Small Mammal Occurrence and Utilization of a Cottonwood/Switchgrass Agroforest System in the Lower Mississippi Alluvial Valley

A study plan submitted in partial fulfillment

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Master of Science in Forest Resources

By

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ABSTRACT

Stimulated by incentive programs and government subsidies, biofuel production in the United States is currently being encouraged in an effort to reduce greenhouse gas emissions and to reduce reliance on foreign oil sources. Agroforest systems, especially those located on marginal-quality landscapes, demonstrate potential to be a viable land-use alternative to traditional biofuel production practices. Cottonwood/switchgrass agroforest systems could be a flexible and innovative cropping system for providing cellulosic feedstocks and ecosystem services. In this study, I investigated small mammal community characteristics, habitat use, and space use associated with compositional gradients of cottonwood/switchgrass agroforest systems established on marginal-quality agricultural land in the Lower Mississippi Alluvial Valley (LMAV).

I sampled small mammal communities using a 6x6 meter square trapping grid composed of Sherman live traps spaced 15 meters apart. Habitat use and space use were monitored using radiotelemetry. Selected hispid cotton rats (*Sigmodon hispidus*) were collared using Advanced Telemetry Systems zip-tie collars and relocated 30 times. Field work (trapping, telemetry, and vegetation sampling) was conducted once per season for 5 consecutive days in February 2011, April 2011, July 2011, and October 2011 (winter, spring, summer, and fall, respectively). During 10,800 trap nights, 560 captures of 289 individuals of 7 species were recorded. Home range size, analyzed using ArcMap 9.3.1, varied by sex, site, and season, with males typically having a larger home range than females. Although small mammal occurrence varied by site and season, of all vegetation types under investigation, switchgrass produced the greatest proportion of captures, with soybeans producing the smallest. When compared to row crops (soybeans) that have traditionally dominated these landscapes, agroforest systems produced more captures of individuals per 100 trap nights, supported greater species diversity, and provided more vegetation structure throughout the year.

Based on the findings of this study, agroforest systems are a viable land-use alternative to traditional biofuel production practices. The increased flora and fauna associated with agroforest systems, as compared to lands traditionally devoted to annual row cropping, contributes to a healthier ecosystem that can in turn be utilized as a renewable source of income for landowners. Documentation of agroforest benefits to small mammal communities on marginal-quality agricultural land in the LMAV further emphasizes the importance of environmentally conscience land management practices and provides a basis for future comparisons at various sites harboring varying flora and fauna.

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INTRODUCTION

Biofuels are non-petroleum based fuels derived from a variety of biological sources (Bies 2006). Biofuel production, fueled by incentive programs and government subsidies, is being encouraged in an effort to reduce greenhouse gas emissions from consumption of fossil fuels and to reduce dependence on foreign oil (Tenenbaum 2008). However, many current land-use practices are less than ideal. For example, they are complicating world hunger by dedicating viable agricultural land to the production of ethanol (Tenebaum 2008), reducing biodiversity and ecosystem health (Groom et al. 2008), and reducing carbon sequestration through deforestation (Fargione et al. 2008).

Biofuel feedstock production systems currently under consideration in the Lower Mississippi Alluvial Valley (LMAV) involve the planting and cropping of a single species. Intensive management associated with annually harvested crops (i.e. burning, disking, and herbicides) dramatically alters the habitat throughout the year. Although these cropping practices may provide substantial amounts of biofuel production, sustainability of these agronomic systems and their ability to provide a diversity of ecosystem services is questionable.

Unlike annually harvested crops, agroforest systems have the potential to maintain relatively stable habitat conditions over an extended period of time. Agroforestry, an integrated approach of using interactive benefits from combining trees and shrubs with crops and/or livestock, combines agricultural and forestry technologies to create more diverse, productive, profitable, healthy and sustainable land-use systems. Agroforest systems, especially those on marginal land, show potential to be a viable land-use alternative to traditional biofuel production practices (Dixon et al. 1994). The idea is that increasing landscape diversity by planting multiple species that harbor naturally occurring species beneath their canopies will increase overall biodiversity and the ecological stability of the surrounding ecosystem.

While the viability of using switchgrass (*Panicum virgatum*) (Gonzalez-Hernandez et al. 2009, Sanderson et al. 2006, Parrish and Fike 2005, Bouton 2007, McLaughlin and Kszos 2005) and cottonwood trees (*Populus deltoides*) (Sannigrahi and Ragauskas 2010, Christian et al. 1997, Bies 2006) independently as biofuel feedstocks has been studied, little, if any, research has been conducted on the effects of an integrated agroforest system combining the two species. Also, because of the economic nature of most biofuel studies, sound ecological data is severely lacking. Therefore, before all marginal agricultural land located within the LMAV is planted with cottonwood/switchgrass agroforests, the ecosystems services of these systems needs to be examined a bit more closely.

One approach to assessing these ecosystem services is by monitoring small mammal populations. Small mammals are prime candidates for study because of their highly invasive nature and impressive reproductive capacity. Small mammals are also considered indicator species of environmental quality and ecosystem health. Small mammals are ecologically important for a multitude of reasons and play a vital role in the enhancement and preservation of biological diversity. They serve as a primary prey base for many avian, reptilian, and mammalian predators (Carey and Johnson 1995). Many species consume detrimental insects (Carey and Johnson 1995). They also facilitate dispersal of fungal spores that form root-inhabiting ectomycorrhizae, which are required by many plants for nutrient procurement, water absorption, and protection from root pathogens (Maser et. al. 1978). In some circumstances, small mammals can impact the regeneration of plants through the consumption of seeds (Plucinski and Hunter 2001, Vander Wall et. al. 2001). A few species may also, through burrowing, influence hydrological processes (Laundre and Reynolds 1993).

Cottonwood/switchgrass agroforest systems could be a flexible and innovative cropping system for providing cellulosic feedstocks as well as ecosystem services. This project investigated habitat features, small mammal community characteristics and space use associated with compositional gradients of cottonwood/switchgrass agroforest systems established on marginal agricultural land in the LMAV.

STUDY OBJECTIVES

The goal of this study was to assess small mammal habitat utilization of different agroforest treatments at three sites along the Lower Mississippi Alluvial Valley (LMAV). Specifically, the objectives were to:

1. Compare small mammal community composition;
2. Assess home ranges of collared hispid cotton rats (*Sigmodon hispidus*); and
3. Compare habitat composition and structural characteristics among different agroforest treatments at three sites along the LMAV.

