Alabama Natural Heritage Program[SM]

2012 Annual Report

Staff Directory & Resources

Staff Directory

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The mission of the Alabama Natural Heritage Program[SM] (ALNHP) is to provide the best available scientific information on the biological diversity of Alabama to guide conservation action and promote sound stewardship practices. ALNHP is administered by the Environmental Institute at Auburn University. Established by The Nature Conservancy in 1989, it is one of a network of such programs across the United States, Canada, and Latin America, collectively known as the Natural Heritage Network (NHN). As a member of the NHN, ALNHP is represented by its membership organization NatureServe. NatureServe works to aggregate data from individual Network Programs and is dedicated to the furtherance of the Network and the application of Heritage data to biodiversity conservation.

Natural Heritage Programs have three broad functions:

- to collect information on the status and distribution of species and natural communities,
- to manage this information in a standardized way, and
- to disseminate this information to a wide array of users.

Natural Heritage Programs use a standardized information management system to track biodiversity data including taxonomy, distribution, population trends, habitat requirements, relative abundance, quality, condition, and viability. ALNHP provides the following services: biodiversity data management, inventory, biological monitoring, site prioritization, conservation planning, Geographic Information System services, and land management expertise.

Affiliations

NatureServe

A Network Connecting Science With Conservation

NatureServe is a non-profit conservation organization that provides the scientific information and tools needed to help guide effective conservation action.

NatureServe represents an international network of biological inventories - known as natural heritage programs or conservation data centers - operating in all 50 U.S. states, Canada, Latin America and the Caribbean. NatureServe and its network of natural heritage programs are the leading source for information about rare and endangered species and threatened ecosystems. Together we not only collect and manage detailed local information on plants, animals, and ecosystems, but develop information products, data management tools, and conservation services to help meet local, national, and global conservation needs. The objective scientific information about species and ecosystems developed by NatureServe is used by all sectors of society - conservation groups, government agencies, corporations, academia, and the public - to make informed decisions about managing our natural resources.

AUBURN UNIVERSITY

OFFICE OF THE VICE PRESIDENT FOR RESEARCH

ENVIRONMENTAL INSTITUTE

The mission of the Auburn University Environmental Institute is to serve the state, nation, and global community by providing leadership and coherence in all university areas of environmental instruction, research, and extension/outreach. The goal of the Environmental Institute is to promote, coordinate, and implement multi-disciplinary programs and activities to meet the environmental needs of the University, state, and nation. There are several ways in which the Institute works to meet these goals.

By supporting and coordinating interdisciplinary teams, programs, or specialized centers, the Institute creates a new forum for environmental research and education. The associated faculty program promotes the work and research across many disciplines which may not ordinarily coordinate investigative efforts. The Institute also serves the faculty by increasing information and access to extramural funding, and developing proposals and other means for improving the quality of environmental education and research at Auburn University. The Institute serves as a source of information concerning funding, through public and private monies, of new and innovative research opportunities. It is additionally important to increase the effectiveness of Auburn University educational programs, curriculum, and professional opportunities for all students in all academic fields related to the environment, such as through lecture series and sponsored annual conferences.

Introduction

The Alabama Natural Heritage ProgramSM (ALNHP) has had a productive and successful year. The program staff continue to conduct in-depth surveys for imperiled species in Alabama and to produce quality reports and publications on the state's diverse flora and fauna. The comprehensive database of Alabama's natural heritage continues to grow, and provides a sound foundation for conservation efforts in the state. This report includes summaries of our projects over the past year. Thank you for your interest in and support of ALNHP and our efforts to protect Alabama's rich biodiversity.

Project Summaries

Botany & Community Ecology – General Overview

The botany/community ecology component continues to be actively involved presenting lectures, conducting field surveys, and preparing reports in 2012. As in past years, a significant proportion of the year was devoted to updating and preparing status surveys for species of conservation concern and federally-listed plants on behalf of the U.S. Fish and Wildlife Service (USFWS). ALNHP is also currently working in conjunction with the Department of Defense to conduct an inventory of rare animal and vascular plant species at the Albany Marine Base in Albany, Georgia, in an effort to better guide conservation strategies. In September 2011 the ALNHP entered into agreement with JMR Architecture of Montgomery to institute a comprehensive plant inventory of the Fort McClellan Army National Guard Training Center on Pelham Range near Anniston. This project spans two growing seasons, with an anticipated completion date of September 2013.

Alabama Red-bellied Turtle (*Pseudemys alabamensis*)

Genetic analysis of the Alabama Red-bellied Turtle (Pseudemys alabamensis): estimation of population subdivision, among population gene flow, and species boundaries

Sampling for the Alabama red-bellied turtle to collect samples for genetic studies and data on the status of the species was range-wide, during the 2012 field season. This large herbivorous turtle occupies only eight drainage basins in coastal Alabama and Mississippi. Locations of Alabama red-bellied turtle population centers sampled in Alabama included Fish and Magnolia rivers of Weeks Bay, Bon Secour River, Dog River, and Fowl River. The Mississippi sampling site was the lower Pascagoula River. Samples from the Mobile-Tensaw Delta were available from previous studies thus the only drainage remaining to be sampled is the lower Biloxi River in Mississippi. Co-occurring with the Alabama red-bellied turtle, throughout its range, are two congeners, the river cooter and Florida cooter. The study was to address three important questions:

1. Is geographic distance or species assignment a better predictor of genetic variation among Mobile Basin *Pseudemys*?
2. Is there population subdivision (e.g., among-drainage variation) within Mobile Basin *P. alabamensis*? and

Alabama red-bellied turtle (*Pseudemys alabamensis*)

3. Are Mobile Basin populations genetically distinct from Mississippi P. *alabamensis*?

Importantly, in Question 1, if geographic distance is a better predictor than species assignment, then this would suggest that *P. alabamensis* is either not a distinct species or is experiencing extensive hybridization with sympatric congeners. This answer to this question is critical considering that the Alabama red-bellied turtle is listed as endangered by the U.S. Fish and Wildlife Service. Conclusions from the genetic analysis were:

1) There is strong evidence for recognizing the Alabama red-bellied turtle as a distinct species.

