., and T.D. Tuberville. Evaluating vulnerability of Sandhills amphibians to climate change. Southeastern Partners in Amphibian and Reptile Conservation, Fall Creek Falls State Park, TN. February 2012. (*Presentation*)

Tuberville, T.D., and K.M. Andrews. Evaluating vulnerability of sandhills herpetofauna to climate change. World Congress of Herpetology, Vancouver. August 2012. (*Presentation*)

Survivorship of juvenile gopher tortoises

Funding Entity

Riverbanks Zoo Conservation Fund, Friends of Georgia Department of Natural Resources, St. Catherines Island Research Foundation

SREL Collaborators

Dr. Tracey Tuberville

Objectives

Characterize the ecology of juvenile gopher tortoises in terms of survivorship, spatial ecology and growth rates and inform management of this critical but poorly understood lifestage.

Summary of Research Activities

We deployed standard radio-transmitters on 20 juvenile gopher tortoises at St. Catherines Island, GA to monitor their movement patterns and burrow use. We also attached miniature temperature dataloggers (i-buttons) to characterize daily and seasonal surface activity of juveniles. Finally, we initiated a pilot study to evaluate the effectiveness of miniaturized GPS dataloggers for studying the spatial ecology of the species rarely observed away from its burrow and that presumably uses their habitat at very small spatial scales.

Conclusions

1) This research has just begun, thus there are no conclusions at this time.

Major Impact(s) of Research

- 1) Ours will be only the second study to investigate the spatial ecology of juvenile gopher tortoises, a candidate species for federal listing.
- 2) Novel data comparing spatial data collected from GPS dataloggers compared to traditional tracking methods in a species in which traditional tracking locations are centered on one or a very few number of burrows.

Other Project Personnel

Bess Harris, MS Student - UGA

External Collaborators

Dr. Nathan Nibbelink – University of Georgia

Dr. Terry Norton - St. Catherines Island / Georgia Sea Turtle Center

Products (Publications, Presentations, Technical Reports)

Harris, B.B., N.P. Nibbelink, T.M. Norton, and T.D. Tuberville. Movements and activity of juvenile gopher tortoises (*Gopherus polyphemus*) on St. Catherines Island, Georgia. Gopher Tortoise Council Meetings, Bainbridge, GA. (*Presentation*)

Habitat Suitability Models and Use of Head-Start Techniques as Planning and Mitigation Tools for Ensured Persistence of Mojave Desert Tortoises to Offset Solar Energy Projects

Funding Entity

California Energy Commission (via subcontract from University of California, Davis)

SREL Collaborators

Dr. Kurt Buhlmann

Objectives

- 1) Determine behavior, survivorship, and habitat use of head-started juvenile desert tortoises compared to direct-release hatchlings (i.e., juveniles released shortly after hatching).
- 2) Develop habitat suitability models for juvenile desert tortoises to identify optimal desert tortoise habitat.

Summary of Research Activities

We initiated the desert tortoise head-starting program in 2011 by capturing females to radio-track and to monitor their reproductive status with xradiography. Gravid females were brought back to the head-starting facility, allowed to nest, and the nests were monitored for hatching. We obtained a total of 39 offspring in 2011 and 72 hatchlings in 2012, of which 18 have been released with radio-transmitters and the remaining retained for head-starting. In addition to tracking both the released juveniles and the adult females, we are also collecting habitat data at tracking locations to characterize habitat selection in juveniles and how selected microhabitat characteristics vary between adults and juveniles.

Conclusions

- 1) This research has just begun, thus there are no conclusions at this time.

Major Impact(s) of Research

- 1) Important life history data for a poorly understood life stage of a federally listed species
- 2) Improve management for species by factoring juvenile requirements into management and policy decisions, such as identifying habitats likely to serve as important areas of juvenile recruitment. These data will be helpful when selecting potential solar development sites by identifying areas to avoid.

Other Project Personnel

None

External Collaborators

Dr. Brian Todd - University of California, Davis

Melia Nafus - University of California, Davis

Products (Publications, Presentations, Technical Reports)

Nafus, M.G., T.D. Tuberville, K.A. Buhlmann, and B.D. Todd. *In review*. Effects of road and traffic volume on occurrence and demography of Agassiz's desert tortoise (*Gopherus agassizii*).

Submitted to: Biological Conservation.

Nafus, M.G., T.D. Tuberville, K.A. Buhlmann, and B.D. Todd. *In review*. Differential habitat use by desert tortoises (*Gopherus agassizii*) in relation to forage availability. *Submitted to:* Ecology.

Tuberville, T.D., K.A. Buhlmann, B.D. Todd, and M. Nafus. 2012. Desert tortoise head-starting project, Mojave National Preserve, California: 2011 activities and results. Report to Desert Tortoise Recovery Office, U.S. Fish and Wildlife Service and California Department of Game and Fish.

Tuberville, T.D. Population augmentation and reintroduction as species recovery tools: lessons from North American tortoises. Archbold Biological Station, Lake Placid, FL (*Presentation*)

Tuberville, T.D. Population augmentation and reintroduction as species recovery tools: lessons from North American tortoises. UGA, Warnell School of Forestry & Natural Resources (*Presentation*)

Effects of road fencing on desert tortoises

Funding Entity

Bureau of Land Management (via subcontract from University of California, Davis)

SREL Collaborators

Dr. Kurt Buhlmann

Objectives

Investigate the effects of road fencing installed as a mitigation tool on desert tortoises.

Summary of Research Activities

We initiated field work to investigate the "road zone effect" on desert tortoises by conducting transect surveys for desert tortoises sign at varying distances from roads of different size and traffic volume. Radio-tracking of desert tortoises along roads will be initiated in the upcoming field season.

Conclusions

1) This research has just begun, thus there are no conclusions at this time.

Major Impact(s) of Research

- 1) Data on long-term demographic effects of roads on desert tortoise populations adjacent to roads and how effects vary as function of road size and traffic volume.
- 2) Comparison of pre- and post-fencing spatial ecology of desert tortoises living adjacent to roads and whose home ranges bisected by road to determine the potential positive and negative effects of fencing on desert tortoises.

Other Project Personnel

None

External Collaborators

Dr. Brian Todd - University of California, Davis

Mark Peaden - University of California, Davis

Products (Publications, Presentations, Technical Reports)

No publications, presentations, or reports have been prepared yet.

External (non-SRS) Funding Received in FY12

Analysis of wood stork satellite telemetry location data relative to regulatory guidelines:

The core foraging area concept.

Funding Entity

US Fish & Wildlife Service / University of Florida

Start Date and Funding Amount

June 2012; \$30,000.00

SREL Investigators and Roles

L. Bryan (coPI)

Co-Investigators, Roles, and Affiliations

Dr. R. Borkhataria (PI), University of Florida

Foraging ecology of coastal Wood Storks in the northern portion of their range

Funding Entity

US Fish & Wildlife Service

Start Date and Funding Amount

October 2011; \$76,000.

SREL Investigators and Roles

L. Bryan (PI)

Co-Investigators, Roles, and Affiliations

Dr. R. Borkhataria (coPI), University of Florida

Washo Wood Stork Satellite Telemetry Project

Funding Entity

US Fish & Wildlife Service / Univ. of Florida

Start Date and Funding Amount

January 2012; \$38,000.00

SREL Investigators and Roles

L. Bryan (coPI)

Co-Investigators, Roles, and Affiliations

Dr. R. Borkhataria (PI), University of Florida

Occurrence of avian malaria in wading bird species of the South Atlantic region: Prevalence and assessment of potential links to mercury uptake.