STUDY AREA

This project was conducted at 3 separate sites (Fig. 1). Each site, located on marginal agricultural land along the Lower Mississippi Alluvial Valley (LMAV) from Northeast Arkansas to Northeast Louisiana, while unique in geographic location and plot positioning, was comprised of similar agroforest treatments consisting of two-year old cottonwood trees, switchgrass, and row crop plots.

Along with 10 90 x 30 meter plots, each site contained 5 90 x 90 meter plots ("wildlife plots") on which small mammal trapping was conducted (Fig. 5). Due to the size of trapping grids, the 90 x 90 meter plots were the only plots large enough to meet the demands of trapping criteria. These 90 x 90 meter plots consisted of one of each of the following treatments: 1) 100% cottonwood plot, 2) 100% switchgrass plot, 3) 100% row crop plot, 4)67% cottonwood 33% switchgrass plot, and 5) 33% cottonwood 67% switchgrass plot.

While each site was intended to be a replicate of the others, vast latitudinal distances coupled with varied management timings and techniques resulted in apparent and statistical compositional differences across sites.

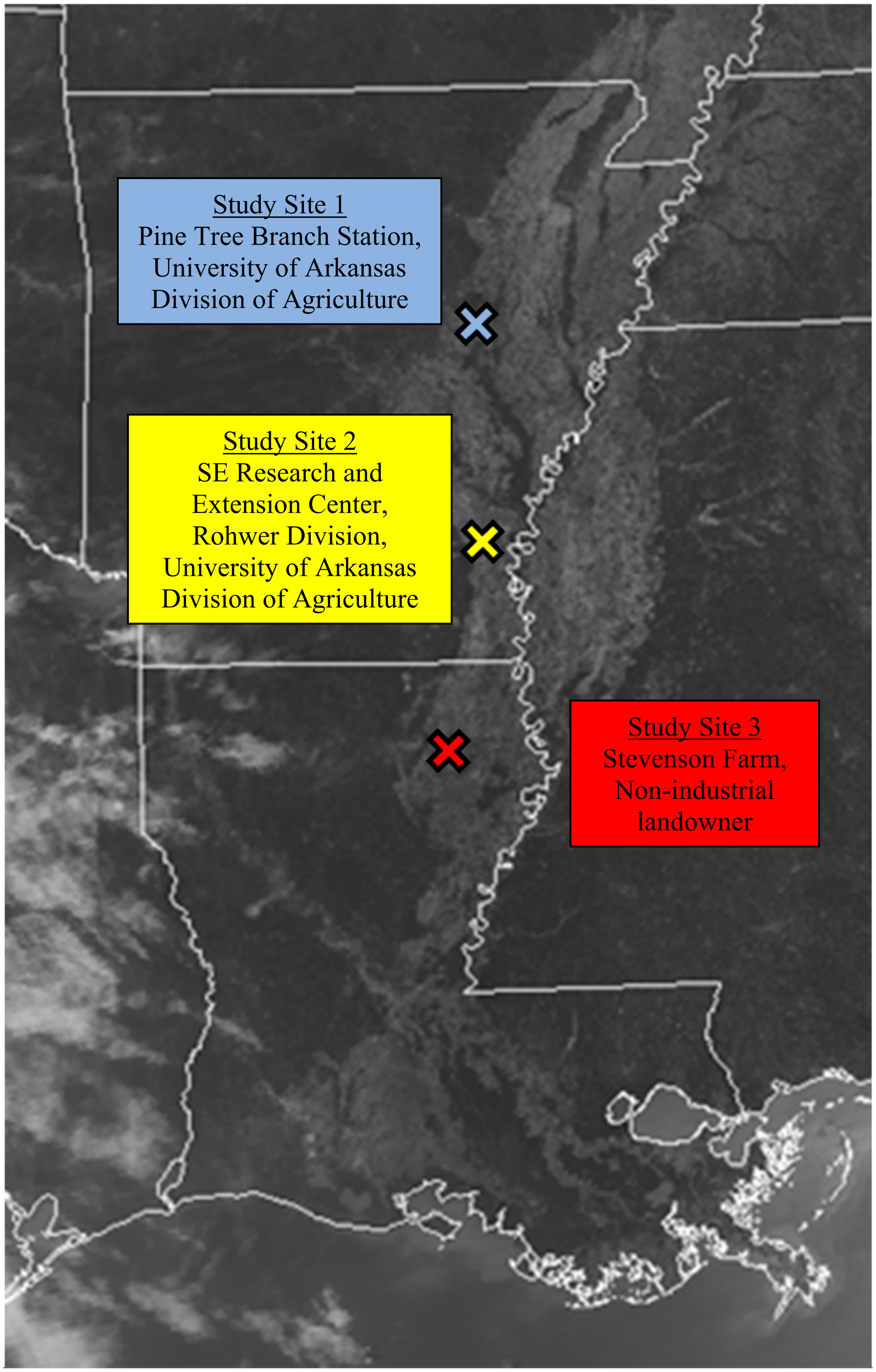

Figure 1. Study site locations.

Study Site 1 (Pine Tree)

The most northerly study site was located in St. Francis County, AR at the Pine Tree Branch Experiment Station, University of Arkansas Division of Agriculture (Fig 2). The station's mission revolves around providing farmers and landowners in East Arkansas with cutting-edge information regarding crop research, foundation seed production, timber research, and wildlife management. This station consists of approximately 4,856 ha, of which 3,238 ha is comprised of mostly hardwood timber and 1,417 ha is comprised of cropland or fallow land. Much of the station's resources are devoted to the production of soybeans, rice, and wheat. Wildlife plots are surrounded by crops (soybeans) to the east and south, fallow land to the north, and 90 x 30 meter agroforest plots to the west. Research plots were located roughly 1.5 miles north of Arkansas Highway 306 East, which positioned the site approximately 95 miles northeast of Little Rock, AR and approximately 60 miles west of Memphis, TN.

While switchgrass plots grew exceptionally well here, reaching over two meters in height in certain areas, plots containing cottonwood trees were among the poorest of any site, averaging two meters in height across the site. Growth of these trees seemed doomed from the beginning, because of invasions by insect pests and morning glory (*Ipomoea* sp.). In addition to these impeders, tree growth was also hindered by an accidental herbicide application via drift, resulting in significant mortality. Unlike those at the other two sites, plots containing cottonwood trees were dominated by horseweed (*Conyza canadensis*), increasing competition and further contributing to poor tree growth. Also unlike at the other two sites, the crop plot (soybeans) was separated from the other wildlife plots by a substantial distance and surrounded by acres of additional soybeans.

Although abundant rainfall resulted in the crop plot being planted later than at the other two sites, once established, the plot was densely stocked with productive plants.