2) Preliminary results show no evidence of among-drainage variation for Mobile Bay.

3) Preliminary results show some limited differentiation between Mobile Bay populations and the Pascagoula population.

4) The Alabama red-bellied turtle and sympatric congeners do hybridize, but hybrids are rare.

5) The Florida cooter and river cooter are not supported as being distinct, indicating the need for further study of species delimitation in this genus.

This study was done in collaboration with Gregory B. Pauly (Section of Herpetology, Natural History Museum of Los Angeles, CA), Phillip Q. Spinks and H. Bradley Shaffer (Department of Ecology and Evolutionary Biology, University of California, Los Angeles, CA)

Black Warrior waterdog (*Necturus alabamensis*)

Status surveys for the Alabama red-bellied turtle will continue during 2012-2013. These surveys and the genetics studies have been funded through the Alabama Department of Conservation and Natural Resources.

Biological Inventory of the Marine Corps Logistics Base, Albany, Georgia

The Alabama Natural Heritage Program has partnered with the Department of Defense to identify and document federally and state listed species and significant natural communities at the Marine Corps Logistics Base in Albany, Georgia. The project will also entail identifying infestations of exotic species and providing management recommendations for listed taxa and the control of non-native species. Field studies will be conducted throughout the 2013 growing season with a final report submitted by October 1, 2013.

Black Warrior Waterdog (*Necturus alabamensis*) and Flattened Musk Turtle (*Sternotherus depressus*)

The Black Warrior River basin, above the Fall Line, is an area of aquatic endemism in Alabama; two of these species are the Black Warrior waterdog (*Necturus alabamensis*) and the flattened musk turtle (*Sternotherus depressus*). Both species are state protected while the flattened musk turtle is federally threatened and the Black Warrior waterdog is a US Fish and Wildlife Service candidate species. The waterdog and musk turtle each inhabit,

flattened musk turtle (*Sternotheurs depressus*)

ideally, clear streams and rivers with permanent flow, reduced sedimentation, and a substrate of underwater rocks, crevices, and ledges, although degraded water quality is thought to have impacted populations of these animals. Their ranges overlay to a very large extent and they occupy similar sites and habitats. Studies at sites within the Bankhead National Forest where these species are known to co-occur have revealed interesting seasonal patterns between these species. The Black Warrior waterdog is active during the winter months but as waters warm the salamander "disappears", to be seemingly replaced by the flattened musk turtle from late spring through early fall.

Status Survey for the Black Warrior Waterdog (Necturus alabamensis)

The Black Warrior waterdog (*Necturus alabamensis*) is a rare, aquatic, neotenic, salamander endemic to the Black Warrior River basin known to inhabit clean, clear, rocky streams of the watershed above the Fall Line. The most recent surveys and habitat analysis are over 10 years old. During the last survey the waterdog was reported at only 14 of 112 sites and of 11 sites examined regarding habitat quality three were ranked good to excellent, four moderate, two poor to unsuitable, and two impounded and undetermined. The present survey is to update this information for the U.S. Fish and Wildlife Service using standard collection techniques of dip netting leaf beds and setting of baited minnow traps, as well as qualitative habitat assessments. The Black Warrior waterdog is under consideration for listing as threatened by the USFWS and information gathered during this survey will be used in making a determination to list or not.

Black Warrior Waterdog and Flattened Musk Turtle Status Survey using Environmental DNA (eDNA)

The Black Warrior waterdog is thought to have experienced a precipitous decline in range as the most recent surveys have documented the species from only 14 localities. The flattened musk turtle is known from more localities, approximately 60, yet a large percentage (>50%) of its occupied habitat is thought to have been lost due to habitat fragmentation. Based on known localities of both species and their shared habitat these species are considered to have very similar, if not nearly identical, distributions. In comparing known localities of the waterdog and musk turtle, six sites have both species, eight sites waterdog only, and approximately 50 sites with musk turtle only.

Typical sampling techniques for Black Warrior waterdog include dip netting leaf packs, setting baited minnow traps, and occasionally electroshocking. Flattened musk turtles are

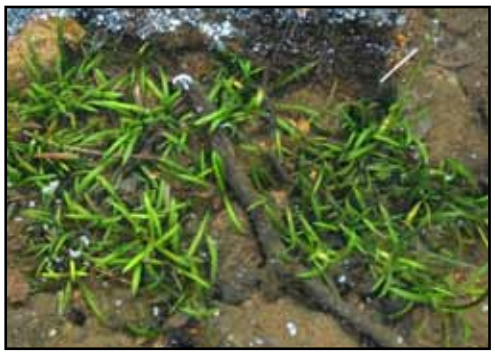
Sipsey Fork

collected with the setting of baited traps. Drawbacks to waterdog and musk turtle sampling include limitations of dip netting and electroshocking to chest deep water, and for dip netting a dependence upon the persistence of leaf packs. High water conditions preclude dip netting and may wash out leaf packs and inhibit the setting of minnow traps and baited turtle traps. Baited minnow traps and turtle traps must be checked regularly, at least once every 24 hours, and turtle traps must be set to avoid drowning of turtles, or checked more frequently than 24 hours.

Individuals, as they interact with their environment, shed tissue that contains species specific DNA segments. Techniques have recently been developed to capture the DNA from water, analyze the samples, and identify species-specific DNA segments. The use of environmental DNA (eDNA) in presence/absence studies has proven to be quite effective, and has the utility of providing an qualitative estimate of abundance. The use of the eDNA technique is being used in this study for both the Black Warrior waterdog and the flattened musk turtle as a methodology to reassess the status and refine the distribution of both species.

