# *Alabama Cooperative Fish and Wildlife Research Unit*



***Report of Activities***

***October 2005 – September 2006***

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***Cooperating Agencies***
*U.S. Geological Survey*
*Alabama Department of Conservation and Natural Resources, Wildlife and Freshwater Fisheries Division*
*Auburn University*
*Wildlife Management Institute*
*U.S. Fish and Wildlife Service*

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**Unit Staff**



**Cooperating Faculty**



OTHER PROJECTS

**Unit Staff**



**Cooperating Faculty**



PRODUCTIVITY

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University of North Alabama
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NatureServe
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## *Program Direction Statement*

The Cooperative Fish and Wildlife Research Unit program facilitates cooperation among the U.S. Geological Survey, Biological Resources Division; universities; state fish and wildlife agencies; and private organizations in programs of research and education related to fish and wildlife resource management. The objectives of the program are: 1) to conduct research on fish and wildlife ecology and to investigate the production, utilization, management, protection, and restoration of populations of fish and wildlife; 2) to provide technical and professional education and continuing education primarily on the graduate and professional level in the fields of fish and wildlife management, teaching, research, demonstration and administration; and 3) to make facts, methods, and new findings discovered through research available to scientists, landowners, sportsmen, outdoor recreationists, conservationists, extension workers, teachers, and local, state and federal agencies. The Unit shall also continue to work closely with the U.S. Fish and Wildlife Service to be informed of, and where requested, assist with the development of that agency's initiatives ecosystem management system. The operations of the Alabama Unit are governed by a Coordinating Committee operating under a formal cooperative agreement signed by the U.S. Geological Survey, Biological Resources Division; Auburn University; the Alabama Department of Conservation and Natural Resources, Division of Wildlife and Freshwater Fisheries; U.S. Fish and Wildlife Service, and the Wildlife Management Institute.

The Alabama Unit has identified four areas in which to concentrate its research efforts: 1) determining the effects of forest management techniques on wildlife species, 2) investigating the ecology and management of stream corridors, 3) investigating the status, life history and habitat requirements, and of endangered or threatened species to obtain information necessary for the development of comprehensive recovery plans, and 4) investigating the ecology and management of fish and wildlife species on landscape scales. The Unit will not be restricted to these areas of investigation; however, it will work towards the development of comprehensive research programs in each.

### ***Effects of Forest Management on Wildlife Populations***

Approximately 70% of non-urban land in Alabama is forested, much of it managed intensively for the production of forest products. Wildlife populations can be valuable components of forestlands. However, in some forests wildlife may be quite scarce. The abundance of wildlife in woodlands depends upon available food and cover resources that are in turn determined by forest management practices. Timber management can have major impacts on wildlife populations, and information is required to enable adequate evaluation of these impacts and to permit provision for support of wildlife species in the timber program. Many questions need to be answered relative to the relationships between wildlife species or groups and timber management practices. The response of wildlife to such factors as rotation schedule, species composition of forests, burning and thinning schedules, snag retention or removal, and size of clear cuts, needs to be determined. Area sensitive species need to be identified and their area requirements determined. Response of wildlife species to reforestation efforts requires evaluation. Wildlife is of high economic and aesthetic value and represents an important component of our forest ecosystem. It is important that we obtain the necessary

information to ensure the retention of wildlife populations as forest management intensifies.

## ***Ecology and Management of Stream Corridors***

A typical southeastern stream corridor is a wetland complex composed of flowing-water aquatic habitats, adjacent riparian habitats, and periodically flooded bottomland habitats. Also, any particular stream corridor is just a segment of a drainage system with a sequence of corridor zones associated with streams from headwaters to large rivers. Stream corridors are important sources of renewable resources such as commercial and recreational fisheries, aquatic-oriented wildlife, and terrestrial wildlife utilizing productive bottomland areas. In addition, stream corridors are highly valued recreation and aesthetic areas due to high biological productivity and landscape diversity.

Stream corridors have always been, and continue to be, the focus of many forms of economic and land developments that exert some effect on these systems. Impacts to stream and river systems basically stem from two general factors, altered hydrologic conditions (i.e., water quality and quantity) and physical alterations of streams and associated lands (e.g., agricultural plots, backwater draining, navigation improvements). Both land and water changes tend to influence the integrity of instream, riparian, and bottomland communities since all these habitats are dependent on water/land relationships. The natural flowing-water processes of erosion and deposition impose a dynamic character to instream, riparian, and bottomland habitats and their associated fish and wildlife communities. Human modifications to stream corridors tend to intensify this dynamic character and frequently require continual human intervention to maintain artificial stream corridor conditions.

The most pressing areas of research involving stream corridors concern the interactions between fish and wildlife communities and the physical and chemical processes of flowing waters. The Unit intends to develop research that integrates fish and wildlife resource characteristics and functions with the hydrologic processes that influence stream corridor habitats. Specific areas for development include: renewable resource management, conservation of species, preservation of communities, impact assessment and prediction of effects, and mitigation and restoration.

## ***Endangered Species***

**One hundred seventeen*** species or subspecies that occur in Alabama have been declared endangered or threatened by the federal government (Threatened and Endangered Species System, USFWS); included are **99** animals and **18** plants. Information on the status, habitat requirements, and life history of these taxa is required to permit identification and declaration of critical habitat and to enable the formulation of management practices providing for their protection and, where possible, eventual recovery. Addressing the needs of these species now may prevent the need for listing them as threatened or endangered in the future. Research needs vary greatly by taxon; however, the Unit is capable of enlisting a diversity of expertise in addressing identified needs. Research in this area will be developed primarily in response to specific requests for assistance by cooperating agencies.

## ***Landscape Ecology***

Traditionally, research in wildlife and fisheries has focused on population or community dynamics on relatively small or undefined spatial scales, with the size of a study area defined by protocols for collecting data or by management units such as forest stands or agricultural fields. Recent work in the field of landscape ecology strongly suggests that many ecological processes of interest to wildlife and fisheries researchers and managers occur on a variety of spatial scales, ranging from local (e.g. stand-scale) to regional (e.g. landscape-scale) dynamics. Landscape processes often are an emergent ecological property that cannot be directly extrapolated from observations collected on small scales. Inferences from small-scale or aspatial studies could be misleading in addressing the large scale ecological effects of increasing urbanization, changes in land use, and habitat fragmentation evident on modern landscapes.

Recent advances in technology are making spatially explicit data covering large areas widely available at relatively low cost. These data and the tools required to access and interpret them are rapidly becoming essential and affordable to wildlife and fisheries biologists. The Unit will develop research that quantifies and evaluates large-scale, landscape processes for wild populations and the ecological communities that sustain them. The Unit will also be involved in other landscape approaches, including the development and application of spatially explicit, individual-based behavioral models and the use of landscape characteristics to predict the distribution of wild populations.

*Text in bold represents a revision.