Funding Entity

US Fish & Wildlife Service

Start Date and Funding Amount

June 2012; \$27,400

SREL Investigators and Roles

L. Bryan, Dr. S. Lance, Dr. G. Mills (coPI's)

Co-Investigators, Roles, and Affiliations

None

Kings Bay Rare, Threatened, and Endangered Wildlife Surveys: Aquatic Avifauna and Marsh Hammocks

Funding Entity

DoD-Navy/US Fish & Wildlife Service

Start Date and Funding Amount

September 2012; \$56,750

SREL Investigators and Roles

L. Bryan (coPI)

Co-Investigators, Roles, and Affiliations

Dr. S. Wilde (PI), University of Georgia

The Ecological Study of Birds in the Vicinity of Augusta Regional Airport at Bush Field

Funding Entity

City of Augusta, GA

Start Date and Funding Amount

October 2011; \$100,129

SREL Investigators and Roles

R. Kennamer, Dr. I.L. Brisbin, Jr. (PIs)

Co-Investigators, Roles, and Affiliations

Dr. A. Saxon, Jr. (Collaborator), Augusta, GA Utilities Department

Comparison of uptake of different flavors of ONRAB placebo sachets by rabies hosts

Funding Entity

USDA – Wildlife Services – NWRC

Start Date and Funding Amount

September 2012; \$16,406

SREL Investigators and Roles

Dr. J. Beasley (PI)

Co-Investigators, Roles, and Affiliations

Dr. K. VerCauteren (Collaborator), USDA

Survey of NAS Jacksonville & associated properties for gopher tortoises and burrow commensals

Funding Entity

U.S. Department of Navy

Start Date and Funding Amount

June 2012; \$26,319

SREL Investigators and Roles

Dr. T. Tuberville (PI)

Co-Investigators, Roles, and Affiliations

N/A

Reintroduction, monitoring, and habitat use of Translocated Gopher Tortoises on the Aiken Gopher Tortoise Natural Heritage Preserve, Windsor, South Carolina

Funding Entity

South Carolina DNR

Start Date and Funding Amount

September 2011; \$15,492.00

SREL Investigators and Roles

Dr. K. Buhlmann. Dr. T. Tuberville (coPIs)

Co-Investigators, Roles, and Affiliations

B. Moule (Collaborator), SCDNR

A. Grosse (Collaborator), SREL

Habitat and Population Ecology of endangered Bog Turtles (*Glyptemys muhlenbergii*) and threatened Wood Turtle (*Glyptemys insculpta*) on the Great Swamp and Walkkill River National Wildlife Refuges, New Jersey

Funding Entity

U.S. Fish and Wildlife Service, Great Swamp NWR (through CESU)

Start Date and Funding Amount

May 2011; \$13,000.00

SREL Investigators and Roles

Dr. K. Buhlmann (PI)

Co-Investigators, Roles, and Affiliations

C. Osborn (Collaborator), USFWS

M. Horne (Collaborator), USFWS

Head-starting, Reintroduction, and Habitat Use of Wood Turtles (*Glyptemys insculpta*) on the Great Swamp National Wildlife Refuge, New Jersey

Funding Entity

Friends of the Great Swamp National Wildlife Refuge, Pleasantville, NJ

Start Date and Funding Amount

April 2012; \$15,000.00

SREL Investigators and Roles

Dr. K. Buhlmann (PI)

Co-Investigators, Roles, and Affiliations

C. Osborn (Collaborator), USFWS

Habitat management for endangered Flatwoods Salamanders (*Ambystoma cingulatum/bishopi*) on the U.S. Navy's Outlying Landing Field Holley, Milton, Florida.

Funding Entity

Department of Defense, U.S. Navy (through CESU)

Start Date and Funding Amount

September 2011; \$24,000.00

SREL Investigators and Roles

Dr. K. Buhlmann (PI)

Co-Investigators, Roles, and Affiliations

R. Cherry (Collaborator), US Navy

R. Smith (Collaborator), US Navy

H. Mitchell (Collaborator), USFWS

J. Himes (Collaborator), Florida NAP

A. Kane (Collaborator), FFGD

Habitat Assessment of the East Pearl and Mikes Rivers for threatened Ringed Map Turtles (*Gratemys oculifera*) and management recommendations to minimize conflicts with US Navy Training Activities.

Funding Entity

Department of Defense, U.S. Navy and NASA Stennis (through CESU)

Start Date and Funding Amount

June 2012; \$27,527.00

SREL Investigators and Roles

Dr. K. Buhlmann (PI)

Co-Investigators, Roles, and Affiliations

M. Fannaly (Collaborator), NASA

R. Smith (Collaborator), US Navy

Reptile and Amphibian Habitat Assessment of Outlying Airfields of the Whiting Naval Air Station, Milton, Florida.

Funding Entity

Department of Defense, U.S. Navy (through CESU)

Start Date and Funding Amount

June 2012; \$30,336.00

SREL Investigators and Roles

Dr. K. Buhlmann (PI)

Co-Investigators, Roles, and Affiliations

R. Cherry (Collaborator), US Navy

R. Smith (Collaborator), US Navy

*Experimental Evaluation of Trophic Transfer
of Toxicants Used for Insular Rodents*

Funding Entity

USDA

Start Date and Funding Amount

September 2012; \$99,990

SREL Investigators and Roles

Dr. O. Rhodes (PI)

Dr. J. Beasley (co-PI)

Co-Investigators, Roles, and Affiliations

W. Pitt (Collaborator), USDA

T. DeVault (Collaborator), USDA

E. Abernathy (MS Student) UGA

Technical Expertise Requests in FY12

SREL Investigator

R. Kennamer

Date of Request

October 2011

Requesting Entity

Augusta Regional Airport at Bush Field

Nature of Request

Wildlife hazard consultant for Augusta Regional Airport at Bush Field, under contract with City of Augusta, GA

SREL Investigator

Dr. W. Gibbons

Date of Request

September 2012

Requesting Entity

South Carolina Senate

Nature of Request

Invited to represent the National Wildlife Federation as a member of the Isolated Wetlands and Carolina Bays Task Force, The Task Force was established by Act 198 (H. 4654) of 2012.

SREL Investigator

Dr. S. Lance

Date of Request

November 2011

Requesting Entity

Faculty member, Wichita State University

Nature of Request

Develop genetic markers (microsatellites) for giant goldenrod.

SREL Investigator

Dr. S. Lance

Date of Request

November 2011

Requesting Entity

Faculty member, University of Oklahoma

Nature of Request

Develop genetic markers (microsatellites) for glossy Ibis.

SREL Investigator

Dr. S. Lance

Date of Request

November 2011

Requesting Entity

Faculty member, Florida Institute of Technology

Nature of Request

Develop genetic markers (microsatellites) for scrub lupine.

SREL Investigator

Dr. S. Lance

Date of Request

November 2011

Requesting Entity

Faculty member, Universidade Federal de Pelotas, Brazil.

Nature of Request

Develop genetic markers (microsatellites) for two plant species.

SREL Investigator

Dr. S. Lance

Date of Request

December 2011

Requesting Entity

Faculty member, Universidad Autónoma de México, Mexico.

Nature of Request

Develop genetic markers (microsatellites) for the Honduran white bat and a mouse opossum.

SREL Investigator

Dr. S. Lance

Date of Request

December 2011

Requesting Entity

Faculty member, Universidad Austral de Chile, Chile.

Nature of Request

Develop genetic markers (microsatellites) for a flatworm parasite.

SREL Investigator

Dr. S. Lance

Date of Request

December 2011

Requesting Entity

Faculty member, Desert Botanical Gardens, Arizona.

Nature of Request

Develop genetic markers (microsatellites) for a cactus species.

SREL Investigator

Dr. S. Lance

Date of Request

January 2012

Requesting Entity

Faculty member, Asociacion para el desarrollo sostenible, Canary Islands, Spain

Nature of Request

Develop genetic markers (microsatellites) for the eastern kingsnake.

SREL Investigator

Dr. S. Lance

Date of Request

February 2012

Requesting Entity

Faculty member, University of California, Santa Cruz

Nature of Request

Develop genetic markers (microsatellites) for the Anahuacan graphic lizard.

SREL Investigator

Dr. S. Lance

Date of Request

March 2012

Requesting Entity

Faculty member, California State University, Fullerton

Nature of Request

Develop genetic markers (microsatellites) for the Northern grasshopper mouse.

SREL Investigator

Dr. S. Lance

Date of Request

March 2012

Requesting Entity

Graduate student, Brock University, Canada

Nature of Request

Develop genetic markers (microsatellites) for the Northern grasshopper mouse.

SREL Investigator

Dr. S. Lance

Date of Request

April 2012

Requesting Entity

Faculty member, Colorado College

Nature of Request

Develop genetic markers (microsatellites) for the flammulated owl.