This project is being funded by the Alabama Department of Conservation and Natural Resources through Section 6 and is in collaboration with Dr. Lesley de Souza, Shedd Aquarium, Chicago, IL.

Alabama streak sorus fern (Thelypteris burksiorum)



Kral's water plantain (*Sagitaria secundifolia*)

Black Warrior Waterdog, Flattened Musk Turtle, Streak Sorus Fern, and Kral's Water Plantain Studies in the Bankhead National Forest, Alabama

The drainage area of the upper Black Warrior River basin is an estimated 3,095,559 acres and encompasses the 348,989 acre Bankhead National Forest, thus, the Bankhead National Forest totals ~11% of the total of the upper Black Warrior River basin. Considering that the ranges of the Black Warrior waterdog and flattened musk closely correspond to the upper Black Warrior River basin, and then the Bankhead National Forest contains approximately 11% of the range of these species. As many streams within the river basin are degraded, management of Forest Service lands to promote high water quality will be critical to the long-term survival of these rare aquatic species.

The Alabama streak sorus fern (*Thelypteris burksiorum*) is a federally listed species endemic to the Sipsey Fork of the Black Warrior River in Bankhead National Forest. Given the low number of individuals combined with an extremely limited distribution prompted the U.S. Fish and Wildlife Service to list the species as threatened under the Endangered Species Act on July 8, 1992. It was during this time that a comprehensive status assessment was prepared to obtain census data, to qualify habitat preferences, and to identify apparent disturbances and potential long-term threats to the species. Since the initial assessment of the species in the early 1990s, field inspections have


Carpenter's ground cherry (*Physalis carpenteri*)

not been implemented to evaluate population trends and to identify disturbances and apparent threats. Because of outdated census data and the absence of recent systematic survey efforts, inspections of existing populations and inventories for new localities are proposed. In addition to survey efforts, permanent monitoring plots are also proposed, in an effort to further assess the long-term effects of natural and human-derived disturbances.

Kral's water plantain (*Sagitaria secundifolia*) is a federally threatened submerged aquatic plant that occupies cracks in exposed bedrock, and crevices between rocky slabs. Surveys for the distribution and status of this species will be conducted alongside surveys for other species.

Over the next five years studies will be done within the Bankhead National Forest to: 1) determine the distribution of the Black Warrior waterdog, flattened musk turtle, streak sorus fern, and Kral's water plantain in the Sipsey Fork and Brushy Creek; 2) determine the status of these species in the Sipsey Fork and Brushy Creek; 3) collect data on the seasonal movements and nesting of the flattened musk turtle; and 4) provide streamside management recommendations to the U.S. Forest Service pertaining to these species. This 5 year project is being funded by the U.S. Forest Service.

Carpenter's Groundcherry Status Survey

A range-wide status assessment of the Carpenter's ground-cherry (*Calliphysalis carpenteri*) was completed October 2012, resulting in a small number of new occurrences of this globally imperiled plant. The species is currently known from five states, including Alabama which contains four extant occurrences. The project, funded through the U.S. Fish and Wildlife Service, will provide critical information pertaining to population dynamics, habitat characteristics, and disturbances and potential threats to determine viable conservation efforts for the species.

Gopher Tortoise (*Gopherus polyphemus*)

Distribution, Abundance, and Health Assessment of the Gopher Tortoise (Gopherus polyphemus) in Alabama

As the keystone species of the Southeast US coastal plain, the gopher tortoise has experienced population declines across its range. Currently, populations of the gopher tortoise, range-wide, are being studied with the goal of providing information to the US Fish and Wildlife Service regarding a final decision on federal listing. Due to a lack of basic information on the status of the gopher tortoise in Alabama, on public and private lands, this effort will be to conduct an in-depth study on the distribution, abundance, movement patterns, and health of gopher


Gopher tortoise (*Gopherus polyphemus*)

tortoises in Alabama. Additionally, because a potentially life-threatening emerging infectious disease (URTD) has been observed in tortoises across North America, an additional study will be done to further understand the mechanism that may be causing gopher tortoise mortality in Alabama, and how land management might help conserve this species. Over a three year timeline, basic data related to the current distribution and abundance of gopher tortoises in the state will be acquired, with a focus on understanding their status on public property; in this first leg of the study, data collected will directly relate to the distribution, abundance, and health of wild gopher tortoises. This 3-year study is being funded by a State Wildlife Grant through the Alabama Department of Conservation and Natural Resources and is in collaboration with Dr. Mary Mendonca and Jeff Goessling (Department of Biology, Auburn University).

Gopher Tortoise EO Data Entry

Following up on the recent revision of EO specs and EO rank specs for the gopher tortoise (*Gopherus polyphemus*), NatureServe provided funding to create EOs and begin to address our backlog of tortoise occurrence data. We entered 84 new Element Occurrences and edited 2 existing EOs based on 799 burrow or tortoise locations from a recently completed survey of three public areas in south Alabama by personnel from Dr. Craig Guyer's lab and several miscellaneous locations provided by Dr. Guyer and Mark Bailey.