# *EFFECTS OF FOREST MANAGEMENT ON WILDLIFE POPULATIONS*

## *Effects of growing season prescribed fire on productivity and survival of northern bobwhite populations (completed)*

Funding Source: Alabama Division of Wildlife and Freshwater Fisheries, Auburn University, Quail Unlimited

Principal Investigator: Barry Grand

Student: Travis Folk

Duration: August 2001 – August 2005

Over the last 3 decades northern bobwhite (*Colinus virginianus*, hereafter bobwhite) populations have declined precipitously throughout the Southeastern and Midwestern United States. In the southeast, forested lands offer some of the best opportunities for bobwhite management. In stands of pine and mixed pine-hardwoods with low (<50%) canopy cover, frequent (1-3yr) controlled fires can be used to maintain the early successional, mainly herbaceous, understory vegetation required by breeding bobwhites. This habitat is typified by the "native" stands of longleaf pine (*Pinus palustris*) described by early explorers. Traditionally, prescribed fire has been applied during the winter months to reduce damage to desirable plant and animal populations. However, there is increasing support for the use of prescribed fire in longleaf pine forests during the growing season, because it may mimic the natural occurrence of lightning-caused wildfires and may favor the native condition of longleaf pine ecosystem preferred by some characteristic threatened and endangered species. This approach to forest ecosystem management may have adverse effects on populations of ground nesting birds including bobwhites, which may suffer nest losses and mortality when fire occurs during the growing season. The objective of this research is to determine the effects of controlled growing season fires on the productivity, survival, and growth rate of bobwhite populations in the longleaf pine ecosystem.

*Status*–The final field season was completed in September 2004. In total, 374 bobwhites were radio-marked and approximately 21,000 locations were collected for these individuals over the 2 and one-half year duration of the project. Analyses of survival, movement, and female success of bobwhites were completed. Age-based periodic population models were developed to represent summer and winter seasons for bobwhite populations in Wisconsin and Alabama, the latitudinal extent of their range. Prospective and retrospective analyses were conducted to evaluate the functional and observed relationship of vital rates to population growth rate within each population. Additionally, retrospective analyses were used to evaluate the influence that latitude had on population dynamics of bobwhites in Wisconsin and Alabama. The results are presented in Travis Folk's Ph.D. dissertation. Manuscripts detailing these results as well as novel methods for analyzing periodic matrix models and appropriate uses of bobwhite telemetry data have been accepted for publication in Wildlife Society Bulletin, Journal of Wildlife Management, Journal of Animal Ecology, and Auk.

# *ECOLOGY AND MANAGEMENT OF STREAM CORRIDORS*

## *Development of a monitoring plan to assess potential effects of co-generation plants on fish communities*

Funding Source: Alabama Division of Wildlife and Fresh Water Fisheries

Principal Investigator: Elise Irwin

Research Associate: Kathryn Mickett

Duration: October 2004 – September 2006

The Mobile River Basin harbors fish communities that are diverse and high in endemism. Conservation of these resources has been identified as a priority by state and federal agencies. In addition, water resources are increasingly impacted by population growth, land-use changes, and other anthropomorphic impacts. However, monitoring plans that are sensitive to detecting changes in fish assemblages relative to impacts on water resources quality and quantity have not been developed and tested. The goal of this project is to develop a monitoring protocol to assess impacts to fish communities from proposed co-generation (COGEN) plants. Co-generation plants are power generating facilities that produce electricity and heat, usually in the form of steam. There are 24 ADEM permits for COGEN plants on record and all are located in proximity to streams in Alabama. It is unclear how much water will be withdrawn from streams for COGEN plants; however, water withdrawals may have negative impacts on fish communities (M. Freeman, unpublished data). Specific objectives will be to: 1) Develop a monitoring protocol that incorporates detection, site occupancy rates and extinction/colonization probabilities for fishes; 2) Collect baseline data from multiple proposed COGEN sites using the developed protocol; and 3) Compare PAE data with backpack electrofishing data collected by ADCNR.

*Status* - We have identified 68 potential sampling sites for monitoring. We considered 11 potential CoGen sites located within a 100 mile radius of Auburn; using ArcGIS we placed a 10 mile buffer around each site. We then located road crossings for streams within the buffer using a GIS transportation layer. This will allow for selection of sampling sites based on proximity of the proposed plants (e.g., upstream and downstream). Potential sampling sites on other streams within each subwatershed were considered, particularly for their potential as reference streams, and we conducted reconnaissance visits to the 68 sites. Because we are using pre-positioned area electrofishers, site characters must allow for stream depths and widths conducive to the gear. Sites were selected based on access, stream characters and position in the subwatershed relative to the proposed plant. In 2005 we sampled 20 sites. After extensive research on CoGen plants, we determined that there was only one plant in operation (Tenaska Plant) and concentrated our efforts there in 2006, sampling three sites, three times each. In addition, we sampled sites around the seemingly abandoned Hillabee Plant. Sampling is complete and data are being analyzed for the final report. In addition, detection probabilities for approximately 87 species of fish in the Alabama River Basin have been calculated (Irwin and Hayer, unpublished data). These detection probabilities will be incorporated into the monitoring program. The final report will be complete 31 December 2006.

# *ENDANGERED/DECLINING POPULATIONS*

## *Assessment of habitats in areas historically used by Ivory-billed Woodpeckers in southern and western Alabama and the Florida panhandle*

Funding Source: US Fish and Wildlife Service

Principal Investigator: James B. Grand

Co-principal investigators: Geoffrey Hill

Duration: August 1 2006 – July 2008

The recent re-discovery of Ivory-billed Woodpeckers (IBWO) in Arkansas has spawned interest in surveys in areas of suitable habitat within the former range of the species. In the mid-to late-1860s IBWO were shot along the Tombigbee River in Marengo County and the Warrior River west of Greensboro in Alabama. In 1907, one was reported killed in the Conecuh swamps north of Troy. Numerous birds were collected in river-swamps of the Florida panhandle during that time period. Large tracts of bottom-land hardwoods and river-swamps still exist in the Tombigbee, Mobile, Tensaw, Black Warrior, Conecuh/ Escambia, Pea/Choctawhatchee, Appalachicola/Chipola, Rivers in Alabama and panhandle Florida.

IBWO are reclusive, wary, and easily confused with related Pileated Woodpeckers, which frequent habitats similar to those once occupied by IBWO. Due to presumably low numbers, reclusive behavior and similarity to Pileated Woodpeckers intensive monitoring techniques capable of recording evidence for later review are required. The objectives of this project are to: research and document historical and recent reports of IBWO along the Tombigbee, Mobile and Tensaw Rivers in Alabama and in panhandle Florida, estimate the extent or remaining mature, bottomland hardwood forest in suitable areas of Alabama and panhandle Florida with the historic range of IBWO using remotely-sensed data, conduct field searches for IBWO in areas of suitable habita, and characterize the habitats associated with all potential IBWO observations and sign.

*Status* – The announcement was made recently that strong evidence exists for a small population of IBWO inhabiting the Choctawhatchee River basin in the panhandle of Florida. Search efforts are now focused on obtaining indisputable evidence for a reproducing population and documenting their use of habitats. For more information on this recent discovery see www.auburn.edu/ivorybill and publications in the online journal Avian Conservation and Ecology volume 1 (www.ace-eco.org).

## *Conservation genetics of the federally endangered Alabama leather flower, Clematis socialis*

Funding Source: U.S. Fish and Wildlife Service

Principal Investigators: Robert Boyd and Leslie Goertzen (Auburn University)
Graduate Students: Irene (Rena) Miller
Research Technicians: Jennifer Trusty (Post-doctoral Associate)
Duration: April 2006-December 2007

The endangered Alabama Leather Flower, *Clematis socialis* (USFWS1989) is found in five populations in three Alabama counties, Cherokee, Etowah and St. Clair, as well as in Floyd County, Georgia (Garrett 1004). In order to ensure the long-term preservation of this rare plant species, conservation programs based on informed management decisions are necessary. The success of these programs is dependent on knowledge of the genetic diversity within and among natural populations of these species. Expanding human populations in Alabama have directly impacted *Clematis socialis* through the loss of habitat to urbanization and by road building activities. What is unknown is how to best ensure the long-term survival of this species in the remaining populations. An analysis of the genetic diversity within and among populations of rare species is an important tool that can help direct conservation efforts. Maximizing the genetic diversity in ex-situ populations of this *Clematis* species is the best protection we can provide against future environmental challenges. In addition, reintroduction to extirpated sites will benefit from data on which genotypes were most likely found (and adapted) to that site and the amount of genetic diversity necessary to maintain the re-introduced populations into the future.