SREL Investigator

Dr. S. Lance

Date of Request

May 2012

Requesting Entity

Postdoctoral Fellow, University of New Mexico

Nature of Request

Develop genetic markers (microsatellites) for the pupfish.

SREL Investigator

Dr. S. Lance

Date of Request

July 2012

Requesting Entity

Faculty member, Universidad Central del Ecuador, Ecuador

Nature of Request

Develop genetic markers (microsatellites) for two species of shrimp.

SREL Investigator

Dr. S. Lance

Date of Request

August 2012

Requesting Entity

Faculty member, Harvard University

Nature of Request

Develop genetic markers (microsatellites) for two species of fungus growing ants.

SREL Investigator

Dr. S. Lance

Date of Request

July 2012

Requesting Entity

Faculty member, Tasmanian Institute of Agriculture, Australia

Nature of Request

Develop genetic markers (microsatellites) for a pathogenic plant fungus.

SREL Investigator

Dr. S. Lance

Date of Request

July 2012

Requesting Entity

Faculty member, University of Michigan

Nature of Request

Develop genetic markers (microsatellites) for a spiny pocket mouse.

SREL Investigator

Dr. S. Lance

Date of Request

July 2012

Requesting Entity

Graduate student, Florida International University

Nature of Request

Develop genetic markers (microsatellites) for the Mayan cichlid.

SREL Investigator

Dr. S. Lance

Date of Request

July 2012

Requesting Entity

Faculty member, Pacific Biological Station-- Fisheries and Oceans Canada

Nature of Request

Develop genetic markers (microsatellites) for the Indian mackerel.

SREL Investigator

Dr. S. Lance

Date of Request

July 2012

Requesting Entity

Faculty member, St. Olaf College

Nature of Request

Develop genetic markers (microsatellites) for an oyster.

SREL Investigator

Dr. S. Lance

Date of Request

August 2012

Requesting Entity

Faculty member, University of Wisconsin, LaCrosse

Nature of Request

Develop genetic markers (microsatellites) for two species of ostracods.

SREL Investigator

Dr. S. Lance

Date of Request

September 2012

Requesting Entity

Faculty member, Kuwait Institute for Scientific Research, Kuwait.

Nature of Request

Develop genetic markers (microsatellites) for silver pomfret fish.

SREL Investigator

Dr. T. Tuberville

Date of Request

October 2011

Requesting Entity

Gopher Tortoise Council and Florida Fish and Wildlife Commission

Nature of Request

Led panel (with Dr. Kurt Buhlmann) on reintroduction and restocking techniques for gopher tortoises. Meeting attended by state and federal agency biologists as well as academic researchers.

SREL Investigator

Dr. T. Tuberville

Date of Request

March 2012

Requesting Entity

IUCN Amphibian Specialist Group/World Bank

Nature of Request

Help design research and monitoring protocols for reintroduction of Kihansi spray toad in Tanzania.

SREL Investigator

Dr. T. Tuberville

Date of Request

2012; ongoing

Requesting Entity

South Carolina Department of Natural Resources

Nature of Request

Serve as biological expert on gopher tortoise population biology and reintroduction techniques.

SREL Investigator

Dr. T. Tuberville

Date of Request

2012; ongoing

Requesting Entity

National Park Service

Nature of Request

Help design and conduct population monitoring of Texas tortoises at Palo Alto National Monument in order to inform management of the park.

SREL Investigator

Dr. T. Tuberville

Date of Request

2012; ongoing

Requesting Entity

US Fish and Wildlife Service

Nature of Request

Serve as biological expert on population viability and reintroduction of Blanding's turtles for Great Meadows Wildlife Refuge Complex, MA.

SREL Investigator

Dr. K. Buhlmann

Date of Request

June 2011

Requesting Entity

U.S. Fish and Wildlife Service, Shepards town, WV

Nature of Request

Taught a workshop and provided identification of turtles from around the world for USFWS Law Enforcement Agents, Special Agents, and Airport inspectors (with Whit Gibbons).

SREL Investigator

Dr. K. Buhlmann

Date of Request

September 2011

Requesting Entity

U.S. Fish and Wildlife Service, Office of Management Authority

Nature of Request

Attend invited meeting in St. Louis Mo where USFWS solicited expert opinion from turtle ecologists regarding the issue of commercial harvest of turtles in the U.S. and export to China

SREL Investigator

Dr. K. Buhlmann

Date of Request

October 2011

Requesting Entity

Florida Game and Freshwater Fish Commission

Nature of Request

Attend and present at a panel discussion at request of FGFFC in Orlando, FL Assist FGFFC on formulating their agency response to development of gopher tortoise habitats and translocation of displaced tortoises.

SREL Investigator

Dr. K. Buhlmann

Date of Request

November 2011

Requesting Entity

U.S. Fish and Wildlife Service

Nature of Request

Invited attendance to a meeting in Langhorne PA by USFWS to help them design more effective survey and monitoring strategies for endangered bog turtles in the northeastern US.

SREL Investigator

Dr. K. Buhlmann

Date of Request

December 2011

Requesting Entity

U.S. Forest Service-SR

Nature of Request

Assist USFS-SR with prescribed burning planning for Mona Bay and Woodward Bay Set-Asides

SREL Investigator

Dr. K. Buhlmann

Date of Request

December 2011

Requesting Entity

Turtle Conservation Fund

Nature of Request

Review, evaluate, and rank 27 proposals for potential funding support by this non-profit conservation group.

SREL Investigator

Dr. K. Buhlmann

Date of Request

February 2012

Requesting Entity

IUCN Freshwater Turtle and Tortoise Specialist Group and Red List Authority

Nature of Request

Requested to provide shape files of world turtle maps to help with their global distribution and threat assessment efforts.

SREL Investigator

Dr. K. Buhlmann

Date of Request

February 2012

Requesting Entity

Southeast Partners in Amphibian and Reptile Conservation

Nature of Request

Asked to co-chair Reintroduction Task Force and conduct workshop/discussion at annual SEPARC meetings (with Tracey Tuberville).

SREL Investigator

Dr. K. Buhlmann

Date of Request

April 2012

Requesting Entity

Jeykll Island Authority and Georgia Sea Turtle Center

Nature of Request

Asked to assist with design of a diamondback terrapin conservation program to reduce road mortalities on the Jeykll Island Causeway and to help implement a program to provide nesting habitat for terrapins that deters terrapin road mortality.

SREL Investigator

Dr. K. Buhlmann

Date of Request

May 2012

Requesting Entity

Turtle Conservation Fund

Nature of Request

Review, evaluate, and rank 33 proposals for potential funding support by this non-profit conservation group.

SREL Investigator

Dr. K. Buhlmann

Date of Request

July 2012

Requesting Entity

Partners in Amphibian and Reptile Conservation

Nature of Request

Participated in discussions with PARC leadership to finish the 5th publication in the Habitat Management Guidelines (HMG) series for the Southwest US.

SREL Investigator

Dr. K. Buhlmann

Date of Request

August 2012

Requesting Entity

Bristol County Agricultural High School, Dighton, MA

Nature of Request

Asked to write a letter of support for the natural resources management offered by the high school, as the school is a partner our Blanding's turtle translocation effort with the USFWS.

SREL Investigator

Dr. K. Buhlmann

Date of Request

September 2012

Requesting Entity

SREL Outreach Program

Nature of Request

Assisted with SREL Touch an Animal day.

purchase (for a state natural heritage preserve)
the portion of Craig's Pond off-site.

SREL Investigator

Dr. K. Buhlmann

Date of Request

September 2012

Requesting Entity

US Fish and Wildlife Service, Charleston SC
office

Nature of Request

Asked by USFWS for estimates of gopher
tortoise abundance in South Carolina in support
of Recovery Plan.

SREL Investigator

Dr. K. Buhlmann

Date of Request

September 2012

Requesting Entity

IUCN Global Amphibian Specialist Group

Nature of Request

Approached by IUCN requesting assistance
with the design and implementation of a
program to reintroduce the Kihansi Spray Toad
(*Nectophrynoides asperginus*), a species
currently extinct-in-the-wild, back to native,
recovered habitat in Eastern Arc Mountains of
Tanzania, Africa.