Historical changes to amphibian and reptile faunas in five key Alabama streams

Amphibians and some reptiles are important sentinel species in conservation planning because of their ties to both terrestrial and aquatic habitats. Because amphibian populations can be adversely affected by change to either environment, they are particularly sensitive to factors such as global climate change. Alabama's rich amphibian and reptile faunas contain several species of conservation concern because they require habitat features that do not persist in landscapes altered by human activities. For example, the Hellbender, largest of Alabama's salamander, is documented from Alabama by a series of museum specimens, but no known populations remain in the state. This species likely had breeding habitat severely diminished as a result of impoundment of the Tennessee River and associated changes to water temperature, water flow, and rates of sedimentation. Using historical and contemporary data for selected streams to encompass Alabama's physiographic variation, patterns of faunal persistence will be investigated. Streams selected for study include systems with extensive historical data and representing upland and coastal plain physiography. In addition, the streams proposed for study have recently been designated as Strategic Habitat and River Reach units for aquatic species of conservation concern in Alabama: Bear Creek (Tennessee River drainage), Cypress Creek (Tennessee River drainage), Shoal Creek (Coosa River drainage), Five Runs Creek (Yellow River drainage) and Uphapee Creek (Tallapoosa River drainage). Finally, the data from this study will provide current information on the distributional status, relative abundance and habitat use of amphibians and reptiles of conservation concern in these systems. This 3-year study is being funded by a State Wildlife Grant through the Alabama Department of Conservation and Natural Resources.

Inventory, Classification, and Assessment of Alabama's Geographically Isolated Wetlands

In October 2011, we initiated a 3-year EPA-funded wetland mapping project to identify, classify, and assess geographically isolated wetlands in Alabama. After completing the Quality Assurance Project Plan, we starting mapping wetlands in the northern third of the

cypress pond in Conecuh National Forest

state using National Wetlands Inventory (NWI) data, GIS-based wetland models, and object based image analysis (OBIA) of 2011 National Imagery Program (NAIP). OBIA of 2011 NAIP imagery was conducted by constructing algorithms that delineate open waters using Definiens eCognition Developer., with the objects identified exported into georeferenced shapefiles. NWI data for Alabama was used to construct a NWI wetland model, with all of the wetland polygons within the NWI dataset imported into the model, regardless of the NWI classification of wetland type. A hydric soils wetland model was constructed from Soil Survey Geographic (SSURGO) data. For the hydric soils model (HSM), we selected map units that were rated all hydric (consisting entirely of hydric soils) or were identified as water, swamp, or tidal marsh by map unit name. Expanding the methodology introduced by Tiner (2003), we created a GIS model that identifies geographically isolated wetlands from each of the wetland models based on the USGS National Hydrography Dataset (NHD) high resolution line and polygon data and Federal Emergency Management Agency (FEMA) National Flood Hazard Layer (NFHL) database. We have begun field work to visit selected wetlands identified as geographically isolated from the models for field verification and to conduct an ecological classification and assessment. This project is being done in collaboration with Luke Marzen and Tyler Jones (Auburn University Department of Geology and Geography) and the AU Water Resources Cener.

Map Turtles

Taxonomic Assessment of Map Turtles (Graptemys) of the Choctawhatchee and Pea Rivers, Alabama and Florida

In the late 1990s map turtles (genus *Graptemys*) were discovered in the Choctawhatchee and Pea rivers in southeast Alabama. At that time this finding was significant because the Choctawhatchee River drainage was a gap in the distribution of this group of turtles. Map turtles exhibit a pattern of drainage-specific endemism, that is, only one species of broad-headed, or only one species of narrow-headed is found in any river system, although a broad-headed and narrow-headed form may co-exist. Thus the questions surrounding the map turtles in the Choctawhatchee were: 1) is this an unknown taxon; 2) is this a range extension of a known species. Subsequent collecting only hinted at answers as individuals identifiable to both Barbour's map turtles and Escambia map turtles were captured, along with seemingly intermediate forms. To resolve this taxonomic conundrum turtles were collected in spring and

Graptemys barbouri x *G. ernsti*

Mohr's Barbara-buttons (*Marshallia mohrii*)

summer of 2012, with morphological and genetic data being obtained from each individual. For comparative purposes we collected Escambia map turtles from the Conecuh and Yellow rivers, and Barbour's map turtles from the Flint River. Results of genetic and morphological data indicate that in the Pea River Barbour's map turtles and Escambia map turtles are in a state of hybridization. In the Choctawhatchee River downstream of the confluence of the Pea River forms more akin to Barbour's map turtle are dominant, showing little influence of the Escamabia map turtle. The results of this study raise further questions pertaining to the zoogeography of the coastal plain rivers of the southeastern US, the ecological interactions of these two species, and how and why pre- and post-zygotic isolating mechanisms have broken down allowing these species to interbreed. Collaborators on this study were Dr. Jeffrey Lovich (US Geological Survey, Flagstaff, AZ), Dr. Joshua Ennen (University of Tennessee, Knoxville, TN), Dr. Brian Kreiser (University of Southern Mississippi, Hattiesburg, MS), Brian Folt (Auburn University), and Chris Lechowicz (Sanibel Captiva Conservation Foundation, Sanibel, FL).

Mohr's Barbara-buttons Status Survey

A status survey on Mohr's Barbara-buttons (*Marshallia mohrii*) in Alabama and Georgia, funded by the U.S. Fish and Wildlife Service, began in May 2012. The purpose of the survey is to furnish an updated, range-wide assessment of the species to systematically analyze population dynamics, to characterize general habitat requirements, and to ascertain apparent disturbances and potential threats. Known only from Alabama and Georgia, this relative of the daisy and dandelion is currently represented by a small number of widely distributed populations across the central and northern portions of Alabama and adjacent Georgia. The species inhabits limestone glades, prairies, and gravelly stream margins, having now become globally imperiled due to a combination of residential development, incompatible timber harvesting, quarrying, trash disposal, and other modifications of its habitat.