*Status* – To date, ten populations of *Clematis socialis* (nine in Alabama and one in Rome, Georgia) have been sampled for DNA. A total of 145 individuals of *C. socialis* were collected. DNA was extracted using the CTAB protocol and is currently stored at -20°C at Auburn University. In order to determine the genetic diversity of the nine populations, four individuals from each population were PCR amplified using ISSR primers using the Wolfe protocol. Overall, *Clematis socialis* individuals are highly variable. Interestingly, there was very little grouping of individuals by population location although this result is very preliminary. We will continue to add data from new ISSR primers. If there continues to be little differentiation between populations, this would suggest gene flow (pollen or seed) between the populations into the recent past despite their apparent geographical distinctness. In conjunction with the ISSR data, we have developed a number of highly variable nuclear DNA markers for *Clematis socialis.* Two of these markers were amplified, cloned and sequenced. Preliminary data have shown that these two regions are also highly variable between individuals. Rena Miller, graduate student, has begun using ISSR markers to examine the genetic diversity of the ex situ *C. socialis* collections held at the Cincinnati Zoo. We have DNA from 16 individuals and will be gathering data to determine whether these collections are redundant this fall and winter.

## ***Endangered bats (Mammalia Chiroptera) at Redstone Arsenal, Alabama*)**

Funding Source: Department of Defense

Principal Investigator: Troy Best (Auburn University)

Graduate Students: Sara Gardner, Charles Kilgore, Lisa McWilliams

Duration: June 2005 –December 2007

Relatively little is known about the 15 species of bats in Alabama, but considerable research has been conducted within the past decade (e.g., Best et al., 1993, 1997; Best and Hudson, 1996; Durden et al., 1992; Gobel, 1996; Henry, 1998; Henry et al., 2000; Hilton, 1994; Hilton and Best, 2000; Kiser, 1996, 2000; Milam, 1996; Thomas, 1994; Thomas and Best, 2000). Bats occurring on Redstone Arsenal are of special interest because two endangered species are known from the area, the gray bat and the Indiana bat. In preparing management plans, it would be useful to know if both of these species are present and what habitats they may occupy.

Considering the need for information on bats in the region, a field survey of species present, distribution, habitats occupied, etc., would be highly desirable. These data would be useful in developing management plans for the Redstone Arsenal, and they would provide baseline data for comparisons and future research. This study would be a significant contribution to overall assessment of presence, distribution, and habitat associations of endangered bats in Alabama.

*Status* – The first year of data collection was completed in late summer 2006 and the annual report was submitted to Redstone Arsenal in September 2006. The second and final sampling sessions are scheduled to begin in spring and continue through summer 2007. To date, more than 100 sites have been sampled and five species of bats have been captured, including several endangered gray bats.

## *Patterns of movement of male gopher tortoises on the Solon Dixon Forest Education Center*

Funding Source: U.S. Fish and Wildlife Service

Principal Investigator: Craig Guyer (Auburn University)

Research Assistant: Jimmy Stiles, Sierra Stiles

Duration: August 2004 – December 2005

The gopher tortoise (*Gopherus polyphemus*) is federally protected in the western portion of its range and protected by state legislation throughout the remainder of its distribution. Long-term conservation of the gopher tortoise depends upon distinguishing areas where management efforts can maintain or increase population density from those where populations are likely to decline. Data regarding the distances that male gopher tortoises travel in order to find mates are important for documenting the potential for populating persistence and for designing reserve areas for tortoises. Because data regarding movements of animals are affected by local population density, studies from a variety of tortoise populations spanning the range of known populating densities are needed. The data gathered from this study will be vital to development of strategies for creating conservation reserves for tortoises. Such reserves require sufficient space for resident animals to grow and reproduce. Comparison of movement data for tortoises at the Dixon Forestry Education Center with those from other sites will indicate whether such reserves can be of consistent size throughout the range of the tortoise or whether reserves must be designed to fit the unique history of local population density.

*Status* – This project is completed. Examined patterns of gopher tortoises to determine the rate of visitation by males to burrows used by females in an areas of extremely low density. This information and data from five other sites will be used by USFWS to estimate the minimum density of viable tortoise populations.Presentation from this work – "Johnson, V.M. and C. Guyer. Seasonal and diel peaks of Gopher Tortoise mating behavior. 2005. American Society of Ichthyologists and Herpetologists, Tampa, Florida.

## *Immune, stress and reproductive measures in gopher tortoises at Camp Shelby, Mississippi*

Funding Source: Department of Energy

Principal Investigator: Mary Mendonca (Auburn University)

Graduate Student: Paula Kahn

Duration: April 2006 – February 2007

This study will focus on characterizing the immune response as well as sex steroid and adrenal steroid hormone profiles in gopher tortoises from a variety of anthropogenically impacted and non-impacted habitats at Camp Shelby, MS. It is part of a larger project conducted by Dr. Marshall Adams from the Oak Ridge National Laboratory (ORNL) and supported by the Strategic Environmental Research Program (SERDP) of the Dept. of Defense. The primary objective of this SERDP project is to develop and apply a suite of sensitive and quick-responding biomarkers and bioindicators for Threatened and Endangered Species (TES) which are subjected to a variety of environmental stressors on military installations. To assess the health and fitness of gopher tortoises residing in areas subjected to different types and levels of stressors, biomolecular, biochemical, physiological, immunological, histopathological, reproductive, and population-level responses are being measured from non-impacted reference areas and at areas experiencing different levels of military activities. The primary product of this study will be a bioassessment tool that can be used by environmental managers at military facilities to rapidly assess the possible effects of various military training and testing activities on the health of keystone TES such as the gopher tortoise.

*Status* – We analyzed blood samples from gopher tortoises for indicators of stress or compromises to immunocompetence during 30 days following relocation. No physiological indicators of stress were discovered within the 30-day period post capture. This information was used by Department of Defense to evaluate the potential effects of tortoise relocation to areas not affected by encroachment.

## *Gopher tortoise relocation at Ft. Benning: Effects on stress, immunocompetence, and reproduction*

Funding Source: Department of Defense

Principal Investigator: Mary Mendonca (Auburn University)

Student: Paula Kahn

Duration: May 2003 – September 2006

The relocation of endangered and threatened animals has become a common practice in the United States due to increased human populations and subsequent developmental progress. The gopher tortoise (*Gopherus polyphemus*) is one of the species that is affected by relocation policies. This tortoise is a threatened species indigenous only to the southeastern United States. *G. polyphemus* is considered a keystone species in its environment, with other animals depending on the use of the tortoise burrows for their protection from predators and harsh weather conditions, and therefore for their survival. However, while tortoises are being moved out of physical harm's way, they may be suffering physiological consequences that have yet to be determined. Ideally, to ensure that relocation of tortoises is successful, long-term monitoring of movement and physiological condition needs to take place. Since this is not a viable option in many cases, we have established some proven biomarkers that will indicate the success of relocation in terms of stress, immunocompetence, and reproductive capacity. These biomarkers can be assessed during and after relocation to monitor tortoises' progress in adapting to their new environment. In the absence of data on long-term mortality and/or ultimate reproductive success of relocated animals, these biomarkers are proposed as a short-term measure of those stresses which could ultimately result in such consequences.