SREL Investigator

Dr. K. Buhlmann

Date of Request

September 2012

Requesting Entity

South Carolina Department of Natural
Resources

Nature of Request

Provide information about rare species and the
ecology of Craig's Pond to assist SCDNR in
writing a proposal to USFWS for funds to

TASK 9. SREL scientists will work closely with SRS personnel to assist DOE and other SRS contractors in making wise and informed decisions concerning land and facilities management. SREL will continue to publish its scientific findings in peer-reviewed scientific journals to aid the public and to assist DOE in making policy decisions by providing a basis of independent, verifiable science

Please see SECTION VIII of this report for a list of SREL publications in FY12. Below we provide examples of specific activities that SREL personnel have conducted in FY12 to assist DOE and other SRS site tenants with ongoing missions and to leverage federal funding provided to SREL to attract non-federal funding to conduct research activities on the SRS.

Department of Energy – SR

- SREL Director escorted Dr. Moody, SRS DOE Site Manager, to UGA for meetings with the OVPR, Provost, and a variety of deans to discuss potential for UGA to contribute to DOE-SR mission needs
- SREL Director provided two presentations to the SRS Citizens Advisory Board, one on current SREL research, education, and outreach programs and one on the radioecology strategic initiative at SRS
- SREL personnel provided a presentation to the Citizens for Nuclear Technologies Association on the current status of SREL research, education, and outreach programs
- SREL personnel conducted preliminary data collection on amphibian diseases on the SRS and provided recommended protocols for biosafety procedures to other SRS site tenants
- SREL leveraged DOE funding against UGA funding to hire a new postdoctoral researcher to work on development of pilot projects in proteomics/metabolomics research in the SREL low dose facility to examine consequences of low dose exposures to aquatic species on the SRS
- SREL has leveraged DOE funding and SRS site assets to obtain >450K in new external dollars from FAA and USDA to conduct research on the SRS in support of aviation safety and invasive species management
- SREL personnel hosted Pat McGuire of DOE to a tour of SREL to highlight analytical capabilities that might be used in support of SRS missions
- SREL personnel participated in a DOE meeting on Land Reuse on the SRS
- SREL personnel presented on the Radioecology Strategic Initiative at the offsite meeting of the SRS Strategic Initiative Champions with the Mission Development Council

Department of Energy – NNSA

- SREL personnel met with Doug Dearolph, Scott Cannon, and Roxanne Jump of NNSA Tritium to discuss ongoing and future research in support of tritium production on the SRS
- SREL personnel leveraged funding from NNSA to conduct research on biogeochemical cycling and efficiency of metal treatment of the HO2 wetland associated with the regulatory requirements of tritium production on the SRS
- SREL personnel leveraged funding from NNSA to conduct ecotoxicological research on amphibians utilizing the HO2 metal treatment wetlands to elucidate the biological effects of copper and other metals associated with tritium production on the SRS
- SREL personnel met with Sam Wisdom of NNSA to discuss SREL activities and research in support of MOX
- SREL personnel leveraged funding from the NNSA to conduct research focused on the impacts of MOX construction on the viability of upper three runs creek
- SREL outreach personnel conducted extensive community outreach and education programs for NNSA and SRS and specifically provided support to DOE's Take Our Children to Work Day (Kids Day) with exhibits and presentations at onsite facilities plus hosting MOX personnel and children for visits to see the SREL alligators and other animals

Savannah River Remediation

- SREL personnel hosted Terry Spears and Jim Folk of DOE to a tour of SREL to highlight analytical capabilities that might be used in support of SRS missions
- SREL personnel hosted a tour for representatives of Savannah River Remediation to highlight analytical capabilities that might be used in support of SRS missions
- SREL personnel established a new contract with SRR to perform work scope related to derivation of Kd values for cementitious materials

Savannah River Nuclear Solutions

- SREL personnel leveraged funding from ACP to conduct radioecology research programs on radionuclides in long-lived reptiles, radionuclides in game species, and tritium mitigation activities at the Mixed Waste Facilities on SRS
- In 2012, SREL personnel completed final reports for ACP-funded research on the SRS involving remote stream sampling for contaminants, vegetation alternatives for waste caps, risk assessments in Tims Branch and Steed Pond, Ash-related contaminants in Dunbarton Bay, trophic transfer models, and other ecological research on site
- SREL personnel met with ACP senior management team to discuss partnership involving green remediation technologies to be piloted and employed on SRS and internationally – Planning for Green Remediation workshop to be held in spring 2013 is underway

Wackenhut

- SREL personnel with Randy Garver, the General Manager of Wackenhut on the SRS, to provide information on SREL capabilities and to discuss potential Wackenhut needs for SREL expertise
- SREL personnel provided subject matter expertise to address K-Area intrusion alarm issues associated with wildlife and have submitted a proposal to DOE and SRNS to experimentally evaluate cost-effective solutions to reduce false alarm responses by Wackenhut personnel

Savannah River National Laboratory

- SREL personnel held a workshop on the potential for development of Green Remediation research on the SRS with SRNL, SREL, and UGA participants
- SREL personnel traveled to Japan to meet with faculty researchers at the University of Tokyo to discuss potential research and education collaborations
- SREL personnel gave a tour of the SREL Low Dose Facility to Dr. Tony Burris, Associate Director of SRNL's Security Programs
- SREL personnel participated in the 2012 National Center for Radioecology workshop and presented on the status of radioecology at SREL and on the use of the SRS as a test bed for radioecology research
- SREL personnel briefed SRNL Embassy Science Fellow, Bob Sendalar, on SREL environmental capabilities for cleanup activities in Japan

US Forest Service

- SREL personnel participated in a meeting with SRNS, USFS, and DOE regarding the future of SRS deer hunt operations
- SREL personnel met with Dr. John Blake of the USFS to discuss potential collaborations on biofuel production on the SRS

TASK 10. SREL will provide stipend support to college undergraduates, graduate students, and visiting faculty to conduct research on the Savannah River Site in association with ongoing environmental research studies. The objective of the program will be to provide participants, including minority students and Historically Black Colleges and Universities, with an opportunity to pursue ecological research and training under the direction and supervision of SREL scientific staff members

The objectives of the SREL Education Program are to (1) recruit and develop additional professionals to the environmental sciences and (2) enhance environmental awareness and research opportunities among undergraduate and graduate students with emphasis on conducting ecological research important to the DOE and Savannah River Site mission. We have made special efforts in the recruitment from under-represented minority groups and our faculty members have worked with both students and faculty from Historically Black Colleges and Universities (HBCU) throughout the Southeast.

SREL has a long history of graduate and undergraduate education, training over 400 graduate and over 600 undergraduate researchers since 1967. Undergraduate students from more than 275 different colleges and universities have coauthored more than 170 peer reviewed research publications and more than 200 of these students have gone on to pursue careers in science. SREL offers students state-of-the-science laboratory facilities, a wide variety of natural and impacted habitats for field research, a diversity of faculty expertise, and more than sixty years of experience in ecological research. Since 1967, an average of six students per year have completed graduate studies at SREL, resulting in a total of more than 335 dissertations and theses. Since 1985, our graduate students have won over 200 awards from regional, national, and international competitions at numerous professional societies and foundations. In recent years, SREL has undergone significant changes in administrative infrastructure and transitioned to self-supporting funding model. Throughout this transition period, SREL has maintained its commitment to student research and education as an integral component of its mission. In fact, many of the current graduate students initiated their program of study in 2011.

Although we had no funded program in 2012, SREL faculty and staff mentored and supervised 7 undergraduate students (Table 1) from several universities. These students were supported from several funding sources including DOE supported projects and other extramural grants and projects. In addition, SREL faculty provided support for 27 graduate students (Table 2) from universities across the country in 2012. In many cases, this included formal involvement by serving as major advisors/co-major advisors and committee members for M.S. and Ph.D. candidates and in a few cases students received stipend support. However, support for students also included various activities in less formal relationships such as assistance at and access to field sites, use of field equipment, temporary lab space, as well as analytical and GIS resources for their studies.