Pine Tree

Figure 2. Arrangement of treatment plots at the Pine Tree Branch Experimental Station, St. Francis County, Arkansas, 2011.

Study Site 2 (Rohwer)

Study site 2, located in Desha County, AR, at the Southeast Research and Extension Center, Rohwer Division, University of Arkansas Division of Agriculture, was positioned south of study site one and north of study site three (Fig. 3). The station's mission revolves around providing farmers in Southeast Arkansas with problem-solving information, concentrating on irrigation and the establishment of a rotation or double-crop research program with early maturing soybeans. This station consists of approximately 336 ha, of which 81 ha are leased. Positioned in the heart of the Mississippi River Delta, this station is comprised almost entirely of cropland, of which most resources are devoted to production of soybeans, rice, cotton, corn, wheat, and grain sorghum. Wildlife plots are surrounded by crops (soybeans) to the west, fallow land to the south and east, and abandoned fish ponds to the north. Research plots were located roughly 1 mile west of Arkansas Highway 1 South, which positioned the site approximately 60 miles southeast of Pine Bluff, AR and approximately 40 miles northeast of Monticello, AR.

This site was compositionally unique in that switchgrass was never established. Instead, the plots intended to house switchgrass were dominated by signalgrass (*Urochloa platyphylla*). In contrast to the lack of switchgrass, the cottonwood trees were among the most impressive of any site, averaging 4 to 5 meters in height. Increased canopy cover resulted in decreased vegetative growth in the understory of plots containing cottonwood trees. The crop plot (soybeans) was the least densely stocked of all the sites and consisted of productive plants.

Figure 3. Arrangement of treatment plots at the (Rohwer) Southeast Research and Extension Center, Desha County, Arkansas, 2011.

Study Site 3 (Archibald):

The most southerly study site was located on private land at the Stevenson Farm in Richland Parish, LA (Fig. 4).As opposed to the other two sites that were planted on established cropland, this site was planted on land previously used for haying. Wildlife plots were surrounded by fallow land to the north, a stand of mixed hardwoods to the west, cropland (soybeans) to the east, and a maintained (mowed) field to the south. Research plots were located roughly 0.25 miles north of Louisiana Highway 856 East, which positioned the site approximately 25 miles southeast of Monroe, LA and approximately 65 miles west of Vicksburg, MS.

This site differed from the other two in that the wildlife plots and remaining 90 x 30 meter agroforest plots were not located in close proximity to one another. With the exception of S1, the 100% switchgrass plot, which lacked switchgrass in its northwest corner, switchgrass plots were fully stocked with 2-meter tall switchgrass. The plots containing cottonwood trees were characterized by moderate mortality as the result of prolonged inundation and, on average, trees 3 meters in height with abundant grass cover in the understory. The crop plot (soybeans) was intermediately stocked compared to the other two sites, consisting of healthy, productive plants.

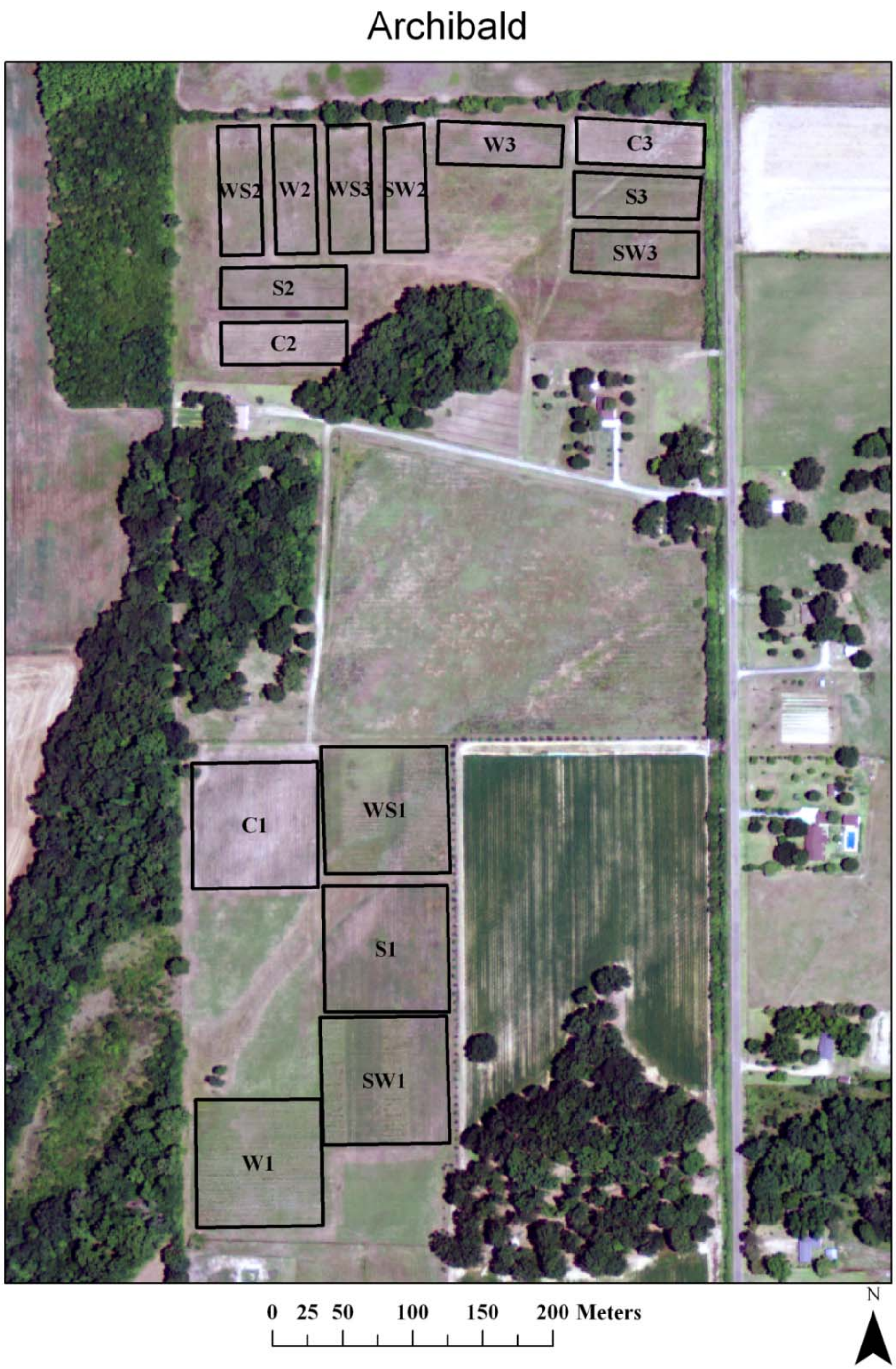

Figure 4. Arrangement of treatment plots at (Archibald) Stevenson Farms, Richland Parish, Louisiana, 2011.