Predictive Distribution Modeling and Field Surveys for Upland Snakes of Conservation Concern

Habitat loss and degradation resulting from the destruction and degradation of longleaf pine (*Pinus palustris*) forests when converted to other land uses, intensive silvicultural practices, and fire suppression has resulted in declines for many of the large snakes associated with this habitat. Species which have undergone declines with the loss of longleaf pine habitat include the eastern indigo snake (*Drymarchon couperi* (Holbrook)), black pine snake (*Pituophis melanoleucus lodingi* Blanchard), Florida pine snake (*Pituophis melanoleucus mugitus* (Barbour)), and southern hognose snake (*Heterodon simus*

black pine snake (*Pituophis melanoleucus lodingi*)

(Linnaeus)). Declines in the distribution of these species throughout their range have raised considerable concern for the species.

Development and refinements of species distribution modeling (SDM) methodologies has provided the opportunity to predict species' distribution across broad geographic areas. Depending on data quality, these models can assist in identifying previously unknown populations, determining sites of high candidacy for reintroductions, guiding additional surveys, informing selection and management of protected areas, examining patterns of species richness, investigating the invasive potential of non-native species, and assessing potential impacts of environmental change (e.g. climate change) on species' distributions. SDMs were developed for the four upland snake species of conservation concern to identify areas of potentially suitable habitat using MaxEnt and DOMAIN. Area under the curve (AUC) ranged from 0.7 to 0.94, indicating a high goodness of fit for the models. In general, areas predicted as suitable that were visited to evaluate habitat appeared to be suitable habitat or moderately suitable habitat that could be improved with additional management. However, areas on private land tended to be fire suppressed. None of the four snake species modeled were detected in surveys of areas predicted as suitable in the models.

Red Hills Salamander (*Phaeognathus hubrichti)*

Informing Management of Endemic Habitat Specialists: Multi-scale Habitat Selection of the Red Hills Salamander, Phaeognathus hubrichti

ALNHP conducted a study on the Red Hills salamander between 2008-11 funded with a State Wildlife Grant through the Alabama Department of Conservation and Natural Resources. During the course of the study a body of data was collected on Red Hills salamander burrow densities and distribution, topographical features of Red Hills salamander habitat, and woody vegetation associated with Red Hills salamander localities. In 2001-12 the Alabama Department of Conservation and Natural Resources, through Section 6, provided funding to re-analyze this data on several landscape levels. Red Hills salamander habitat is characterized by steep slopes with a native hardwood forest cover and mid-story shrub layer. From this study management recommendations put forth are to focus on sites occupied by the salamander and restore or enhance the native shrubby vegetation and hardwood forest cover, plus occupied ravines should be surrounded by a minimum 250 m2 of deciduous forest. These habitat characters are within the realm of management whereas characteristic geological features, such as steep slopes, are not. This study was in collaboration with Dr. David Steen (Virginia Tech, Blacksburg, VA) and Dr. Christopher McClure (Boise State University, Boise, ID).

Red Hills salamander (*Phaeognathus hubrichti*)

Falkenberry Hill Activity Study

In 2008 a study on a population of Red Hills salamanders (*Phaeognathus hubrichti*) in Monroe County was initiated in which all burrows were identified and mapped, with a significant number of Red Hills salamanders being captured, measured, weighed, sexed, implanted with a PIT tag, and returned to their

red-cockaded woodpecker (*Picoides borealis*)
(Photo by Jim Hanula)

respective burrows. With completion of this short-term study the essential elements of a long-term study were in place, thus beginning in January 2010 monthly trips have been made to the site to collect activity and movement data on the PIT tagged salamanders. Using a PIT tag reader and antenna capable of detecting a tag as deep as 30 cm underground an entire year of data, taken once a month, has been gathered on activity and movements of Red Hills salamanders. This Red Hills salamander activity study continued through September 2012 with funding from the USFWS. A second component of the study is a fine-scale genetics assessment of the population with comparison to two other sites, one contiguous and one separated by an anthropogenic barrier. We have collected much of the tissue samples needed and genetics analysis is underway. Completion of this study is scheduled for summer 2013. This project is in collaboration with Dr. Kristin Bakkegard of Samford University and Dr. Rulon Clark and Shannon Hoss of San Diego State University.

Red-cockaded Woodpecker Safe Harbor Agreement

In order to encourage landowners with existing or potential Red-cockaded Woodpecker habitat to manage their lands in order to conserve RCW populations, the U.S. Fish and Wildlife Service (USFWS) and the Alabama Department of Conservation and Natural Resources (ADCNR) has implemented a Red-cockaded Woodpecker Safe Agreement in Alabama. Under a Safe Harbor Agreement, the landowner agrees to carry out activities expected to benefit red-cockaded woodpeckers, but no added federal restrictions will be imposed should the numbers (or occurrences) of the species expand beyond a "baseline" level when the agreement is entered into.

ALNHP is working with ADCNR and USFWS to encourage forest landowners to enroll property in the Safe Harbor Program. Copies of the brochure describing the Safe Harbor Agreement have continued to be distributed to interested individuals. Numerous property owners have been contacted and given information regarding the program (brochures, e-mail messages, and verbal communications). Annual monitoring reports were submitted for the nine properties enrolled in the program. During 2011-12, letters and Safe Harbor brochures were mailed to 54 major property owners in south and central Alabama encouraging them to consider enrolling in the Safe Harbor program. This mailing resulted in only one contact.

Reintroduction of the Eastern Indigo Snake onto Conecuh National Forest

The third release of juvenile eastern indigo snakes took place May 2012 with a total of 31 snakes. Twenty-four snakes were implanted with radio transmitters while 7 were PIT tagged only. This brings the total number of snakes released in Conecuh National Forest to 78.

Two female snakes were confirmed gravid in the spring of 2012, one about 2 ½ years old, the other about 3 ½ years old. Both females were held in the lab until their eggs had been laid and from the two we obtained nine hatchlings. Unfortunately an unidentified infection swept

through the young leading to the death of seven; two survived and have well recovered from the disease. Twenty-two of the 62 snakes total released with transmitters are known to have died, but radio signals from others have been lost, or transmitters have been expelled. Although radio telemetry has its limitations it has proven to be the best technique to follow the success of the released snakes.