With the arrival of the new SREL director, an emphasis has been placed on finding creative ways to cost share graduate students by leveraging UGA funding with federal funding acquired through SREL's cooperative agreement with the Department of Energy. In addition, new emphases have been placed on enhancing participation of SREL Research Faculty in both graduate and undergraduate instruction. To these ends, SREL accomplished the following in FY12.

- SREL has leveraged SRS site assets to acquire external resources to conduct UGA Maymester courses in radioecology and wildlife ecology beginning in May 2013
- SREL has leveraged UGA funding against project specific funding from DOE and other sources to cost share 15 new graduate students – selected from over 100 applications received by SREL Research Faculty in FY12 - all of whom have projects which will contribute to the knowledge base and needs of the SRS

- SREL leveraged DOE dollars to obtain 4 months of salary support for each of 2 research faculty to provide instructional support to UGA departments as a means to maintain critical environmental expertise on the SRS
- SREL provided funding to establish 5 undergraduate internships in radioecology as part of collaborative education and research efforts in radioecology with faculty at USC-Aiken and the University of Georgia Warnell School of Forest and Natural Resources
- SREL personnel submitted a National Science Foundation Proposal to develop a *Research Experience For Undergraduates* internship program for undergraduates in radioecology
- SREL personnel met with Program Managers for the US Department of Education's Graduate Assistantships in Areas of National Needs Program and the McNair Fellows Program to brief them on the need for graduate research in radioecology and to discuss future funding opportunities to support graduate stipends
- SREL personnel traveled to Washington D.C. to meet with representatives of Homeland Security's National Technical Forensics Center to discuss potential opportunities for funding graduate student research

Table 10.1. SREL Undergraduate Student Program Participants, FY 12

Undergraduate	University	Faculty Advisor
Traci Jones	Tennessee Technological University	Mills
Shelby Weathersbee	University of South Carolina-Aiken	Mills
Aubrey Danielson	University of South Carolina-Aiken	Mills
Nicholas Scobe	Michigan State University	Buhlman
Frances Owens	University of Iowa	Buhlman
Nicole Gerrard	Rutgers University	Buhlman
Jeff Slocum	University of Connecticut	Buhlman

Table 10.2. SREL Graduate Student Program Participants, FY 12

Student	Degree	University	SREL Faculty	Role
Shea Beuttner	M.S.	University of Georgia	Seaman	Advisor
Julian Singer	Ph.D.	University of Georgia	Seaman	Advisor
Yi –Ting Deng	M.S.	University of Georgia	Seaman	Committee
Bess Harris	Ph.D.	University of Georgia	Tuberville	Advisor
Melia Nafus	Ph.D.	University of CA.-Davis	Tuberville	Committee
Jess McGuire	Ph.D.	University of Georgia	Tuberville	Committee
Mark Peaden	M.S.	University of CA.	Tuberville	Committee
John Finger	Ph.D.	University of Georgia	Tuberville	Committee
Jared Green	M.S.	University of Mass	Buhlman	Committee
Nassor Mohammed	M.Sc.	University of Sares Salaam	Buhlman	Committee
Brian Metts	Ph.D.	University of Georgia	Buhlman	Advisor
Brian Crawford	M.S.	University of Georgia	Buhlman	Committee
Brett Moule	Ph.D.	Clemson University	Buhlman	Committee
Wesley Flynn	Ph.D.	University of Georgia	Lance	Advisor
Caitlin Rumrill	M.S.	University of Georgia	Lance	Advisor
Allison Williams	Ph.D.	University of Georgia	Lance	Committee
Eric Goolsbey	Ph.D.	University of Georgia	Lance	Committee
Jason O’Bryhim	Ph.D.	George Mason University	Lance	Committee
Erin Abernathy	M.S.	University of Georgia	Rhodes	Advisor
Cecilia Hennessey	Ph.D.	Purdue University	Rhodes	Advisor
William. Beatty	Ph.D.	Purdue University	Rhodes	Advisor
Steve Kimble	Ph.D.	Purdue University	Rhodes	Committee
Shem Unger	Ph.D.	Purdue University	Rhodes	Committee
Jusun Hwang	Ph.D.	University of Georgia	Rhodes	Committee
Matt Beard	Ph.D.	Purdue University	Rhodes	Committee
Gabrielle Robinson	M.S.	University of Georgia	Mills	Committee
Paul Edwards	M.S.	Eastern Illinois University	Mills	Committee

TASK 11. The participant will operate and maintain the SREL facilities on the SRS to efficiently and successfully perform the research, education and outreach programs described in this project description (Appendix A of the Cooperative Agreement)

Facilities Maintenance

The Savannah River Ecology Laboratory is the custodian of ten DOE owned buildings with the largest of these being our 45,000 square foot main laboratory and office complex. We also operate a 4,000 square foot radioecology laboratory located near Par Pond, four animal holding facilities, a greenhouse complex, two office buildings, and an assortment of utility buildings (maintenance shops, receiving building, and storage sheds).

As a partner here on the Savannah River Site we strive to maintain our facilities in such a way that they comply with all DOE guidelines for property use and safety standards. We have also worked to develop facilities that are not only aesthetically pleasing, enjoyable and safe to work in, but facilities that lend themselves toward providing our researchers with the best possible environment to conduct their research. To that end, we have set aside significant parts of our overhead budget and dedicated many man-hours to the maintaining and renovation of our facilities.

We have made several significant improvements to our main laboratory and office complex over the last year. In terms of our critical utilities infrastructure, we have invested over \$14,000 in repairing and improving our HVAC and air handling systems and over \$25,000 in repairing and upgrading our general facility. Some of our significant projects include:

- A. Replacing one steam coil and one chill water coil that were on the verge of failure.
- B. Repairing and updating several of our HVAC control systems.
- C. Upgrading our steam room by replacing malfunctioning steam traps and pressure relief valves.
- D. Installing new volume control boxes (temperature controllers) in several offices and labs to replace poorly performing ones.
- E. Clean and repaint entire exterior of our main building 737-A.
- F. Total renovation of our Graduate Student office section including new paint, carpet and furniture.

We have also made efforts throughout our complex to improve our organization and storage capabilities by excessing unneeded or non-functioning supplies and equipment. We have installed new storage cages and shelving in some of our buildings to improve our storage capability and we are making efforts to continually improve our capacity for storing our equipment and supplies in the proper manner. We have also begun efforts to revitalize our facility grounds by purchasing needed lawn equipment, making repairs to our grounds irrigation system, and pruning and attending to our facilities flora.

Currently we are also conducting efforts to bring our radio ecology laboratory at Par Pond back to fully operational status. We have completed a renovation of the facility's exterior by painting it and repairing several water damaged areas, and research personnel are currently working to bring the research capabilities of this facility back on line. While SREL has completed many successful facility improvements this year, it is our continued goal to maintain facilities that comply with DOE guidelines as well as reflect positively on our staff and their research efforts.

Environmental Health and Safety (EH&S) Program

The Savannah River Ecology Laboratory (SREL) continues to operate successfully under safety and environmental requirements and standards established by The University of Georgia and the SREL Safety Manual. These standards continue to address the hazards associated with SREL operations by permitting a focused effort on the health and safety issues most pertinent to SREL operations. SREL supports and

promotes an integrated approach to SRS environmental health and safety issues as a signatory to the SRS Workplace Safety, Health and Security Policy and the SRS Environmental Management System Policy Statement.

SREL maintains a commitment of one, full-time position (SREL EH&S Manager) dedicated to the support of the SREL EH&S Program. The SREL EH&S Manager interfaces with other SRS Contractor Environmental Health and Safety Programs and Professionals through participation in site level management Committees (ISM Integration Council and the SRS Senior Environmental Managers Council).

The SREL EH&S Manager functions as an interface with other SRS organizations in receiving and distributing applicable Lessons Learned information. By integrating with other SRS organizations to share Lessons Learned information, SREL takes advantage of the collective experience and improvements identified by other organizations for similar work processes and controls at SREL. SREL's internal computer network was used to provide targeted safety information to specific groups in the laboratory. The SREL EH&S Manager electronically distributed **20** (twenty) lessons learned notices in FY 2012 to targeted groups at SREL. Additionally, in excess of **100** (one-hundred) SRS operational safety and environmental related announcements and notices were communicated to all SREL personnel.

