

## Swamp Rabbit Occupancy as an Indicator of Bottomland Hardwood Forest Ecosystem Health in Arkansas

It is widely recognized that swamp rabbits (*Sylvilagus aquaticus*) are poorly studied in comparison to other members of its genus. This is surprising because swamp rabbit populations are of conservation concern due to loss and alteration of bottomland hardwood forests and other forested wetland habitats for agricultural purposes. Because the species is of conservation concern across its distribution, has been referred to as an ecosystem indicator, it has been almost 10 years since its distribution was examined across eastern Arkansas, and the species may be affected by climate change, it is necessary to understand the occupancy patterns and the factors associated with occupancy at the landscape scale over time. The objectives of the proposed research are to 1) determine the occupancy of swamp rabbits in Arkansas, 2) determine the factors associated with occupancy, and 3) assess changes over time in occupancy since the last distributional study almost 10 years ago.

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Budget-Values given are estimated.

35%-65%	UAM			50%-50%	UAM		
	Match	SWG	Total		Match	SWG	Total
Salary and Fringe	44822	43328	88150		66486	32496	98982
Travel		33000	33000			33000	33000
Equipment/Supplies		2000	2000			2000	2000
Publication		1000	1000			1000	1000
Indirect Savings	19435		19435		19718		19718
Sub-total	64257	79328	143585		86204	68496	154700
Indirect		13882	13882			11987	11987
Total	64257	93210	157467		86204	80483	166687

**Need:** This project will address two priorities: the emerging issue of climate change and the woodlands and wetlands habitats. Wetlands and bottomland hardwood forests have decreased steadily since the 1960's with more than 2.5 million ha being lost from Arkansas and Louisiana during that time (Harris 1984). Swamp rabbits have been studied in Arkansas only twice in the last decade. One study examined the distribution of swamp rabbits in eastern Arkansas and the factors associated with that distribution (Fowler and Kissell 2007), and the other addressed the factors associated with male home ranges (Vale and Kissell 2010a). Populations of swamp rabbits have been observed to be static (Barbour et al. 2001, Scheibe and Henson 2003) or extirpated (Sole 1994, Roy Nielsen et al. 2007) over time depending upon location and local conditions.

Fowler and Kissell (2007) found between 76% and 85% of sites examined to be occupied each year by swamp rabbits and a strong correlation between occurrence and crossvine (*Bignonia capreolata*) existed. They provided a model predicting swamp rabbit presence based on crossvine density and percent ground cover that was correct 88.3% of the time. Their work is the only study to date of swamp rabbit distribution in state and a need exists to follow through with decadal surveys, similar to other states (Scheibe and Henson 2003), for the purpose of determining population and distributional changes.

Vale and Kissell (2010a) collected data that demonstrated the importance of different stand ages of bottomland hardwoods, the importance of interspersions of cover types, and the importance of season on resource selection. Vale and Kissell (2010b) found a greater mortality rate for swamp rabbits during prolonged periods of high temperatures during the summer and fall suggesting a temperature-related cause for differences in resource selection. Mean monthly high temperatures during summer have occurred more often since 1970 in Arkansas than since records began (<http://www.srh.noaa.gov/images/lzk/pdf/clilit.pdf>). Change in climate, specifically prolonged periods of heat, may affect swamp rabbits such that as temperatures remain high for prolonged periods rabbits may have a difficult time thermoregulating. The loss of the ability to thermoregulate in summer and fall may result in behaviors that increase the likelihood of being preyed upon.

Swamp rabbits are considered an indicator species (Scharine et al. 2009) useful for determining ecosystem health. Management actions taken for swamp rabbits likely benefit many other animals such that swamp rabbits may also be viewed as an umbrella species.

**Location:** The study will be conducted in eastern Arkansas on private and public lands within the Mississippi Alluvial Valley ecoregion. Land use is predominately agricultural, and major crops include rice, soybeans, wheat, and cotton. The majority of remaining forests in eastern Arkansas are bottomland hardwood forests except in the southeastern portion of the state. In southeastern Arkansas, land use is primarily private industrial forests dominated by *Pinus taeda* (loblolly pine), with some forests consisting of mixed pines and hardwoods.