*Status* – Our analyses have indicated that relocation does not increase stress in tortoises, as evidenced by changes in corticosterone levels (a hormone used as a biomarker of stress). However, we did find that tortoises living in impacted habitats do have significantly higher corticosterone levels at baseline than those living in non-impacted habitats. We also found that relocation does not affect at least one immune response in tortoises, as indicated by their swelling response to PHA (phytohemagglutinin), a biomarker of T cell function. In terms of disease status, we found that URTD status (positive vs. negative and symptomatic vs. asymptomatic) does not correlate with any of the measures of stress or immunocompetence. This may be related to the fact that tortoises demonstrated remarkable changes in their URTD titers throughout the study seasons, as determined by an ELISA. As a result, we believe that testing these tortoises for URTD by simply using an ELISA is not an effective method for characterizing disease status. Overall, in the 30 day period that we measured tortoises' stress and immunocompetence, we did not find significant effects of relocation on physiological parameters. However, it is important to note that possible effects may have been present prior to the 30 day testing, and long term effects may arise in the future. Therefore, long term monitoring of this threatened species is critical to determine if such long term effects may exist. In the Fall, 2006, Paula Kahn successfully defended her PhD dissertation based on this research. One manuscript is in press in Copeia.

# *LANDSCAPE ECOLOGY*

## *ACT Aquatic GAP and water quality modeling*

Funding Source: Alabama Division of Wildlife and Freshwater Fisheries

Principal Investigator: Elise Irwin and Diane Hite (Auburn University)

Research Associate: Gareth Turner

Duration: October 2004 – September 2006

The Southeastern Aquatic GAP project was initiated to identify conservation areas in river basins where aquatic biodiversity and endemism are higher than other temperate rivers. As part of a regional assessment of the Alabama-Coosa-Tallapoosa (ACT) and Apalachicola-Chattahoochee-Flint (ACF) basins, we have developed techniques to incorporate geospatial data to analyze aquatic species distribution in relation to local and landscape features and identify conservation potential of specific subwatersheds. Two portions of the ACT have been completed under a previous contract with the U.S. Geological Survey; this project will assess an additional 27,700km² of large river basin habitat (25% of Alabama's riverine habitat) for conservation potential in Alabama. The resulting database will include species and community data for over 184 freshwater fishes and all mussel species from the ACT. Limited data on crayfishes and aquatic herpetofauna are also available for model construction. Completion of the ACT Aquatic GAP will allow for development of decision support systems (DSS) to help natural resource managers make informative decisions for land and riverine management and landscape level conservation planning. In addition, we will develop water quality-land use economic models that will be valuable for assessing restoration activities. Water quality models will also be applied to relate faunal distributions to landscape and land use variables (including economic assessment of land use and potential for land use change). These will be exceptional contributions to the DSS.

*Status* – We are in the process of writing the final report. The landscape data and the faunal database for fishes are complete. We are in the process of running final models for identification of conservation subwatersheds. A Web Page with decision support capabilities will be provided. Water quality-land use models are also being developed and SWAT (Soil and Water Assessment Tools) have been useful in determining areas of the Saugahatchee Watershed that are contributing to increased instream sedimentation. The final report will be complete by 31 December 2006.

## *Gap Analysis for Alabama*

Funding Source: U.S. Geological Survey

Principal Investigator: Barry Grand, Elise Irwin, Mike Mitchell, and Mark MacKenzie (Auburn University)

Project Coordinator: Amy Silvano

Research Assistant: Kevin Kleiner, Ben Taylor, Gareth Turner

Student: John Hogland

Student Workers: James Grand

Duration: August 2000 – December 2007

Alabama spans five physiographic provinces from the Coastal Plain through the Interior and Appalachian Low Plateaus, more than any other state. Within these provinces exist unique and often rare communities and diverse assemblages of plants and animals. Without adequate planning for conservation based on sound scientific information these communities may ultimately disappear. Gap analysis is directed towards identifying native animal species and natural communities that are underrepresented in conservation efforts. The objectives of the project are: (1) to promote cooperative approaches toward the development and use of Gap data, (2) to map the existing natural and semi-natural land cover; (3) to produce maps of the predicted distributions of every vertebrate species; (4) to map the ownership of public and private conservation lands; (5) to categorize all lands according to management status; (6) to produce a database of the total surface area and relative representation for each class of land cover and animal species relative to land stewardship categories; (7) to produce a written report of the mapping, assessment, analysis methods, results, accuracy, and limitations; and (8) to develop a plan for the maintenance and updating of the information.

*Status* – The Ecological Systems described by NatureServe (hereafter Systems) land cover map has been completed for the East Gulf Coastal Plain (zone 46), and a mosaic of land covers completed by the labs in North Carolina and Georgia have been mosaicked to produce a Systems map for the state. Working in conjunction with a contractor hired by National Gap, the stewardship layer has been completed and properly attributed. Animal distribution models have been developed for all of the species of birds, mammals, reptiles, and amphibians breeding in the state and a select group of birds that winter in Alabama. Those models are now being run to produce the predicted distribution maps for expert review. Expert reviews of the predicted distributions and an accuracy assessment for the land cover are planned for early in 2007, with final reports and products to be completed in late April.

## *Development of a decision support tool and procedures for evaluating dam operation in the Southeastern United States (completed)*

Funding Source: U.S. Fish and Wildlife Service

Principal Investigator: Elise Irwin and James Peterson (GACFWRU)

Research Associate: Kathryn Mickett

Duration: June 2002 – December 2005

This project will create a template on which to base future efforts incorporating decision analysis and adaptive management into the Federal Energy Regulatory Commission dam re-licensing process by developing a model for implementation of adaptive flow management for Harris Dam on the Tallapoosa River, Alabama. To do so, we will address the following objectives: (1) determine stakeholder values and objectives; (2) develop models relating aquatic community (specifically, fish and mussels) responses to changes in habitats and flow regime; (3) develop decision models for evaluating the impacts of current and alternative dam operating procedures on (stakeholder) valued outcomes; and (4) develop explicit recommendations for alternative dam operating procedures that will produce the information for resolving key uncertainties about the effect of dam operation on the aquatic community.

*Status* - The workshop, "Adaptive Management Below Dams" was held April 29 through May 1 2003. Guest speakers James Nichols (USGS, Patuxent), Mike Conroy (GACFWRU), and James Peterson (GACFWRU) gave presentations in their fields of expertise. Several important stakeholder groups were represented at this workshop, including (but not limited to) USFWS, ADCNR, Alabama Power, Alabama Rivers Alliance, Middle Tallapoosa River Conservation Association, Upper Tallapoosa Watershed Committee, and Lake Wedowee Property Owners' Association. An interactive forum was facilitated to address common issues among all participants of the workshop. Points of discussion included objectives and values, governance, and decision-making principles. Following this inclusive interactive discussion, a similar forum was opened involving participants with a stake in the adaptive management process at R.L. Harris Dam. The product of this forum was an official stakeholders group with proposed purposes and objectives. Since this initial meeting, there have been three meetings of the R.L. Harris Stakeholders Board. A website (www.rivermanagement.org) has been created and an official charter has been drafted and accepted. An initial decision support computer model has been created with the program NETICA. This model is currently, and will continue to be, under modification as discussion of the board continues and new data become available. Decisions have recently been made to apply a flow adjustment at R.L. Harris that matches the gage reading at Heflin. Flow management was implemented in Spring 2005 and monitoring protocols have also been implemented. The final report was complete in October 2006.