The SREL EH&S Manager provided weekly reports of recordable personnel accidents or injuries to DOE-SR line management. SREL also provided monthly, SREL personnel work hour statistics to DOE-SR. SREL personnel reported **0** (zero) work related recordable injuries/illnesses during FY2012.

The SREL EH&S Program continues to place an emphasis on safety and environmental training of SREL personnel. All new SREL personnel receive an initial, SREL-specific orientation on the topic of SREL safety and environmental programs, policies, and procedures in addition to the SRS required General Employee Training (GET). New SREL personnel also receive job specific safety training provided for by their SREL supervisor. Approximately **27 (twenty-seven)** new SREL personnel received this required training during FY2012. Additionally, SREL personnel received EH&S related training during FY2012 in the following functional areas as their job tasks required:

- Radiological Training – Radiological Worker Training, Radioactive Sealed Source User Training, and Radiation Generating Device training
- Remote worker training in accordance with SRS remote worker requirements
- Georgia Right-To-Know Law (GRTK- HAZCOM equivalent) chemical specific training for UGA/SREL employees who utilize hazardous chemicals in the work place
- Resource Conservation Recovery Act (RCRA) training for employees involved in the management, handling, or manipulation of hazardous or universal wastes.

SREL waste minimization and chemical disposal issues continue to be refined to promote sound environmental practices and support SRS environmental initiatives. Waste minimization techniques such as source reduction and bench-top treatment continue to be incorporated into experimental protocols, reducing the burden associated with waste disposal procedures while supporting SREL's pollution prevention efforts. SREL generated very small amounts of hazardous wastes in FY2012. As part of SREL waste minimization efforts and to ensure that chemical hazards are addressed prior to purchasing chemicals, the SREL EH&S Manager reviewed and approved **39** (thirty-nine) purchase requisitions that included chemicals purchased by SREL personnel.

SREL received no Notices of Violation in FY2012 as the result of external or internal reviews, inspections, or assessments. DOE-SR Field Operations Safety Assessments conducted for SREL

operations and facilities during FY2012 identified 3 (three) safety related findings resulting in 5 (five) corrective actions identified and managed to compliance by SREL through the implementation of a formal Corrective Action Plan (CAP) submitted to DOE-SR. Additionally, SREL conducted assessments in the areas of chemical and radiological air emissions, community right-to-know, and the Georgia Right-to-Know law in compliance with state and federal requirements. SREL also participated in the SRS's annual, comprehensive review and declaration process for Integrated Safety Management Systems (ISMS). As part of the annual ISMS declaration, SREL revised its Integrated Safety Management System Description Document, reviewed its FY2012 safety performance, and established its FY2013 safety performance goals.

Equipment Acquisition and Maintenance

Each year SREL reviews its capital equipment resources to ensure we maintain the analytical instrumentation as well as the laboratory and field equipment needed to meet the goals and objectives of our research programs. Regular review of our equipment infrastructure is important for maintaining and improving our research productivity, completing the tasks and objectives of our grants and contracts, and acquiring new equipment that employs technological advances needed to maintain the high quality of SREL's research programs. Based on input from the SREL research staff and prioritization by the Capital Equipment Committee the following equipment was approved for purchase by the SREL Director. The lists include a mix of new instruments as well as equipment upgrades and repairs that allowed us to best achieve our priority equipment needs within our budget constraints. The total expenditure was \$126,482. Also included are 2 GC-MS instruments acquired at no cost from a SRNL monitoring lab that had exceeded the instruments.

Description	Total Cost	Category	Programs Supported
Automated gamma counter	\$42,742	Replacement for old non-working instrument	Radioecology; NCORE
High- capacity sample manifold for freeze drier	\$5,400	Replacement of an old manifold	Ecotoxicology; Environmental Chemistry; Ecological trophic dynamics
High performance liquid chromatograph with interface and software control for existing ICP-MS	\$39,100	Replacement for old instrument which does interface to new ICP-MS	Environmental Chemistry; Ecotoxicology
Caliper LabChip XT	\$20,000	Nucleic acid fractionation	Ecotoxicology; Disease ecology; Population genetics; Conservation genetics; Marker development
2 Gas chromatograph-mass spectrometers (GC-MS)	\$0; excess From SRNL	Replacements for 20- year old GC-MS	Environmental Chemistry; Ecotoxicology
Setup of GC-MS and half-day training; upgrade to automated liquid sampler	\$19,240	Installation of recently acquired GC-MS excessed from SRNL Monitoring Lab. Includes addition new autosampler	Environment Chemistry; Ecotoxicology

TASK 12. UGARF will be responsible for management and engineering services for the planning, design, and construction of approved projects as may be required to repair, modify or upgrade existing facilities or construct new facilities, not to include line item projects, necessary to support the UGARF scope of work, as approved by the Contracting Officer and appropriate DOE program personnel. Funding for major repairs and new construction will be provided by DOE

No new construction was undertaken in FY12. See Task 11 (above) for summary of facilities upgrades.

SECTION III. Cost Status Report

Provided to DOE-SR budget office monthly and final FY12 report was submitted on time.

SECTION IV. Schedule Status Report

No significant changes in the schedule of deliverables or achievement of milestones were experienced by SREL in FY12.

SECTION V. Changes in Approach or Goals

In FY12 SREL implemented a number of administrative changes designed to improve accountability, facilitate the conduct of business, and focus resources and procedures within those areas deemed most critical to carrying out the mission of the laboratory. These changes include:

- Development of new internal badging control protocols for SREL to increase accountability and awareness of SREL-hosted personnel on the SRS
- Development of new protocols for review and approval of funding proposals prior to official transmittal to UGA for enhanced accountability and communication
- Created and provided initial charges to new standing SREL committees for laboratory management, equipment, facilities, IT, safety, seminars, GIS support, animal care and use, undergraduate programs, and graduate programs
- Instituted new annual review protocols for faculty and staff using formal data collection and tracking processes
- Created detailed guidelines for faculty seeking promotion to Associate and Senior Research Scientist
- Created new, detailed Roles and Responsibilities descriptions and assignments for research scientists
- Created a new set of guidelines and procedures for recruiting, evaluating, and funding of graduate students
- Created and implemented new protocols for evaluation of requests for equipment funding
- Created an Ad Hoc committee to address legacy waste issues at SREL and to develop pathway for disposition of current and future hazardous waste streams
- Instituted regularly scheduled faculty meetings at SREL
- Developed a path forward to address issues involving facilities maintenance, space assignment, equipment upkeep, property excess, and storage needs at SREL
- Implemented quarterly meetings with the DOE Site Manager and monthly meetings with the DOE Assistant Site Manager overseeing the SREL Cooperative Agreement

In addition, the new Director of SREL has challenged the Research Scientists and Staff at the laboratory to increase the proportion of total funding received by the laboratory from sources external to the SRS in an effort to both diversify funding streams for the laboratory and effectively leverage federal dollars to attract external funding to the SRS. In FY12, external funding (non-SRS or UGA dollars) totaled 9% of the laboratories budget (Section I; Section II-Task 8). It is the intent of laboratory management to increase this proportion to >20% in FY13.

SECTION VI. Actual or Anticipated Problems, Delays and Remedial Actions

Due to restrictions on budgetary reprogramming authority and delays associated with the FY12 continuing resolution for budgetary authority, funding from DOE-SR for FY12 was received through the cooperative agreement in late March and late May of 2012. The late arrival of funding resulted in approximately ½ of the anticipated amount of funding targeted for allocation and the carryover of approximately 1/3 of the FY12 allocated funds into FY13.

A loss of approximately \$50,000.00 of funding from Savannah River Nuclear Solutions to support SREL participation in public tours on the SRS resulted in a decision point for SREL management as to whether to continue to provide this service the SRS without cost to SRNS, or to allocate funding received from DOE-SR under the cooperative agreement to cover this shortfall. The SREL director chose to redirect funding to cover the deficit but will need to revisit this decision in subsequent years as it is the understanding of SREL that SRNS has been allocated the funding to run public tours on the SRS and thus it is their responsibility to carry the personnel and animal care costs of SREL's participation in the program.