**Objectives:** The objectives of the proposed research are to 1) determine the occupancy of swamp rabbits in Arkansas, 2) determine the factors associated with occupancy, and 3) assess changes over time in occupancy since the last distributional study almost 10 years ago.

**Approach:**

I will conduct pellet surveys using methods similar to Fowler and Kissell 2007. A sampling frame of sites will be established across the state where potential swamp rabbit habitat exists. A

sample will be drawn from the sampling frame to be visited during winter (November–April) 2012–2013 (year 1) and 2013–2014 (year 2). Sites will be visited three times per year so that occupancy modeling (MacKenzie et al. 2006) may be used. I will search sites on foot using 15 parallel-strip transects at each site. Strip transects will be 100 m in length, 5 m wide, and 50 m apart. Following procedures by McCollum and Holler (1994), I will place strip transects perpendicular to the main flow of a local watercourse to maximize the chance of detecting swamp rabbits. Transects will be placed at least 25 m from the water's edge. I will search logs, stumps, and the ground for swamp rabbit latrines.

I will collect habitat data along transects the same day pellet surveys are conducted using nested, circular plots (0.10 ha, 0.01 ha, and 0.001 ha) (Bowman et al. 1998). Grasses and forbs will be sampled within a 0.001-ha circular plot. Shrubs (< 2 m in height and < 7.5 cm dbh) and vines will be sampled within a 0.01-ha circular plot. I will use the point-quarter method to estimate tree density and composition (Brower and Zar 1984, Zollner et al. 2000). Within a 0.1-ha circular plot, I will record the number of downed logs and stumps ( $\geq 7.5$  cm in diameter). I will also record presence, depth, and percent cover of water. I will estimate angular canopy cover (%) at the center of each plot using a concave densiometer.

I will also integrate landscape scale information, in addition to site-specific habitat information, as factors for modeling occupancy. To estimate detection probability, I will conduct replicate pellet surveys in multiple plots within a site.

**Expected Results and Benefits:** I expect to find a loss of some populations and newly established populations compared to the survey conducted 10 years ago such that the overall population is stable. If sites are occupied in this study where swamp rabbits were found 10 years ago, it may be concluded that the increase in temperature is not having an impact on swamp rabbit occupancy. If swamp rabbits are not being found in sites occupied 10 years ago, the effect of increased temperatures may be a factor affecting the species and may be important relative to the health of bottomland hardwood ecosystems. A list of SGCN include, but is not limited to any mammals, ground nesting-birds, insects, invertebrates that occur adjacent to streams, fishes and amphibians that occur in small streams that occur in the Mississippi Alluvial Plain or West Gulf Plain ecoregions.

### Literature Cited

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Vale, K. B. and R. E. Kissell, Jr. 2010. Male Swamp Rabbit (*Sylvilagus aquaticus*) Habitat Selection at Multiple Scales. *Southeastern Naturalist* 9:547-562.

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**Budget**

	YR 1		YR 2		Total UAM	Total SWG	Total
	UAM	SWG	UAM	SWG			
PI	7162		7162		14324	0	14324
Fringe	2256		2256		4512	0	4512
Program Tech	10080		10080		20160	0	20160
Fringe	2913		2913		5826	0	5826
GRA		20000		20000	0	40000	40000
Fringe		1664		1664	0	3328	3328
Travel		15000		15000	0	30000	30000
Supplies		1000		1000	0	2000	2000
Meeting				3000	0	3000	3000
Publication				1000	0	1000	1000
Indirect Savings	9228		10208		19436	0	19436
Sub-total	31639	37664	32619	41664	64258	79328	143586
Indirect		6591		7291		13882	13882
Total	31639	44255	32619	48955	64258	93210	157468

**Dr. Robert E. Kissell, Jr.** is an Associate Professor in the School of Forest Resources at the University of Arkansas at Monticello. He has experience conducting distributional and resource selection studies on swamp rabbits in Arkansas. He has published four peer-reviewed papers on swamp rabbit ecology in Arkansas in the last 9 years. Those papers are:

Fowler, A. T. and R. E. Kissell, Jr. 2007. Distribution and Ecology of the Swamp Rabbit in the Mississippi Alluvial Plain of Arkansas. *Southeastern Naturalist* 6:247-258.

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