## *Biodiversity of terrestrial vertebrates on the J.D. Martin Skyline Wildlife Management Area and adjacent lands*

Funding Source: Alabama Division of Wildlife and Freshwater Fisheries

Principal Investigator: James B. Grand, Eric Soerhen, and Yong Wang (Alabama A&M University)

Research Associate: Nick Sharp and Shannon Allen

Student(s): Alan Hitch (Ph.D.), Florence Chan (M.S. - AAMU)

Research Assistant(s): Megan Binkley, Helen Czech, Jeff Sorrell, Carrie Johnson, James Fuller

Duration: January 2005 – December 2007

Little is known regarding the composition and habitat requirements of terrestrial vertebrate communities using the forests of the southwestern Appalachian ecoregion in Alabama. This region represents the southernmost extent of the range for many species native to Appalachian Mountains. Thus, the native fauna and flora includes many vertebrates that are found nowhere else in the state. Recent land acquisitions in Jackson County bring the total acreage under state management on the Wildlife Management Area and Forever Wild lands to over 28,000 acres. We propose to perform a comprehensive inventory of terrestrial vertebrates using these lands based on methods that incorporate rigorous statistical design, and estimation of detection rates, which often obfuscate the results of wildlife inventories. Inventory data will be used to develop probabilistic models of wildlife habitat relationships that can in turn be used to map the distribution of the dominant ecological systems and animal communities on the area. These results will ultimately be used to develop a GIS for using in planning conservation and management based on high probability of use by high priority species and areas of high biodiversity. This is a collaborative project with the Alabama Lands Division Natural Heritage Program, and Alabama A & M University.

*Status* – Based on strata derived from models of landform and solar exposure a stratified-random selection of 176 points was selected for sampling over the 2005 and 2006 field seasons. Point counts methods were used to survey breeding birds twice during May 15-June 30 2005 and 2006. Line transect methods were used to survey reptiles and amphibians during April-July and again in August-November 2005 and 2006 at the same 88 points. A combination of live traps and pit-fall arrays were used to sample small mammals at 88 points 15 September-15 November 2005 and 2006. Vegetative was inventoried and classified all 176 points. These data will be used to validate land cover maps developed from the AL-Gap Project, and develop habitat relationship models after accounting for detectability of animals. Data and models will be used to develop a GIS suitable for making management decisions on the properties that were sampled.

## *Adaptive management and monitoring for restoration and faunal recolonization of shoal habitats (new)*

Funding source: Alabama Power Company, Alabama Division of Wildlife and Freshwater Fisheries

Principal Investigator: Elise Irwin

Research Associate (s): Kathryn Mickett and Gareth Turner
Student (s): Taconya Piper (Ph.D.), Ben Martin (M.S.)

Duration: October 2006 – September 2011
High imperilment rates of fishes and mussels in the state of Alabama are related to impoundment and regulation of riverine flows. Specifically, the inundation and disruption of natural flow regimes of shoal habitats in medium sized rivers was hypothesized to be the primary cause for imperilment of 53% of fishes in Southeastern rivers. In Alabama, loss of functional shoal has likely affected 64% of fish species of greatest conservation need (GCN). Restoration and protection of functional shoal habitat in the remaining unimpounded (i.e., free flowing) fragments of rivers of the State is a critical element of conservation of aquatic species. However, effects of specific flow regimes (i.e., magnitude, duration and timing and their combinations) on shoal habitats and ultimately on biotic processes are not well known. Mixed results regarding success of implementation of minimum flow regimes have illuminated the need for process oriented research that evaluate effects of flow regimes on aquatic fauna that depend on functional shoal habitat. In addition, these data would be transferable to the many shoal dependent GCN species in other river basins. Therefore, we propose to evaluate effects of experimental flow regimes on shoal dependent aquatic fauna in the Piedmont region of Tallapoosa River. Specific objectives are to: 1) Compare fish and invertebrate assemblages and population structure between flow-managed and naturally flowing river reaches (including all GNC species); 2) Assess habitat stability (i.e., shoals) and persistence for GCN species and other species of concern; and 3) Determine applicability of flow management and habitat restoration for other river systems.

.*Status* - As of Spring 2005, flow management changes were implemented at Harris Dam (http://www.RiverManagement.org), consistent with an adaptive management approach. Monitoring has been conducted in Spring and Fall of 2006 on five shoals in each of five study reaches, including two “reference” reaches (Upper Tallapoosa River and Hillabee Creek). Fishes were collected using pre-positioned electrofishing grids and invertebrates were collected with a Surber sampler. Species-specific detection probabilities will be determined on individual shoals and sampling dates to ensure unbiased statistics. In addition, spawning windows for fishes are being evaluated for GCN species from both assessment of reproductive condition of adults and collection and aging of juveniles. Fishes from the 2006 sampling season are currently being identified and enumerated.

## *Inventory and conservation planning for species of greatest conservation need on Alabama DCNR lands*

Funding Source: Alabama Department of Conservation and Natural Resources, Wildlife and Freshwater Fisheries Division

Principal Investigator: James B. Grand

Co-principal investigators: Mike Gangloff, Craig Guyer, Elise Irwin, Carol Johnston, Mark MacKenzie, Ed Loewenstein

Project Coordinator: Amy Silvano

GIS Specialist: Garreth Turner

Duration: October 2006 – December 2011

During this five-year project the Alabama Cooperative Fish and Wildlife Research Unit will coordinate the development of multi-species Inventory and Conservation Plans (ICPs) for selected lands managed by the Alabama Department of Conservation and Natural Resources. The project will potentially include lands in six ecological regions, and could affect 303 species of greatest conservation need (GCN), of which 118 are listed as threatened or endangered. During the first year, a steering committee will be established, lands and species for inclusion in the plan will be identified, information needs assessment will begin, and an outreach plan will be developed. Subsequent years will be used to gather information and develop decision support tools, conduct outreach programs, and develop the ICPs.

The overall goal is to provide a science-based plan for the conservation of GCN species and the habitats they depend on as they occur or could occur on ADCNR managed lands. Additional goals are to establish a protocol and a baseline for monitoring GCN species, to provide a basis for the development of new ICPs, to provide guidance for the improvement of populations of GCN species, to improve upon our understanding of the issues affecting the conservation of GCN species, and to foster relationships among public and private stakeholders.

*Status* – Funding has been delivered through a contract with the University. The project will commence in January 2007.

## *Carbon sequestration and natural longleaf pine ecosystems*

Funding Source: U.S. Geological Survey, U.S. Fish and Wildlife Service

Principal Investigator: John Kush (Auburn University)

Graduate Student(s): Ram Thapa, John Gilbert

Student Technicians: Anshu Shrestha, Arpi Shrstha

Duration: July 2003 – September 2008

Forested ecosystems have a significant potential for sequestering large amounts of carbon through land management. To fully realize the potential carbon sequestration capabilities of these ecosystems there is a need to develop strategies and methods for increasing carbon sequestration. A fire-maintained, longleaf pine dominated ecosystem may offer one of the best options for carbon sequestration among the forested ecosystems of the southeastern US while providing habitat for a number of threatened and endangered plant and wildlife species, including red-cockaded woodpeckers, gopher tortoises, indigo snakes, etc … (Hardin and White 1989, Landers et al. 1995, Jackson 1989). Among the southern pines, longleaf may offer the best opportunity for carbon sequestration. It is the longest-living of the southern pines, capable of growing to 500 years (Platt et al. 1988). It will continue to put on growth, even at older ages (West et al. 1993). Products from longleaf pine will sequester carbon longer than most since they are likely to be solid wood products like structural lumber and poles. In addition to the tree itself, a fire-maintained longleaf pine ecosystem supports a productive understory of grasses and herbaceous plants which themselves may offer more carbon storage than the trees. Objectives of the study are: Phase I – Develop a detailed literature review/bibliography of research literature related to longleaf pine, above and below ground biomass, and carbon sequestration; Phase II – Determine the relationships between prescribe burn treatment and above/below ground biomass and carbon sequestration; Phase III – Determine the relationships between root biomass/carbon sequestration and the density, site quality, and age of the longleaf pine overstory.