Table 1. Explanation of coding system used to label treatment plots.

Code	What code represents
S1	Switchgrass only Rep. 1
S2	Switchgrass only Rep. 2
S3	Switchgrass only Rep. 3
C1	Control/Crop only Rep. 1
C2	Control/Crop only Rep. 2
C3	Control/Crop only Rep. 3
SW1	67% Switchgrass 33% Cottonwood Rep. 1
SW2	67% Switchgrass 33% Cottonwood Rep. 2
SW3	67% Switchgrass 33% Cottonwood Rep. 3
WS1	67% Cottonwood 33% Switchgrass Rep. 1
WS2	67% Cottonwood 33% Switchgrass Rep. 2
WS3	67% Cottonwood 33% Switchgrass Rep. 3
W1	Cottonwood only Rep. 1
W2	Cottonwood only Rep. 2
W3	Cottonwood only Rep. 3
C1, W1, S1, SW1, WS1	90 x 90 meter plots
All Others	30 x 90 meter plots

METHODS

Trapping:

Small mammals were captured using 33-cm collapsible and non-collapsible Sherman live traps (Sherman 1941). Each 90 x 90-meter agroforest treatment block (5 per site) was fitted with a 75 meter square trapping grid that was buffered 7.5 meters from the edges of each plot (Fig. 6). Each grid consisted of 36 traps spaced 15 meters apart, and covered 5,625 square meters in each block. Trapping sessions were conducted once per season (February, April, June-July, October-November) for 5 consecutive days, equaling 900 trap nights per season per site, yielding a total of 4 trapping sessions and 3,600 trap nights per year at each site. Each trap was baited with dry rolled oats and, in the cold winter months, supplied with a small piece of cotton to aid any captured animal in heat retention. Oats, as opposed to peanut butter, were used as bait in an effort to reduce mortality of trapped individuals by fire ant (*Solenopsis invicta*) (Dueser and Shugart 1978). Traps were checked each morning beginning at daybreak. In order to reduce mortality (heat or predation by fire ants) in the hot summer months, all traps were closed each morning and reset and re-baited the evening of the same day.

Several parameters were recorded for each captured individual. Each individual was identified to species, with the exception of *Peromyscus* spp. and *Reithrodontomys* spp. which were identified to genus, using defining body characteristics (i.e. pelage). Each individual was placed in a Ziploc bag and weighed to the nearest gram using a Pesola spring scale. Sex was determined based on urogenital distance and the presence/absence of gonads. Age class, either adult or juvenile, was determined based on weight (Sealander and Heidt 1990). Monel self-piercing metal ear tags were used to uniquely mark each captured individual. All individuals were released at the site of capture.

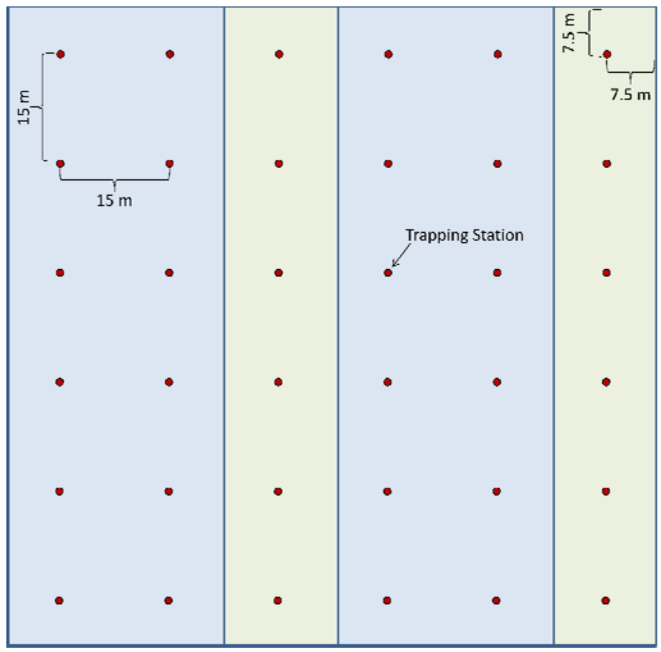

Figure 5. Small mammal trapping grid spacing and arrangement within 90 x 90 meter plots.

Statistical Analysis:

Each site was analyzed independently based on treatment and season. Shannon's diversity index (Shannon 1948), total number of individuals captured per 100 trap nights, sex/age distributions, and proportion of captures by habitat type were calculated for each treatment during each season at each site. Because sprung traps and incidental captures were minimal throughout the course of trapping, captures per 100 trap nights were simply calculated as total number of captures divided by the appropriate number of 100 trap nights. Proportions of captures by habitat type were calculated by dividing the number caught in each type of habitat (i.e. cottonwoods, switchgrass, or soybeans) by the total number of captures.

<u>Telemetry:</u>

In addition to ear tagging, adult hispid cotton rats were fitted with Advanced Telemetry Systems (ATS) Very High Frequency (VHF) zip-tie radio-collars. Halothane, an inhalation anesthetic, was used to sedate rats selected for collar fitting. A cotton ball saturated with Halothane was placed in the Ziploc bag with the rat and sealed. Careful measures were taken to ensure the cotton ball was not located in close proximity to the rat's mouth to prevent overexposure of the drug and, consequently, drug-induced mortality. Rats were then carefully monitored. Once the drug had achieved the desired level of sedation, the rat was removed from the Ziploc bag and fitted with a radio-collar. After the collar was secured, the rat was released at the capture site and monitored until the effects of the anesthesia had subsided. Collars were secured in a fashion so as to ensure retention while not restricting normal respiratory functions or daily activities. Collar models 1520 and 1560 were used. Collar model 1520 weighed 2.9 grams and had a maximum battery life of 164 days. Collar model 1560 weighed 1.4 grams and had a maximum battery life of 34 days.

Radio-collared individuals were re-located using a Yagi antenna and an ATS model R410 receiver. Homing techniques were utilized to determine the location of each rat (Prosser et al. 2004). When using the homing technique, after the approximate location of an individual had been determined, that location was approached either until a sighting was obtained or it was obvious the rat had moved from its original location. Ideally, each rat would have been located a minimum of 30 times (Seaman et al. 1999), but several rats, especially those at Rohwer, were located less than 30 times. Location intervals were ≥ 4 hours in an effort to prevent autocorrelation (Swihart and Slade 1985; Bowne et al. 1999).