Winter surveys were conducted in December 2012 and February 2013 in an attempt to locate un-radio tagged snakes. This would include snakes which were PIT tagged only, snakes that have expelled the transmitter, and snakes that have retained the transmitter but now has dead batteries. On the two dates we had 10 and 35 volunteers, walked miles of the forest, but found none of the lost snakes.

Success of this project is being gauged in several manners: 1) snake survival from year-to-year, 2) home range fidelity, 3) snake use of gopher tortoise burrows, and 4) reproduction. One female from the first release is known to be gravid and monitoring is underway at the tortoise burrow that she has been using. This monitoring will continue into the summer through the time when hatchling snakes are expected to appear.

Collaboration has been the key to this endeavor involving Auburn University (ALNHP/ Environmental Institute & Department of Biology), Alabama Department of Conservation and Natural Resources (ADCNR), The Orianne Society, U.S. Forest Service, U.S. Fish and Wildlife Service, Georgia Department of Natural Resources, Zoo Atlanta, and Ft. Stewart (US Army). Funding for the project has been through a State Wildlife Grants administered by ADCNR with The Orianne Society providing matching funds. Zoo Atlanta's contribution is presently housing and rearing the 2011 snakes.

eastern indigo snake (*Drymarchon couperi*)

Funding for this project has been with State Wildlife Grants administered through the Alabama Department of Conservation and Natural Resources. Team members on this project include Dr. Craig Guyer of the Department of Biology, Auburn University, and his students, Jimmy Stiles, Sierra Stiles, and Mike Wines.

Vascular Plant Inventory of the Fort McClellan Army National Guard Training Center on Pelham Range

In September 2011 ALNHP entered into an agreement with JMR Architecture of Montgomery to conduct a comprehensive vascular plant inventory of the Army National Guard Training Center, a 17,000-acre parcel of land on Fort McClellan near Anniston. The project will span two growing seasons, with the first season having been completed. While the main focus of the project is to document all species of vascular plants, the final product will also include documentation of taxa monitored by ALNHP, an account of rare or otherwise significant ecological communities, and maps depicting the locations of rare species and important natural communities.

Wood Stork Post-breeding Survey

Although not known to breed in Alabama, Wood Storks regularly occur in Alabama in summer and early fall. Surveys were conducted to identify important foraging sites for post-breeding wood storks in Alabama. Past post-breeding distribution data for Wood Storks in Alabama

Wood Stork (*Mycteria americana*)

was compiled into a geodatabase from sightings reported on the Alabama Ornithological Society ALBIRDS forum, sightings reported on eBird, observation records from the AOS records compiler, and observations from the Alabama Breeding Bird Atlas. Surveys were conducted from by visual search of potential foraging areas identified from past sightings and GIS data. Wood Stork use of a particular site varies between days and years, but they are consistently observed in several areas of the state. Wood Storks were most common and occurred in the highest concentrations around the catfish farms and farm ponds of the Black Belt in southern Hale and Perry counties and Greene County. Storks also used shallow water marshes, swamps, and oxbows between and along the Tombigbee and Cahaba rivers in this area, but group size tended to be small and much lower than the large groups observed on the catfish farms. The other cluster of Wood Stork observations was at sites in the area around Montgomery. However, Storks were less abundant and occurred in smaller numbers and groups than found in the western Black Belt. Wood Storks are rare and occur more sporadically in other parts of the state, but occur more frequently in south Alabama than north of the Black Belt. The overwhelming majority of areas used for foraging were on private land. The public lands that appear to provide the best opportunity for managing to provide Wood Stork foraging habitat are Eufaula NWR, the State Cattle Ranch, Demopolis Wildlife Management Area and nearby Army Corps of Engineers land, Choctaw NWR and Powder Magazine Park.

World Congress of Herpetology, University of British Columbia, August 2012

Information on projects conducted through the Alabama Natural Heritage Program was presented at the 7th World Congress of Herpetology. Four presentations were given from work coming out of the eastern indigo snake reintroduction effort and one on the Red Hills salamander:

James Godwin. Return of the eastern indigo snake (*Drymarchon couperi*) to Alabama: Initial success through partnership and collaboration

James Godwin. Conserving the Red Hills salamander (*Phaeognathus hubrichti*) has a long way to go, but at least there is light at the end of the burrow

Jimmy Stiles. Monitoring the reintroduction of eastern indigo snakes into Alabama: Survival and home range

Sierra Stiles. Shelter use by translocated eastern indigo snakes (*Drymarchon couperi*) in Conecuh National Forest, Alabama

Lesser clearweed (*Pilea fontana*)

Michael Wines. Optimal egg incubation temperature for the eastern indigo snake (*Drymarchon couperi*)

Significant Botanical Discoveries

- Lesser clearweed (*Pilea fontana*) was observed in a shallow depression along Hurricane Creek in Jackson County in September 2012. The discovery represents the second occurrence reported for the state, with the first discovery having been made in Houston County in the southern part of the state. The species assumes a broad distribution that covers most of the eastern U.S., but becomes spotty in the Southeast. A common, similar appearing species is also known from the state, but can be easily distinguished by the color of its fruits.