*Status* – The season of burn study plots on the Escambia Experimental Forest in Brewton, AL have been extensively sampled to address the status of carbon in the no-burn, spring, summer and winter season prescribed burn plots. Longleaf pine heights and diameters were measured. Longleaf pine biomass was calculated from these measurements using developed weight and volume equations. Herbaceous (forbs and grasses) and woody (tree and vine) vegetation and litter were collected from each plot. The vegetation and litter was oven-dried and weighed. A sub-sample of the dried vegetation from each component from each plot was ground up and analyzed for carbon. The resulting percent carbon was used to calculate the carbon sequestered in each component. The preliminary results were presented at a meeting in early 2005. Work was completed for the soil samples and the vegetation and soils data is being used by Ram Thapa for his master's degree. Work will begin on Phase III in November 2006. This will have an impact on the plots we will be able to use in Phase III of the study. The search continues for another graduate student to work on more of Phase II and all of Phase III.

## *Monitoring of unexploded ordnance (UXO) sampling plots for impacts on forest development and longleaf pine restoration*

Funding Source: U.S. Fish and Wildlife Service

Principal Investigator: John Kush (Auburn University), Ralph Meldahl (Auburn University)

Graduate Student: John Gilbert

Student Technicians: Anshu Shrestha, Arpi Shrestha

Duration: September 2004 – December 2006

Mountain longleaf pine (*Pinus palustris* Mill.) forests are a critically endangered component of the once vast longleaf pine forests of the Southeast. Stretching from coastal Virginia to the piney woods of east Texas, the longleaf pine forest has dwindled in acreage and integrity. Several small pockets of this once vast forest remain in the Coastal Plain, but in the mountain region only a small National Wildlife Refuge in northeastern Alabama contains a forest that approaches the landscape witnessed by European settlers – Mountain Longleaf National Wildlife Refuge (MLNWR). Several years of extensive field and laboratory work on what was once Fort McClellan indicates that the new MLNWR holds a significant acreage of mountain longleaf pine forest, at least 12 old-growth tracts, lush herbaceous communities, and several management predicaments. These results strengthen the previous contentions that MLNWR contains the finest extant of mountain longleaf pine. MLNWR's longleaf pine forests provide the "missing link" to scientists, land managers, and conservationists in the mountain region, providing the only information on 1) age and stand structure and dynamics of frequently burned old-growth forests, 2) composition of pristine plant communities, and 3) landscape extent of mountain longleaf pine forests.

Most longleaf pine forests on the refuge are adversely impacted by hardwood encroachment resulting from lack of fire. While the reintroduction of prescribed fire will benefit these forests, many areas have evolved beyond the point in which fire alone can restore the forest. These lands require hardwood/mid-story control along with fire. By implementing a monitoring program in various forest types the overall effects of this remediation approach can be measured. It also may be possible to recommend slight modifications to the current methodology that would improve and add benefits to future forest structure.

*Status* – During the 2006 summer, several study plots were visited on the MLNWR. Based on topography and aspect, 26 plots were surveyed and plots installed to collect data on longleaf pine and other site characteristics. A final report has been drafted and sent to the MLNWR for review.

# *OTHER PROJECTS*

## *Modeling the recovery rates of avian populations (completed)*

Funding Source: U.S. Geological Survey

Principal Investigator: Barry Grand

Post-doctoral Researchers: Jennifer Arnold, David Koons

Research Assistants: Nitin Yogi, William Trimble, Jeff Baker, Shaun Tanger, Danielle Warren, Carrie Johnson

Duration: April 2001- March 2006

At least 29 species of birds are known to use the near shore waters of the Beaufort Sea, which makes them potentially vulnerable to catastrophes resulting from industrial activities associated with offshore oil and gas extraction. The goals of this project were to identify the available data on vital rates of selected species, determine the best methods available for modeling the recovery of avian populations from catastrophic mortality events and where possible develop the population model structure for target species, and provide natural resource professionals with an easy to use, well-documented tool for examining population level impacts of oil spills.

*Status* **–** This project has been completed and the final report has been reviewed by USGS and Minerals Management Service. The software tool and the Access database were reviewed and finalized. Manuscripts describing the effect of catastrophic perturbation on short term population dynamics, the momentum of populations across vertebrate life histories, and the use of momentum in making population management decisions have been published in Ecological Applications, Ecological Modeling, and the Journal of Wildlife Management. Additional publications describing the sensitivity of momentum and an innovative method for predicting the sensitivity of animal populations to perturbation or management actions is in preparation. The final report is in preparation for publication as a monograph. A workshop describing the modeling tool and database was presented at the North American Duck Symposium in Bismark, North Dakota in September 2006. More details about the project and the software are available at www.ag.auburn.edu/alcfwru/avsmdl/.

## *Ecology and management of feral hogs on Fort Benning, Georgia*

Funding Source: U.S. Department of Defense, Fort Benning, Georgia

Principal Investigator: Stephen S. Ditchkoff (Auburn University), Barry Grand, Mike Mitchell

Student: Laura Hanson, Buck Jolley, Bill Sparklin

Duration: September 2003 – May 2007

Self-sustaining populations of feral swine have inhabited Fort Benning, Georgia, since at least the 1950s. Originating from free-ranging domesticated hogs and European boar (*Sus scrofa*) introduced for hunting, these populations recently have grown to the point where sightings are common and areas affected by their foraging are extensive. Because hogs forage by vigorous rooting, they can strongly affect their environment by disturbing soil, impeding regeneration of trees, disrupting understory plant communities, and altering habitat for numerous animal species. Hogs are also opportunistic omnivores, consuming a wide variety of plant and animal species. Of particular concern on Fort Benning, evidence is building that hog populations have the potential to strongly affect threatened and endangered animal and plant species such as the gopher tortoise (*Gopherus polyphemus*) and relict trillium (*Trillium reliquum*).

The goal of this project is to investigate the efficacy of removal for reducing the impact of feral hogs on threatened populations and sensitive habitats on the Fort Benning military installation. Currently, management of hogs on Fort Benning includes trapping and removal, as well as an open hunting season (over 2,000 hogs were harvested by hunters from 2001 to 2003). Future management efforts include increasing trapping efforts and broadening hunting opportunities, but the extent to which such efforts will be effective is unknown. The capacity for growth in a hog population is prodigious. Feral hogs breed throughout the year, and mature females can produce several litters of up to 16 piglets per year. The level of mortality needed to offset this potential depends on the size and demographic processes (i.e., annual survival, fertility, population growth rate) of the population, none of which are known. These processes must be understood before the number of removals needed to meet management goals can be estimated.

*Status* – During May-July 2004, 2005, and 2006, we captured and marked approximately 300 feral hogs to facilitate mark-recapture efforts. These data have indicated that feral hog populations are likely more sensitive to juvenile recruitment and survival than adult survival, where effort is normally targeted. Additionally, we have affixed GPS collars to approximately 35 female hogs, and examined aspects of their spatial ecology. These data have indicate that female-juvenile sounders on the study area exhibit spatial patterns that are strikingly similar to species that are territorial, suggesting that traditional control efforts (shooting and trapping individuals) may not be the most effective approach. We also collected food habits data from over 200 individuals, and have documented that feral pigs consume significant numbers of herpetofauna, and possess the potential to impact sensitive species such as the threatened gopher frog (*Rana capito*).