Compilation and analyses of locations were conducted using a geographic information system (ArcMap 9.3.1, 1999-2009). Locations were plotted on a digital landcover classification map and analyzed using the Hawth's Tools Extension in ArcGIS (Rodgers et al. 2005). Home ranges were calculated using the fixed kernel estimation method for each collared individual at each site. Due to extremely variable home range sizes between sexes and sites, single parameter smoothing factors were calculated on an individual basis, with a constant 1x1 m raster cell size, 50% and 95% percent volume contours, and a bivariate normal kernel used for each calculation. Small sample sizes prevented statistical comparisons.

Animal Care:

Capture, handling, tagging, collaring, and release were in compliance with the American Society of Mammalogist guidelines (Sikes et al. 2011) and the University of Arkansas at Monticello Institutional Animal Care and Use Committee regulations (#200601).

Habitat:

Habitat sampling was conducted in each 90 x 90 meter wildlife plot at 9 of the 36 small mammal trapping stations, with plots distributed proportionally throughout combination plots (Fig. 7). Several parameters were recorded at each habitat assessment location. A 2 x 2 meter quadrat with a nested 1 x 1 meter quadrat, centered on the trap location, was utilized to quantify vegetation structure and composition. Within each 2 x 2 meter quadrat, percent ground cover of vegetation was ocularly estimated for bare ground, litter (dead vegetation lying horizontally on the ground), graminoids, herbaceous vegetation, soybeans, stubble (both switchgrass and soybean), trees, vines, and shrubs. Ocular estimations were based on the Daubenmire (1959) scale (0%, 0-5%, 6-25%, 26-50%, 51-75%, 76-95%, and 96-100%). Canopy coverage (standing at plot center using a spherical densitometer), vertical structure height (using a meter stick), and vertical structure density (estimated from 10 meters perpendicular to plot center while staying in the same habitat type as the trap using a 0.5 x 0.5 meter density board at 0.25 m, 1.25m, and 2.25m) were also measured at each sampling location. Canopy coverage was calculated as an average of four readings taken in each cardinal direction, vertical structure height was an average of all vertically growing living vegetation, and vertical structure density was estimated on a scale from 0% (completely visible board) to 100% (completely hidden board). Within each 1 x 1 meter quadrat, plants were identified to species and ocularly estimated for ground coverage according to the Daubenmire (1959) scale.

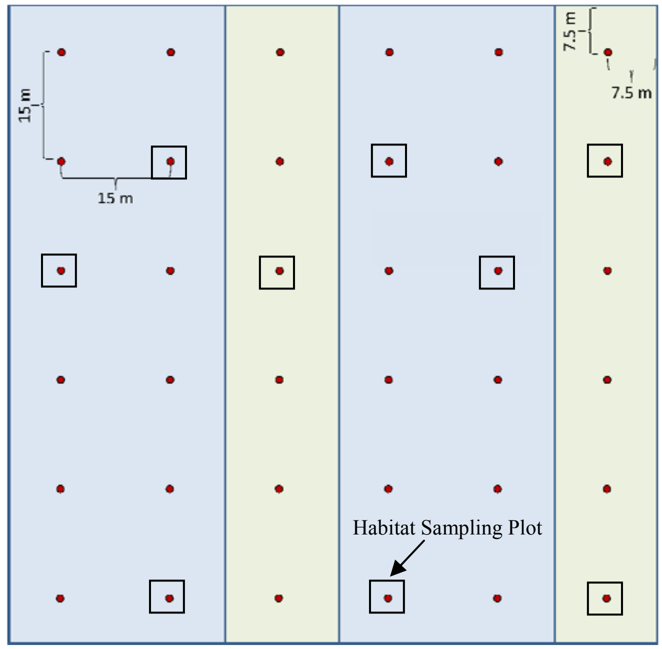

Figure 6. Location of habitat assessment plots within small mammal trapping grid.

Statistical Analysis:

Each site was summarized by average quantitative habitat parameter characteristics by season and treatment. All 2 x 2 habitat variables were tested for normality (SAS Institute Inc., 2002-2008) by looking at the skewness and kurtosis of each variable. Based on the results of the normality tests, most habitat variables proved to be non-parametric. Study sites were then compared (SAS Institute Inc., 2002-2008) ($p \leq 0.05$) using a Kruskal-Wallis test on all 2 x 2 habitat variables. Most variables were significantly different, forcing independent analysis of each study site. For this reason, explorations of microhabitat relationships of small mammals through capture and non-capture site comparisons were performed at each site independently. Capture and non-capture sites were compared (SAS Institute Inc., 2002-2008) ($p \leq .10$) using a Wilcoxon (Mann-Whitney) Rank Sum test on all 2 x 2 habitat variables. Pearson correlations were performed (SAS Institute Inc., 2002-2008) ($P \geq 0.6$) on all statistically significant variables to increase interpretability. Small sample sizes prevented comparisons between season, treatment, and species. Therefore, comparisons are interpretable only to the "small mammal" level.

RESULTS

<u>Trapping:</u>

Pine Tree

During 3,600 trap nights, I recorded 152 captures of 55 individuals. I captured individuals of five species, including hispid cotton rat (27.3% of individuals captured), *Peromyscus* spp. (60.0%), house mouse (*Mus musculus*) (3.6%), *Reithrodontomys* spp. (1.8%), and marsh rice rat (*Oryzomys palustris*) (7.3%) (Table 2).Of all vegetation types under investigation, for all species and seasons, switchgrass produced the greatest proportion of captures (0.55) and soybeans the least (0.09) (Fig. 8). Although small sample sizes prevented meaningful comparisons, number of individuals captured per 100 trap nights and species diversity differed numerically both between treatments and between seasons.

During winter, W1 and SW1 produced the greatest number of individuals captured per 100 trap nights (2.22) and C1 the least (0.56); species diversity was non-existent among all treatments (Table A1). Of all vegetation types under investigation, for all species and seasons, switchgrass produced the highest proportion of captures (0.52) and soybeans the least (0.02) (Fig. A1).

During spring, S1 produced the greatest number of individuals captured per 100 trap nights (2.22), with W1, WS1, and C1 producing the least (1.11); WS1 supported the greatest species diversity (0.69), while W1, S1, and C1 supported the least (0) (Table A2). Of all vegetation types under investigation, for all species and seasons, cottonwoods produced the highest proportion of captures (0.46) and soybeans the least (0.15) (Fig. A2).