- Cypress-knee sedge (*Carex decomposita*) a globally rare wetland herb was newly documented from Jackson County while exploring a series of isolated wetlands on the Cumberland Plateau in August 2012. The discovery represents the fourth known occurrence for the state. The plant acquired its common name from its ability to assume an epiphytic habit of growing on the bases of cypress knees and those of other woody species, most notably buttonbush.

cypress-knee sedge (Carex decomposita)

- Spiked beakrush (*Eleocharis rostellata*) was documented from Baldwin County in October 2012 representing the first report from the county and the second known occurrence from Alabama. Eleocharis rostellata is a widely distributed taxon occurring throughout most of North America, extending south into Mexico and the West Indies. The species assumes a sporadic distribution in the Southeast being primarily confined to brackish marshlands and calcareous prairies along the Atlantic and Gulf coasts, often establishing nearly monospecific stands. The newly discovered second population occurs in a vast coastal wetland complex near the headwaters of Caney Bayou, a low-gradient stream contained within the Perdido River watershed.

Significant Zoological Discoveries

- Nathan Whelan, a graduate student in biology at the University of Alabama rediscovered the oblong rocksnail (*Leptoxis compacta* (Anthony, 1854)) during a May 2011 gastropod survey of the Cahaba River. The oblong rocksnail, a Cahaba River endemic, had not been collected for >70 years and was formally declared extinct in 2000.

oblong rocksnail (*Leptoxis compacta*)

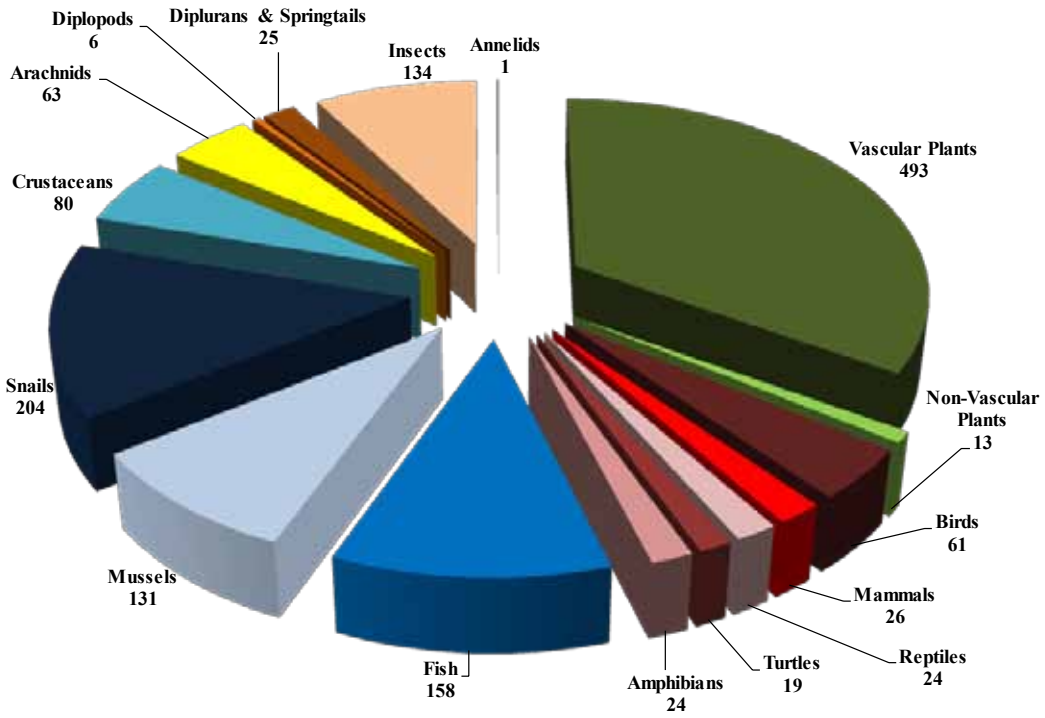


Figure 1. Number of rare plant and animal species track by ALNHP (total 1,453).