## *Evaluation of Triclopyr Amine for controlling alligator weed (Altemanthera philoxeroides) and restoring native plants to wetlands at Eufaula National Wildlife Refuge*

Funding Source: U.S. Fish and Wildlife Service, Eufaula National Wildlife Refuge, SePRO Corporation

Principal Investigator: Gary R. Hepp (Auburn University)

Student: Shannon Allen

Duration: August 2003 – August 2006

Eufaula National Wildlife Refuge (ENWR; 4526 ha) is located on the northern segment of Lake Eufaula, an impoundment of the Chattahoochee River. The primary management objective of ENWR is to provide habitat for waterfowl and other water birds. Alligator weed is an invasive nonindigenous species that has become a dominant plant in ENWR waterfowl impoundments. It provides little or no nutritional value and displaces native plants normally used as a food source, thereby degrading habitat quality for migrating waterfowl. In this study, I am evaluating application rates and application timing of the herbicides triclopyr amine (Renovate®) and imazapyr (Habitat®) for controlling alligator weed and restoring native plants to the waterfowl impoundments at ENWR.

*Status* – In moist-soil managed wetlands, we tested effects of application rate (high, medium and low) and timing (April and July) of triclopyr amine and imazapyr on controlling alligatorweed and restoring native plants. In the year of treatment, imazapyr controlled alligatorweed better than triclopyr amine when applied in April, but both herbicides applied in July were equally effective at controlling alligatorweed. High application rate of herbicides in April controlled alligatorweed better than the low application rate, but application rates of herbicides in July did not differ. In the year of treatment, application of triclopyr amine resulted in greater native plant biomass than imazapyr. High application rate of herbicides in April resulted in greater native plant biomass in the year of treatment than low application rate, but native plant biomass did not differ between application rates in July. One year after treatment, high application rate of herbicides resulted in less alligatorweed than low application rate, and July application of either herbicide generally controlled alligatorweed better than the April application. Application of imazapyr in July resulted in greater biomass of native plants one year after treatment than either imazapyr or triclopyr amine applied in April. This study demonstrates that single herbicide applications can be effective at controlling alligatorweed and restoring native plants to managed wetlands.

## *Abundance and habitat use of King rails at Eufaula National Wildlife Refuge*

Funding Source: U.S. Fish and Wildlife Service

Principal Investigator: Gary Hepp (Auburn University)

Student: Evan Wheeler

Duration: March 2006 – September 2006

Wetland losses have affected many bird species that depend on these habitats. Population levels of several species of marsh birds, including rails and bitterns, for example, appear to be declining. However, little is known about the ecological requirements of these secretive birds, and monitoring programs to determine their continental status are currently lacking. Many of these marsh birds are listed by the U.S. Fish and Wildlife Service as Birds of Management Concern (BMC). In fiscal year 2005-2006, the king rail (Rallus elegans) was placed on the focal species list, identifying this as a species in need of immediate attention by the conservation community. In this study, we initiated a survey to determine examine the status of king rail, black rail (Laterallus jamaicensis), least bittern (Ixobrychus exilis), and common moorhen (Gallinula chloropus) at Eufaula National Wildlife Refuge, and describe habitats used by these marsh birds.

*Status* - Survey points (n= 37) were established in the Bradley, Houston, and Kennedy Units of Eufaula National Wildlife Refuge. We conducted two complete surveys in each of three months (April, May and June) in 2006. Marsh bird sampling protocols established by Courtney Conway (USGS, Arizona Coop. Fish and Wildlife Research Unit) were used for the surveys. Morning surveys were conducted and began 30 min before sunrise and continued for approximately 3 hr. At each survey point, sampling began with a 5 min passive period followed by a 30 sec period in which calls of each species were broadcast. Call-broadcast surveys have been shown to increase detectability of individual marsh bird species. Each individual observed or heard during the survey period and estimated distance to the individual from the survey point were recorded.

Black rails and least bitterns were not recorded during the survey period. Thirty-nine king rails were observed or heard during the surveys. Only 10% (n = 4) of king rails were detected during the passive portion of the survey. Seventy-five common moorhens were observed or heard during the surveys, and 29% (n = 22) were detected during the passive portion of the survey. Incorporating broadcast calls to the survey substantially increased detection of these secretive marsh birds. Data analysis will continue, and the relationships between vegetation and water depth parameters will be determined.

## *Population status and host plant population status of the Gulf Coast solitary bee, Hesperapis oraria*

Funding Source: U.AS. Fish and Wildlife Service

Principal Investigator: George Folkerts (Auburn University)

Research Assistant: Katie Glynn

Duration: March 2006 – March 2007

*Hesperapis oraria* was described in 1996 (Cane et al. 1996) from specimens ranging from Horn Island off the coast in Jackson County, Mississippi, eastward to St. Andrews State Park in Bay County, Florida. This species is the only representative of its genus east of the Mississippi River and thus represents a unique geographical disjunct from other species which inhabit the western U.S. and Mexico. As far as is known the species is restricted to coastal dune habitats and sandy barrier islands. Coastal Plain honeycomb head (*Balduina angustifolia)* is thought to be the sole pollen host for this species (Cane et al. 1996). Although the host plant ranges farther inland and occurs in coastal Georgia and throughout the Florida peninsula, no specimens of the bee have been taken in most areas of the host plant range. Thus, it is possible that the species is restricted to the area from which it is presently known. Nests of this species have not been reported in the literature and were not found during previous survey work. Thus, the conservation significance of many life history parameters of the species cannot be assessed. Since the last survey for this species was completed in 1995, Cane (1997) reported that ten populations, located during 1993-1994, survived the effects of Hurricane Opal (October 1995) which impacted essentially the entire known range of the species to some extent. Since that time, tropical storms or hurricanes have impacted portions of the known range of *Hesperapis oraria.* An additional factor that may have affected populations of *H. oraria* relates to the accelerated coastal development that has occurred throughout its range since the bee was discovered. In areas such as the Fort Morgan peninsula in Baldwin County, Alabama, development has markedly changed habitats in the last decade. Cane (1997) reported that a site from which the species was known at Romar Beach, Baldwin County, Alabama, had been destroyed by building construction.

*Status* – Fourteen trips to sites where the bee was known to occur or might occur were made during the 2006 season. Bees were found at a total of 9 sites during the 2006 survey. Estimates of bee abundance were made by observing a single dense population of host plants and only counting the bees that visited that clump. Even with this method, counts were high. This information seems to indicate that bee populations are healthy at the sites where it was found. *Balduina angustifolia* was judged to be abundant to common at all sites visited. Thus, the hurricanes of the past half decade seem to have had no significant influence on the abundance of the host plant. It is critical that the nesting habitat of bee be found if populations are to be adequately protected. More sites must be visited both along the coast and inland. Because this is the only monolectic species in the genus, the other species being oligoleges, it is critical that populations of host plants related to *Balduina angustifolia* be visited more thoroughly during the active season of the bee.

# *PRODUCTIVITY*

## *Publications*


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Billlodeaux, Lauren E., James B. Grand, Michael S. Mitchell, James B. Armstrong. Occupancy and detection fo coyotes in urban and rural areas in western Georgia.

The Wildlife Society 13th Annual Conference, September 23-27, 2006, Anchorage, AK.

Folk, T.H. and J.B. Grand. Population dynamics of northern bobwhites in a fire-maintained longleaf pine forest. 12th Annual Southeastern Quail Study Group Meeting, August 6-9, 2006, Auburn, AL.