During summer, S1 produced the greatest number of individuals captured per 100 trap nights (6.11) and W1 the least (0); SW1 supported the greatest species diversity (0.69),with all remaining treatments equaling (0) (Table A3). Of all vegetation types under investigation, for all species and seasons, switchgrass produced the greatest proportion of captures (0.91) and cottonwoods the least (0) (Fig. A3).

During fall, WS1 produced the greatest number of individuals captured per 100 trap nights (2.22) and W1 the least (0); WS1 and SW1 supported the greatest species diversity (0.69), with all remaining treatments equaling (0) (Table A4). Of all vegetation types under investigation, for all species and seasons, cottonwoods produced the greatest proportion of captures (0.56) and soybeans the least (0.06) (Fig. A4).

Table 2. Small mammal community characteristics by treatment for all seasons combined at the Pine Tree Branch Experimental Station, St. Francis County, Arkansas, 2011.

	Treatment					
Species	**(W1)**	**(S1)**	**(WS1)**	**(SW1)**	**(C1)**	**Total**
Sigmodon hispidus	0	11	1	3	0	15
Peromyscus spp.	6	9	6	8	4	33
Mus musculus	0	0	1	0	1	2
Reithrodontomys spp.	0	0	0	1	0	1
Oryzomys palustris	0	0	2	2	0	4
Microtus pinetorum	0	0	0	0	0	0
Cryptotis parva	0	0	0	0	0	0
Total	**6**	**20**	**10**	**14**	**5**	**55**
Number of ind./100 TNs	0.83	2.92	1.39	1.81	0.69	1.53
Shannon Index	0.00	0.69	1.09	1.12	0.50	1.04

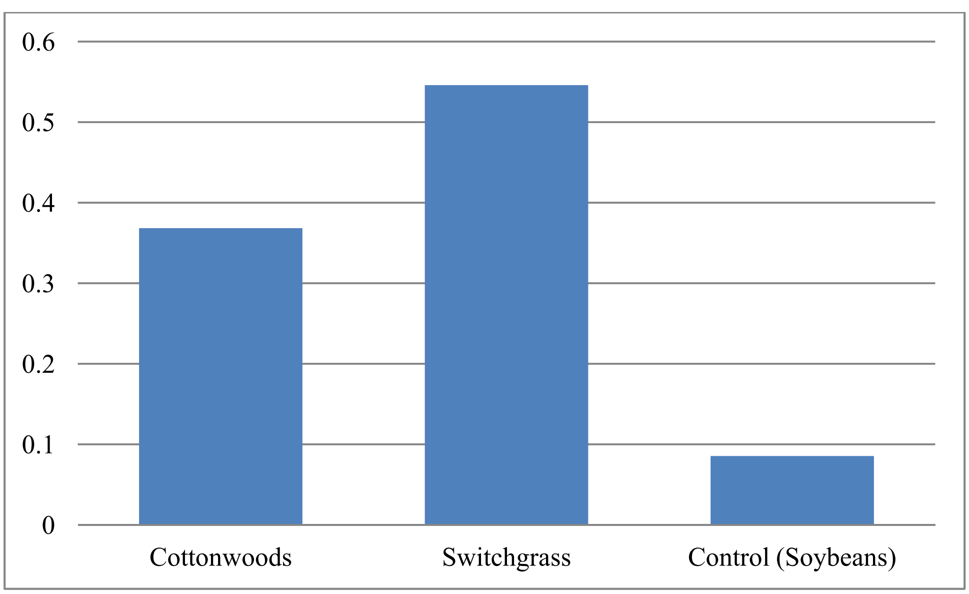

Figure 7. Proportion of captures by habitat type for all species, seasons, and treatments combined at the Pine Tree Branch Experimental Station, St. Francis County, Arkansas, 2011.

Rohwer

During 3,600 trap nights, I recorded 309 captures of 183 individuals. I captured individuals of five species, including hispid cotton rat (13.7% of individuals captured), house mouse (62.8%), *Reithrodontomys* spp. (1.6%), marsh rice rat (20.8%), and least shrew (*Cryptotis parva*) (1.1%) (Table 3).Of all vegetation types under investigation, for all species and seasons, cottonwoods produced the highest proportion of captures (0.61) and soybeans the least (0.17) (Fig. 9). Although small samples sizes prevented statistical comparisons, number of individuals captured per 100 trap nights and species diversity differed numerically both between treatments and between seasons.

During winter, S1 produced the greatest number of individuals captured per 100 trap nights (9.44) and SW1 the least (3.33); W1 supported the greatest species diversity (0.99) and S1 the least (0) (Table A5). Of all vegetation types under investigation, for all species and seasons, cottonwoods produced the greatest proportion of captures (0.44) and swichgrass the smallest (0.26) (Fig. A5).

During spring, W1 produced the greatest number of individuals captured per 100 trap nights (3.89) and C1 the least (0); WS1 supported the greatest species diversity (0.69),with all remaining treatments equaling (0) (Table A6). Of all vegetation types under investigation, for all species and seasons, cottonwoods produced the greatest proportion of captures (0.75) and soybeans the smallest (0.02) (Fig. A6).

During summer, C1 produced the greatest number of individuals captured per 100 trap nights (2.22), with S1 and WS1 producing the least (1.11); W1 supported the greatest species diversity (0.64), with all remaining treatments equaling (0) (Table A7). Of all vegetation types under investigation, for all species and seasons, switchgrass produced the greatest proportion of captures (0.41), while soybeans and cottonwoods produced the smallest (0.29) (Fig. A7).

During fall, W1 produced the greatest number of individuals captured per 100 trap nights (21.67) and S1 the least (3.33); W1 supported the greatest species diversity (0.96), while S1 and C1 supported the least (0) (Table A8). Of all vegetation types under investigation, for all species and seasons, cottonwoods produced the greatest proportion of captures (0.74) and soybeans the smallest (0.10) (Fig. A8).

Table 3. Small mammal community characteristics by treatment for all seasons combined at the (Rohwer) Southeast Research and Extension Center, Desha County, Arkansas, 2011.