Language in the new cooperative agreement (2011-2016) between the University of Georgia Research Foundation and the Department of Energy specifies SREL's right to charge DOE for the use of the University of Georgia Conference Center. This provision was added to the cooperative agreement due to the fact that no funding had been provided to SREL by DOE-SR in the previous several years, thus making the cost of maintaining the conference center as well as the main laboratory facilities the responsibility of SREL management. However, the permit for the use of the DOE land upon which the UGA conference center was built specifies that DOE has free use of the facility. Thus a discrepancy between the cooperative agreement and the permit needed to be addressed. In FY12, a limited amount of funding was once again provided to SREL and the director of SREL resolved this issue by agreeing to allow free use of the facility by DOE personnel, subject to scheduling conflicts, and initiating an effort to change the language in the cooperative agreement to accommodate this action and resolve any discrepancies in authorities. This action is slated to occur in FY13.

SECTION VII. Absence or Changes in Key Personnel or Team Arrangement.

Administrative

Separated – Robert Nestor (Assistant Director)

Separated – Dr. Ken McLeod (Interim Director)

Hired – Dr. Olin Rhodes (Director)

Hired – Chris McBride (Assistant Director)

Research Scientists

Separated – Dr. Cary Tuckfield (Associate Research Scientist)

Hired – Dr. James Beasley (Assistant Research Scientist)

Research Professionals

Separated – Julian Singer (Research Professional I)

Separated – Jeremy Stillings (Research Professional I)

Hired – Rochelle Beasley (Research Professional II)

Research Technicians

Separated – Wes Flynn (Research Technician III)

Separated – Barbara Moyer (Research Technician II)

Support Staff

Hired – Louise Zweifel (Administrative Specialist I)

Graduate Students

Hired – Wes Flynn (Ph.D. Student)

SECTION VIII. Products or technology transfer accomplished: Publications, websites, collaborations, technologies, inventions/patents, other products

SREL faculty and staff added 45 new publications to the SREL reprint list in 2012

- 3199 Goldberg, S., I. Lebron, J. C. Seaman and D. L. Suarez (2011). Soil Colloidal Behavior. Handbook of Soil Science. P. M. Huang, CRC Press: 1-39.
- 3200 Gaines, K. F., J. W. Summers, J. C. Cumbee Jr., W. L. Stephens Jr. and G. L. Mills (2011). "Is the LCP Superfund Site an Ecological Trap for Clapper Rails?" Southeastern Naturalist 10(4): 703-712.
- 3201 DeGregorio, B. A., K. A. Buhlmann, A. M. Grosse, B. B. Harris, R. V. Horan III, T. D. Tuberville and B.M. Moule (2011). "Gopherus polyphemus (Gopher Tortoise) Burrow Associate." Herpetological Review 42(3): 421.
- 3202 Castoe, T. A., A. W. Poole, A. P. J. de Koning, K. L. Jones, D. F. Tomback, S. J. Oyler-McCance, J. A. Fike, S. L. Lance, J. W. Streicher, E. N. Smith and D. D. Pollock (2012). "Rapid Microsatellite Identification from Illumina Paired-End Genomic Sequencing in Two Birds and a Snake." PLoS ONE 7(2): e30953.
- 3203 Koler-Matznick, J., I. L. Brisbin Jr., M. Feinstein and S. Bulmer (2003). "An updated description of the New Guinea singing dog (*Canis hallstromi*, Troughton 1957)." Journal of Zoology 261(2003): 109-118.
- 3204 Gibbons, J. W. (2012). The Value of Long-Term Monitoring. Reptile Biodiversity: Standard Methods for Inventory and Monitoring. R. W. McDiarmid, M. S. Foster, C. Guyer, J. W. Gibbons and N. Chernoff. Berkeley, University of California Press: 29-32.
- 3205 Purdue, J. R., O. T.K. and M. H. Smith (2006). "Independent Occurrences of Multiple Repeats in the Control Region of Mitochondrial DNA of White-Tailed Deer." Journal of Heredity 97(3): 235-243.
- 3206 Hernandez, S. M., T. D. Tuberville, P. Frank, S. J. Stahl, M. M. McBride, K. A. Buhlmann and S. J. Divers (2011). "Health and Reproductive Assessment of a Free-Ranging Gopher Tortoise (*Gopherus polyphemus*) Population Following Translocation." Journal of Herpetological Medicine and Surgery 20(2-3): 84 - 93.
- 3207 Lindsay, D. S., J. L. WeEston and S. E. Little (2001). "Prevalence of antibodies to *Neospora caninum* and *Toxoplasma gondii* in gray foxes (*Urocyon cinereoargenteus*) from South Carolina." Veterinary Parasitology 97(2001): 159-164.
- 3208 Metts, B. S., K. A. Buhlmann, D. E. Scott, T. D. Tuberville and W. A. Hopkins (2012). "Interactive effects of maternal and environmental exposure to coal combustion wastes decrease survival of larval southern toads (*Bufo terrestris*)." Environmental Pollution 164(2012): 211-218.

- 3209 St. John, J. A., E. L. Braun, S. R. Isberg, L. G. Miles, A. Y. Chong, J. Gongora, P. Dalzell, C. Moran, B. Bed'Horn, A. Abzhanov, S. C. Burgess, A. M. Cooksey, T. A. Castoe, N. G. Crawford, L. D. Densmore, J. C. Drew, S. V. Edwards, B. C. Faircloth, M. K. Fujita, M. J. Greenwold, F. G. Hoffmann, J. M. Howard, T. Iguchi, D. E. Janes, S. Y. Khan, S. Kohno, A. P. J. De Koning, S. L. Lance, F. M. McCarthy, J. E. McCormack, M. E. Merchant, D. G. Peterson, D. D. Pollock, N. Pourmand, B. J. Raney, K. A. Roessler, J. R. Sanford, R. H. Sawyer, C. J. Schmidt, E. W. Triplett, T. D. Tuberville, M. Venegas-Anaya, J. T. Howard, E. D. Jarvis, L. J. Guillette Jr., T. C. Glenn, R. E. Green and D. A. Ray (2012). "Sequencing three crocodylian genomes to illuminate the evolution of archosaurs and amniotes." *Genome Biology* 13(1): 415.
- 3210 Burgess, E. A., J. M. Unrine, G. L. Mills, C. S. Romanek and J. Wiegel (2012). "Comparative Geochemical and Microbiological Characterization of Two Thermal Pools in the Uzon Caldera, Kamchatka, Russia." *Environmental Microbiology* 2012(63): 471-489.
- 3211 Li, D., D. I. Kaplan, K. A. Roberts and J. C. Seaman (2012). "Mobile Colloid Generation Induced by a Cementitious Plume: Mineral Surface-Charge Controls on Mobilization." *Environmental Science and Technology* 46(5): 2755-2763.
- 3212 Luhring, T. M. and Z. D. Ross (2012). "*Gastrophryne carolinensis* (Eastern Narrow-mouthed Toad). Predation." *Herpetological Review* 43(1): 118.
- 3213 Matesanz, S., S. E. Sultan, K. L. Jones, C. Hagen and S. L. Lance (2011). "Development and Characterization of Microsatellite Markers for *Polygonum cespitosum* (Polygonaceae)." *American Journal of Botany* 98(7): e180-e182.
- 3214 Milko, L. V., N. M. Haddad and S. L. Lance (2012). "Dispersal via stream corridors structures populations of the endangered St. Francis' satyr butterfly (*Neonympha mitchellii francisci*)." *Journal of Insect Conservation* 2012(16): 263-273.
- 3215 Nunziata, S. O., S. C. Richter, R. D. Denton, J. M. Yeiser, D. E. Wells, K. L. Jones, C. Hagen and S. L. Lance (2012). "Fourteen novel microsatellite markers for the gopher frog, *Lithobates capito* (Amphibia: Ranidae)." *Conservation Genetic Resources* 2012(4): 201-203.
- 3216 Stark, K., D. E. Scott, O. V. Tsyusko, D. P. Coughlin and T. G. Hinton (2012). "Effects of two stressors on amphibian larval development." *Ecotoxicology and Environmental Safety* 2012(79): 283-287.
- 3217 Tuberville, T. D., K. A. Andrews, J. D. Westervelt, H. E. Balbac, J. Macey and L. Carlile (2012). Using Demographic Sensitivity Testing to Guide Management of Gopher Tortoises at Fort Stewart, Georgia: A Comparison of Individual-Based Modeling and Population Viability Analysis Approaches. *Ecologist-Developed Spatially Explicit Dynamic Landscape Models*. J. D. Westervelt and G. L. Cohen. New York, Springer Science+Business Media, LLC: 109 - 130.
- 3218 Palta, M. M., T. W. Doyle, C. R. Jackson, J. L. Meyer and R. R. Sharitz (2012). "Changes in Diameter Growth of *Taxodium distichum* in Response to Flow Alterations in the Savannah River." *Wetlands* 2012(32): 59-71.