Grand, James B. and Travis H. Folk. Prescribed fire, longleaf pine, and Northern Bobwhites: Understanding how fire influences the demography of an important game bird. Alabama Chapter of The Wildlife Society Annual Meeting, May 21, 2006, Livingston, AL.

Grand, J.B. and D. N. Koons. Population Modeling Workshop. 2006 North American Duck Symposium. August 25, 2006, Bismarck, ND.

Hepp, G.R., S. Allen, and J. Miller. Evaluation of herbicides for controlling alligator weed (*Alternanthera philoxeroides)*and restoring native wetland plants at Eufaula National Wildlife Refuge. Seventh Annual Southeast Exotic Plant Conference, May 3-5, 2005, Birmingham, AL.

Hepp, G. R., S. Allen, and J.H. Miller. Evaluation of herbicides for controlling alligator weed (*Alternanthera philoxeroides)* and restoring native wetland plants at Eufaula National Wildlife Refuge. 24th Annual MidSouth Aquatic Plant Management Society Meeting, October 11-13, 2005, Tunica, MS.

Irwin, E. R. and G. Turner. February 2006. Aquatic GAP of the ACT. Alabama Fisheries Association Annual Meeting, Perdido, Alabama (Invited)

Kleiner, K. A GIS model to target restoration hotspots by determining probabilities of existing longleaf pine stands found by remote sensing. Second Montane Longleaf Conference/Workshop, November 19, 2005, Berry College, Mount Berry, GA.

Kleiner, K. J., M. D. MacKenzie, and J.S. Hogland. Creating and using spatial probability distributions for Longleaf Pine Ecosystems across East Mississippi, Alabama, the Panhandle of Florida, and West Georgia. 2005 National Gap Analysis Project Interagency Symposium, December 8, 2005, Reno, NV.

Kleiner, K. and M. MacKenzie. Mapping ecological systems in the East Gulf Coastal Plain via remote sensing: balancing interpretation and modeling. 2006 Annual Meeting of the Ecological Society of America, August 7, 2006, Memphis, TN.

Kleiner, K. and M. MacKenzie. Mapping ecological systems in the East Gulf Coastal Plain via remote sensing: balancing interpretation and modeling. Third Annual GIS Symposium, November 1, 2006, Auburn University, Auburn, AL.

Mickett, K. and E. Irwin. February 2006. Adaptive management of a highly-regulated southeastern river: tools for stakeholders. 2006 Spring Meeting of the Southern Division of the American Fisheries Society, San Antonio, Texas.

Turner, G. and E. Irwin. February 2006. A GIS-based empirical approach for modeling biodiversity in the Alabama-Coosa-Tallapoosa (ACT) river basin. 2006 Spring

Meeting of the Southern Division of the American Fisheries Society, San Antonio, Texas (Invited).

Sakaris, P. and E. Irwin. February 2006. Daily aging of age-0 catfishes with implications for assessing the effects of environmental variables on early life history stages. 2006 Spring Meeting of the Southern Division of the American Fisheries Society, San Antonio, Texas (Invited).

Johnson, V.M. and C. Guyer. Seasonal and diel peaks of Gopher Tortoise mating behavior. Annual Meeting American Society of Icthyologists and Herpetologists, July 6-11, 2005, Tampa, FL.

Thapa, R., D.H. Gjerstad, and J.S. Kush. Carbon sequestration and longleaf pine (*Pinus palustris)* ecosystems. 91st Annual Meeting of the Ecological Society of America, August 5-10, 2006, Memphis, TN.

## *Posters*

MacKenzie, M., K. Kleiner, J. Hogland, A. Silvano, and J. Grand. A map of the ecological systems of the East Gulf Coastal Plain based on satellite imagery. Annual Meeting of the Ecological Society of America, August 7, 2006, Memphis, TN.

Turner, G. T. and E. R. Irwin. November 2006. Modeling Aquatic Biodiversity in the Alabama-Coosa-Tallapoosa Basin-A GIS Based Empirical Approach. 3rd Annual Alabama GIS Sympsium.

## *Graduate Theses and Dissertations*

Allen, S. L. 2006. Restoration of native plants through chemical control of alligator weed (Alternanthera philoxeroides) at Eufaula National Wildlife Refuge. M.S. Thesis. Auburn University, Auburn, Alabama.

Folk, T.H. 2006. Population ecology of Northern bobwhites. Ph.D. Dissertation. Auburn University, Auburn, Alabama.

Hanson, Laura. 2006. Demography of feral pig populations at Fort Benning, Georgia. M.S. Thesis. Auburn University, Auburn, Alabama.

Sakaris, P.C. 2006. Effects of the hydrologic variation on dynamics of channel catfish and flathead catfish populations in regulated and unregulated rivers in the southeast USA. Ph.D. Dissertation. Auburn University, Auburn, Alabama.

## *Awards*

Best Poster Award-AFS Annual Meeting

Hayer, C. A. and E. R. Irwin. September 2005. Effects of gravel mining on selected fishes in the Mobile River drainage, Alabama. (poster) 135th Annual Meeting American Fisheries Society, Anchorage, Alaska.

Peter Sakaris-2006 Jimmy Pigg Memorial Outstanding Student Award, Southern Division, American Fisheries Society

Taconya Piper-2006 Equal Opportunities Section (AFS) Travel Award

James B. Grand – USGS Cooperative Research Units Leadership Excellence Award

James B. Grand – USGS Star Award for Superior Performance in Fiscal Year 2006.

## *Invited Lectures*

Two days of lecture and field laboratory exercises for Introduction to Fisheries class. June 2006 (Irwin)

## *Outreach/Technical Assistance*

Drs. Irwin & Grand

At his request, Unit personnel met with the Director of ADCNR, and his Chiefs of Fisheries and Wildlife, regarding education and training of potential future employees for their agency. April 2006

Dr. Grand

Chair, Multi-Agency Search Committee – East Gulf Coastal Plain Joint Venture Coordinator.

Chair, Faculty Search Committee – Auburn Forest Wildlife and Recreation, Auburn University, School of Forestry and Wildlife Sciences

Member – Research Committee, Auburn University, School of Forestry and Wildlife Sciences

Member – Graduate Program Planning Committee, Auburn University, School of Forestry and Wildlife Sciences

Alabama Chapter of The Wildlife Society – Southeastern Section Representative and Member of the Executive Committee

Assisted Alabama DCNR with design and conduct of a pilot program for estimating the abundance and structure of wild turkey population.

Student Quiz Bowl Judge, The Wildlife Society 13th Annual Conference.

Dr. Irwin

Interview Article - Jackson, K. 2006. First adaptive management implemented in Southeast on Tallapoosa River. Ag Illustrated:3(2) (http://www.ag.auburn.edu/adm/comm/agillustrated/Winter06/agec.html#fish)

FAA Search Committee for Assistant Professor, Aquatic Ecology/Limnology-Jensen, Chair (2006)

Becoming an Outdoors Woman. Taught ABC's of Fly Fishing and Wooly Boogers and Friends Workshops. March 2006.

AFS History Section; Secretary/Treasurer (2004-present)

## *Training Provided*

Dr. Grand

North American Duck Symposium Workshop in Bismarck, North Dakota (23-26 August) entitled "Modeling Waterfowl Populations".

## *Teaching*

Dr. Irwin

Spring 2006 – Ecology and Management of Riverine Systems

Dr. Grand

Fall 2005 – Analysis of Wildlife Populations

Fall 2006 – Occupancy estimation and modeling (Special Topic)

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