	Treatment					
Species	**(W1)**	**(S1)**	**(WS1)**	**(SW1)**	**(C1)**	**Total**
Sigmodon hispidus	22	0	1	2	0	25
Peromyscus spp.	0	0	0	0	0	0
Mus musculus	15	25	25	24	26	115
Reithrodontomys spp.	3	0	0	0	0	3
Oryzomys palustris	15	6	10	6	1	38
Microtus pinetorum	0	0	0	0	0	0
Cryptotis parva	2	0	0	0	0	2
Total	**57**	**31**	**36**	**32**	**27**	**183**
Number of ind./100 TNs	7.92	4.31	5.00	4.44	3.75	5.08
Shannon Index	1.34	0.49	0.71	0.70	0.16	1.01

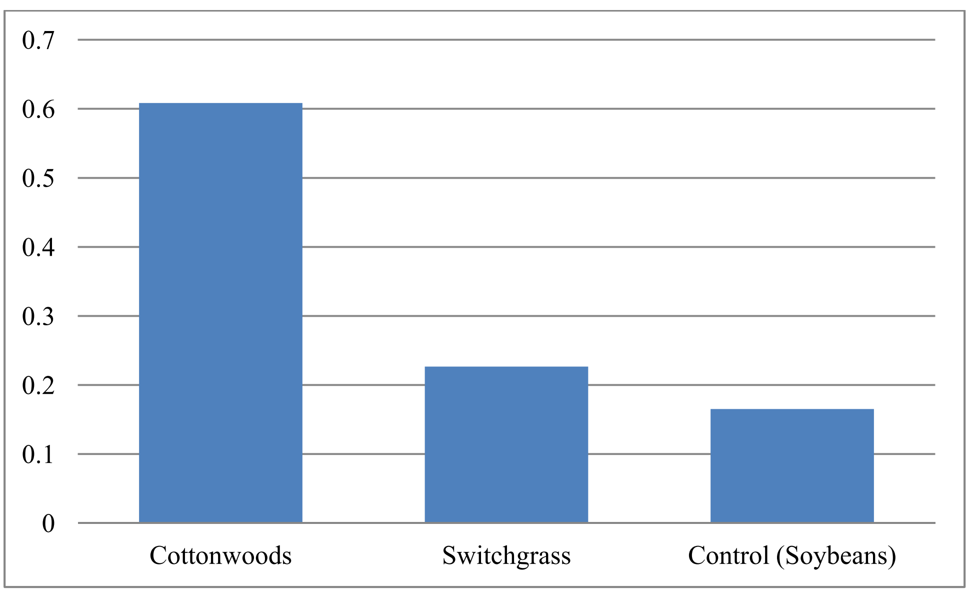

Figure 8. Proportion of captures by habitat type for all species, seasons, and treatments combined at the (Rohwer) Southeast Research and Extension Center, Desha County, Arkansas, 2011.

Archibald

During 3,600 trap nights, I recorded 99 captures of 51 individuals. I captured individuals of four species, including the hispid cotton rat (27.4% of individuals captured), *Peromyscus* spp. (3.9%), house mouse (56.9%), and woodland vole (*Microtus pinetorum*) (11.8%) (Table 4). Of all vegetation types under investigation, for all species and seasons, switchgrass produced the greatest proportion of captures (0.74) and soybeans the smallest (0.12) (Fig.10). Although small samples sizes prevented statistical comparisons, number of individuals captured per 100 trap nights and species diversity differed numerically both between treatments and between seasons.

During winter, WS1 produced the greatest number of individuals captured per 100 trap nights (4.44), with all remaining treatments equaling (1.67); WS1 also supported the greatest species diversity (1.39), while W1, S1, and C1 supported the least (0) (Table A9).Of all vegetation types under investigation, for all species and seasons, switchgrass produced the greatest proportion of captures (0.52) and soybeans the smallest (0.13) (Fig. A9).

During spring, S1 produced the greatest number of individuals captured per 100 trap nights (5.00), with W1 and C1 producing the smallest (0.56); S1 also supported the greatest species diversity (0.64), while W1, SW1, and C1 supported the smallest (0) (Table A10).Of all vegetation types under investigation, for all species and seasons, switchgrass produced the greatest proportion of captures (0.94) and cottonwoods the smallest (0.02) (Fig. A10).

During summer, C1 produced the greatest number of individuals captured per 100 trap nights (2.22) and WS1 the smallest (0); species diversity was non-existent among all treatments (Table A11). Of all vegetation types under investigation, for all species and seasons, switchgrass and soybeans produced the greatest proportion of captures (0.43) and cottonwoods the smallest (0.14) (Fig.A11).

During fall, SW1 produced the greatest number of individuals captured per 100 trap nights (1.11), with all remaining treatments equaling (0); species diversity was non-existent among all treatments (Table A12). Of all vegetation types under investigation, for all species and seasons, switchgrass produced all captures (Fig. A12).

Table 4. Small mammal community characteristics by treatment for all seasons combined at (Archibald) Stevenson Farms, Richland Parish, Louisiana, 2011.

	Treatment					
Species	**(W1)**	**(S1)**	**(WS1)**	**(SW1)**	**(C1)**	**Total**
Sigmodon hispidus	0	3	6	5	0	14
Peromyscus spp.	0	0	2	0	0	2
Mus musculus	3	11	3	4	8	29
Reithrodontomys spp.	0	0	0	0	0	0
Oryzomys palustris	0	0	0	0	0	0
Microtus pinetorum	2	0	2	2	0	6
Cryptotis parva	0	0	0	0	0	0
Total	**5**	**14**	**13**	**11**	**8**	**51**
Number of ind./100 TNs	0.69	1.94	1.81	1.53	1.11	1.42
Shannon Index	0.67	0.52	1.27	1.04	0.00	1.05

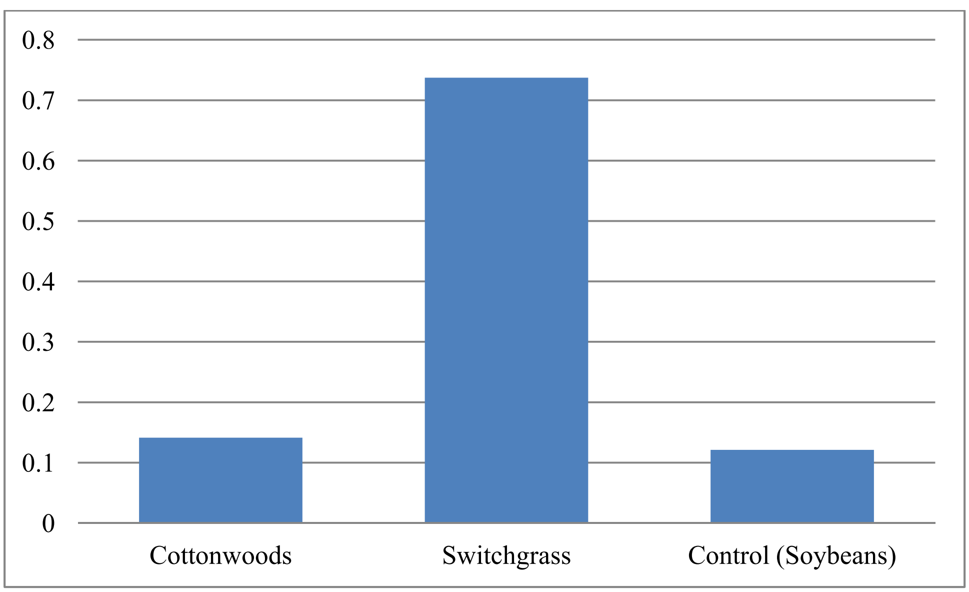

Figure 9. Proportion of captures by habitat type for all species, seasons, and treatments combined at (Archibald) Stevenson Farms, Richland Parish, Louisiana, 2011.