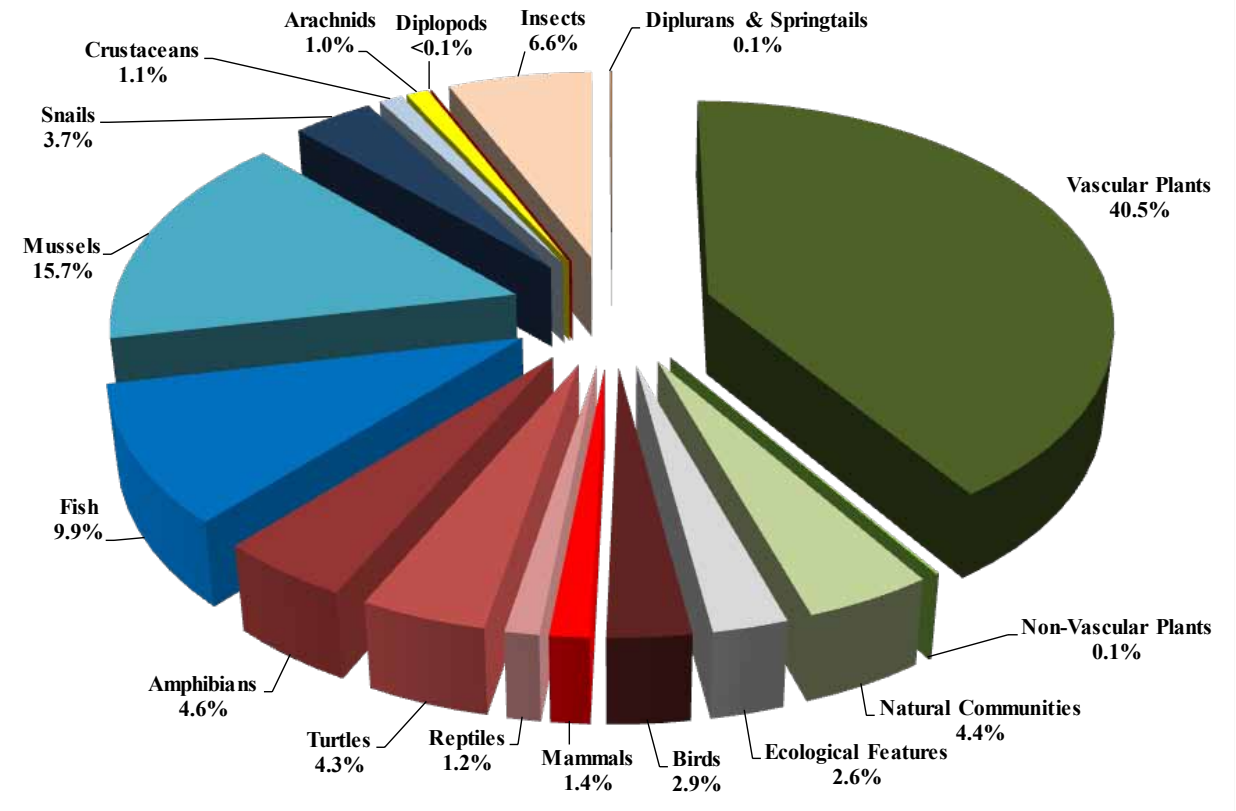


Figure 2. Percentage of 7,199 Element Occurrences in Biotics by major taxonomic group.

Information Systems & Technology

Biodiversity Database

ALNHP maintains a comprehensive database on the location and conservation status of species and ecological communities in Alabama. The Biotics database is supported by funding through our inventory and conservation planning projects. Although building and improving the database has always been a primary goal of the program, securing funding to support this important program area remains a challenge. ALNHP is currently tracking 1,453 rare plant and animal taxon (Fig. 1) + 90 natural communities. There are 7,199 individual occurrences of these species and natural communities documented in Biotics, with the majority of the Element Occurrences (EO) being for vascular plants or mussels (Fig. 2).

Following the conversion of our database to Biotics in March 2008, we have been working on improving our database compliance with the Benchmark Data Content Standards (BDCS) for natural heritage data. This past year's efforts focused on QC of federal and state status fields. We will continue working to improve the database with the goal of meeting all BDCS goals. The focus in the coming year will be redigitizing data imported from BCD to improve the spatial representation and improving EO Rank completeness and quality.

One of the important tasks each heritage program performs is the regular compilation of a Rare Species Inventory List for the state that ranks each element tracked by the program based on the number and quality of occurrences. Our revised Alabama Inventory List was published October 2012, with the list distributed to cooperators and other interested parties and posted to the ALNHP website.

Data Requests

Over the past year, ALNHP has responded to 22 paid data requests; 43 requests from academia, conservation non-profits, government agencies, NatureServe, other Heritage Network members, or cooperating partners; and 17 requests for an environmental review. The number of requests was similar to past years.

Publications

Published Articles:

Apodaca, Joseph J., Leslie J. Rissler, and James C. Godwin. 2012. Population structure and gene flow in a heavily disturbed habitat: implications for the management of the imperiled Red Hills salamander (*Phaeognathus hubricthti*). Conservation Genetics 13:913-923.

Unpublished Project Reports:

Barbour, Michael. 2012. Predictive distribution modeling and field surveys for upland snakes of conservation concern. Unpublished report submitted to the Alabama Department of Conservation and Natural Resources, Division of Wildlife and Freshwater Fisheries, Montgomery, Alabama. 19 pages.

Barbour, Michael. 2012. Wood Stork post-breeding survey. Unpublished report submitted to the Alabama Department of Conservation and Natural Resources, Division of Wildlife and Freshwater Fisheries, Montgomery, Alabama. 16 pages.

Barbour, Michael, Alfred Schotz, Tyler Jones, Luke Marzen, and Samuel Fowler. 2012. Inventory, classification, and assessment of Alabama's geographically isolated wetlands - 2012 annual report. Unpublished report submitted to U.S. Environmental Protection Agency, Atlanta, Georgia. Alabama Natural Heritage Program[SM], Auburn University Department of Geology and Geography, and Auburn University Water Resources Center; Auburn University, Alabama. 11 pages.

Godwin, James C., Jeffrey E. Lovich, Joshua R. Ennen, Brian R. Kreiser, Brian P. Folt, and Chris Lechowicz. 2013. Taxonomic assessment of map turtles (*Graptemys*) of the Choctawhatchee and Pea Rivers, Alabama and Florida. Unpublished report submitted to the Alabama Department of Conservation and Natural Resources, Division of Wildlife and Freshwater Fisheries, Montgomery, Alabama. 42 pages.

Godwin, James C., David A. Steen, Christopher J. W. McClure, and Michael Barbour. 2013. Informing management of endemic habitat specialists: multi-scale habitat selection of the Red Hills Salamander, *Phaeognathus hubrichti*. Unpublished report submitted to the Alabama Department of Conservation and Natural Resources, Division of Wildlife and Freshwater Fisheries, Montgomery, Alabama. 17 pages.

Godwin, James C., Gregory B. Pauly, Philip Spinks and H. Bradley Shaffer. 2013. Genetic analysis of the Alabama red-bellied turtle (*Pseudemys alabamensis*): estimation of population subdivision, among population gene flow, and species boundaries. Unpublished report submitted to the Alabama Department of Conservation and Natural Resources, Division of Wildlife and Freshwater Fisheries, Montgomery, Alabama. 21 pages.

Hastings, Robert W. 2012. Implementation of the Safe Harbor Plan for the endangered Red-cockaded Woodpecker in Alabama. Unpublished report submitted to the Alabama Department of Conservation and Natural Resources, Division of Wildlife and Freshwater Fisheries, Montgomery, Alabama. 9 pages.

Schotz, Alfred. 2012. Range-wide status assessment of *Calliphysalis carpenteri* (Riddell) M. Whitson (Solanaceae), the Carpenter's Ground-cherry. Unpublished report for the United States Fish and Wildlife Service. 90 pages, including 4 Appendices.