- 3219 Steen, D. A., J. P. Gibbs, K. A. Buhlmann, J. L. Carr, B. W. Compton, J. D. Congdon, J. S. Doody, J. C. Godwin, K. L. Holcomb, D. R. Jackson, F. J. Janzen, G. Johnson, M. T. Jones, J. T. Lamer, T. A. Langen, M. V. Plummer, J. W. Rowe, R. A. Saumure, J. K. Tucker and D. S. Wilson (2012). "Terrestrial habitat requirements of nesting freshwater turtles." *Biological Conservation* 150(2012): 121-128.
- 3220 Ennen, J. R., B. R. Kreiser, C. P. Qualls, D. Gaillard, M. Aresco, R. Birkhead, T. D. Tuberville, E. D. McCoy, H. Mushinsky, T. W. Hentges and A. Schrey (2012). "Mitochondrial DNA Assessment of the Phylogeography of the Gopher Tortoise." *Journal of Fish and Wildlife Management* 3(1): 110-122.
- 3221 Allen, J. M., S. G. Obae, M. H. Brand, J. A. Silander, K. L. Jones, S. O. Nunziata and S. L. Lance (2012). "Development and Characterization of Microsatellite Markers for *Berberis thunbergii* (Berberidaceae)." *American Journal of Botany* 99(5): e220-e222.
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- 3229 Seaman, J. C., H. Chang, S. Goldberg and J. Šimůnek (2012). "Reactive Transport Modeling." *Vadose Zone Journal* 11(2): 2012.0066.
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- 3232 DeGregorio, B. A., K. A. Buhlmann and T. D. Tuberville (2012). "Overwintering of Gopher Tortoises (*Gopherus polyphemus*) Translocated to the Northern Limit of Their Geographic Range: Temperatures, Timing and Survival." *Chelonian Conservation and Biology* 11(1): 84-90.
- 3233 Garibay, E. S., A. Silva-Caballero, M. Del Real-Monroy, S. L. Lance, D. Valenzuela-Galvan and J. Ortega (2012). "Development of 24 microsatellite markers for the white nosed coati (*Nasua narica*) using 454 sequencing." *Conservation Genetic Resources* 2012(4): 661-663.
- 3234 Jenssen, T. A., S. Garrett and W. J. Sydor (2012). "Complex Signal Usage by Advertising Male Green Anoles (*Anolis carolinensis*): A Test of Assumptions." *Herpetologica* 68(3): 345-357.
- 3235 Kashiwagi, T., D. Broderick, S. L. Lance, M. B. Bennett and J. R. Ovenden (2012). Development and characterization of ten microsatellite loci for the reef manta ray *Manta alfredi*. *Conservation Genetic Resources*. 2012: 1055-1058.
- 3236 Pate, S. J., J. A. Clement, J. H. McCoy, S. L. Lance and K. G. Mathews (2012). "Development and Characterization of Microsatellite Markers for *Actaea racemosa* (Black cohosh, Ranunculaceae)." *American Journal of Botany* 99(7): e274-e276.
- 3237 Stoutamore, J. L., C. N. Love, S. L. Lance, K. L. Jones and D. Tallmon (2012). "Development of polymorphic microsatellite markers for blue king crab (*Paralithodes platypus*)." *Conservation Genetic Resources* 2012(4): 897-899.
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- 3239 Walls, J. G., G. R. Hepp and L. G. Eckhardt (2012). "Effects of Nest Reuse and Onset of Incubation on Microbial Growth and Viability of Wood Duck Eggs." *The Condor* 114(4): 720-725.
- 3240 McArthur, J. V., R. C. Tuckfield and C. Baker-Austin (2012). *Antimicrobial Textiles. Handbook of Experimental Pharmacology* 211. A. R. M. Coates. Berlin Heidelberg, Springer-Verlag: 135-152.
- 3241 DeGregorio, B. A., A. M. Grosse and J. W. Gibbons (2012). "Density and Size Class Distribution of Yellow-bellied Sliders (*Trachemys scripta scripta*) Inhabiting Two Barrier Island Wetlands." *Herpetological Conservation and Biology* 7(3): 306-312.
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SECTION IX. Special Accomplishments by Laboratory Personnel

Dr. Domy Adriano was given the Soil Science Distinguished Service Award by the Soil Science Society of America

Dr. Jim Beasley was certified as a Wildlife Biologist by the Wildlife Society

Dr. I. Lehr Brisbin was elected as a member of the Board of Trustees for Aiken's Hitchcock Woods Foundation and serves as the Board's Chairman of its Wildlife Committee.

Dr. I Lehr Brisbin served as a member of the Board of Directors and Scientific Advisor to the Southwest Pacific Research Foundation.

Dr. Kurt Buhlmann was asked to participate on the Kihansi Spray Toad Reintroduction Team, in Tanzania

Dr. Kurt Buhlmann served as an Executive Board Member of the Turtle Conservation Fund

Dr. Kurt Buhlmann served as the Co-Chair of the Partners in Amphibian and Reptile Conservation Reintroduction Working Group

Dr. Whit Gibbons served Chair of the Education Committee for the Society for the Study of Amphibians and Reptiles

Dr. Stacey Lance served as a member of the Student Activities Committee of the Society for Environmental Toxicology and Chemistry

Dr. Stacey Lance served as a member of the SETAC Ecotoxicology of Amphibians and Reptiles Global Advisory Group

Dr. Stacey Lance served as a member of the SETAC subcommittee on Advancing Herpetofauna in Ecological Risk Assessment

Dr. J Vaun McArthur received the 2012 Outstanding Teaching Award from the University of Georgia's Odum School of Ecology

Dr. Gary Mills served as a member of the Organizing and Planning Committees for 12th International Conference on Biogeochemistry of Trace Elements in the Environment

Dr. Gene Rhodes served as a member of The Wildlife Society's Wildlife Damage Management and Wildlife Diseases working groups

Dr. Gene Rhodes and Dr. Stacey Lance participated as panel members speaking on the topic *Ecosystem Impacts from Nuclear Energy: Lessons from Chernobyl and Fukushima* at the 2013 Disasters and the Environment Conference hosted by the National Council for Science and the Environment

Dr. Gene Rhodes was featured in the University of Georgia's Research Magazine

Dr. Gene Rhodes was listed in the 21013 Editions of Who's Who in America and the World

David Scott received Service Recognition for four years on the board of the Aiken Land Conservancy

Dr. John Seaman was nominated to serve as a representative to the SSSA governing board - S2 (Soil Chemistry)

Dr. John Seaman is serving as chair for the 12th International Conference for the Biogeochemistry of Trace Elements in the Environment

Dr. John Seaman served as the editor for a special edition of the Vadose Zone Journal: Reactive Transport Modeling

Dr. Rebecca Sharitz served as an Executive Board Member for the International Association for Ecology

Dr. Rebecca Sharitz was named a Fellow of the Ecological Society of America (ESA)

Dr. Tracey Tuberville was invited to serve on NSF review panel for proposals to the Biological Field Stations and Marine Laboratories Program

Dr. Tracey Tuberville was asked to submit her name for consideration for the American Society of Ichthyologists and Herpetologists Board of Governors

Dr. Tracey Tuberville served as Associate Editor for the Journal of Herpetology