Telemetry:

During 10,800 trap nights, across all sites and seasons, I successfully collared 30 adult hispid cotton rats. Of these, 9 (6 males and 3 females) were collared at the Pine Tree study site, 9 (2 males and 7 females) at the Rohwer study site, and 12 (5 males and 7 females) at the Archibald study site. On average, males had a larger home range than females, 3.52 ha and 0.64 ha, respectively, with average home range for both sexes combined being 2.01 ha (Table 5). As a result, the average smoothing factor used to obtain results also varied between males and females, 30 and 14, respectively, with the average smoothing factor for both sexes combined being 22. Although small sample sizes prevented meaningful comparisons, obvious numerical differences in home range sizes existed between collared males and collared females.

Pine Tree

A total of 9 adult hispid cotton rats were collared during the summer trapping season. Of these, 6 were males and 3 were females. Collared individuals were distributed across 3 treatments, with 1 being collared in WS1, 2 in SW1, and 6 in S1. However, due to collar-malfunction (1 individual) and unexplained disappearance (1 individual) a sufficient number of locations were only obtainable for 7 individuals. On average, males had a larger home range than females, 5.86 ha and 1.39 ha, respectively, with average home range for both sexes combined being 4.58 ha (Table 5). As a result, the average smoothing factor used to obtain results also varied between males and females, 44 and 20, respectively, with the average smoothing factor for both sexes combined being 37.

The first individual (.194) was a 220-gram female collared in S1. Her 50% (core) and 95% home range sizes were 0.44 ha and 1.84 ha, respectively (Fig. A13). A smoothing factor of 25 was used to summarize her 29 locations.

The second individual (.846) was a 95-gram female collared in WS1. Her 50% (core) and 95% home range sizes were 0.20 ha and 0.93 ha, respectively (Fig. A14). A smoothing factor of 14 was used to summarize her 30 locations.

The third individual (.233) was a 130-gram male collared in S1. His 50% (core) and 95% home range sizes were 1.17 ha and 4.44 ha, respectively (Fig. A15). A smoothing factor of 32 was used to summarize his 28 locations.

The fourth individual (.946) was a 110-gram male collared in SW1. His 50% (core) and 95% home range sizes were 1.52 ha and 7.60 ha, respectively (Fig. A16). A smoothing factor of 52 was used to summarize his 30 locations.

The fifth individual (.207) was a 90-gram male collared in S1. His 50% (core) and 95% home range sizes were 1.22 ha and 5.32 ha, respectively (Fig. A17). A smoothing factor of 50 was used to summarize his 30 locations.

The sixth individual (.182) was a 110-gram male collared in S1. His 50% (core) and 95% home range sizes were 1.44 ha and 6.20 ha, respectively (Fig. A18). A smoothing factor of 45 was used to summarize his 30 locations.

The seventh individual (.884) was a 170-gram male collared in S1. His 50% (core) and 95% home range sizes were 1.31 ha and 5.73 ha, respectively (Fig. A19). A smoothing factor of 40 was used to summarize his 30 locations.

Rohwer

A total of 9 adult hispid cotton rats were collared during the fall trapping season. Of these, 2 were males and 7 were females. Collared individuals were distributed between 2 treatments, with 1 being collared in WS1 and 8 in W1. However, due to collar-induced mortality (2 individuals), unexplained disappearance (1 individual), and logistical complications, a sufficient number of locations were only obtainable for 6 individuals. On average, males had a larger home range than females, 0.75 ha and 0.61 ha, respectively, with average home range for both sexes combined being 0.66 ha (Table 5). Unlike the other two sites, the average smoothing factor used to obtain results was higher for females than for males, 15 and 12, respectively, with the average smoothing factor for both sexes combined being 14.

The first individual (.307) was a 70-gram female collared in W1. Her 50% (core) and 95% home range sizes were 0.04 ha and 0.23 ha, respectively (Fig. A20). A smoothing factor of 10 was used to summarize her 22 locations.

The second individual (.007) was a 120-gram female collared in W1. Her 50% (core) and 95% home range sizes were 0.04 ha and 0.26 ha, respectively (Fig. A21). A smoothing factor of 13 was used to summarize her 22 locations.

The third individual (.170) was a 97-gram female collared in W1. Her 50% (core) and 95% home range sizes were 0.09 ha and 0.65 ha, respectively (Fig. A22). A smoothing factor of 16 was used to summarize her 23 locations.

The fourth individual (.834) was a 101-gram female collared in W1. Her 50% (core) and 95% home range sizes were 0.27 ha and 1.31 ha, respectively (Fig. A23). A smoothing factor of 20 was used to summarize her 23 locations.

The fifth individual (.131) was a 154-gram male collared in W1. His 50% (core) and 95% home range sizes were 0.18 ha and 0.84 ha, respectively (Fig. A24). A smoothing factor of 15 was used to summarize his 22 locations.

The sixth individual (.144) was a 74-gram male collared in W1. His 50% (core) and 95% home range sizes were 0.15 ha and 0.67 ha, respectively (Fig. A25). A smoothing factor of 9 was used to summarize his 23 locations.

Archibald

A total of 12 adult hispid cotton rats were collared during the spring trapping season. Of these, 5 were males and 7 were females. Collared individuals were distributed across 3 treatments, with 5 being collared in WS1, 4 in SW1, and 3 in S1. However, due to collar-induced mortality (2 individuals), snake predation (1 individual), and unexplained disappearance (1 individual) a sufficient number of locations was only obtainable for 8 individuals. On average, males had a larger home range than females, 1.47 ha and 0.36 ha, respectively, with the average home range for both sexes combined being 0.78 ha (Table 5). As a result, the average smoothing factor used to obtain results also varied between males and females, 20 and 11, respectively, with average smoothing factor for both sexes combined being 14.

The first individual (.671) was a 95-gram female collared in S1. Her 50% (core) and 95% home range sizes were 0.08 ha and 0.39 ha, respectively (Fig. A26). A smoothing factor of 11 was used to summarize her 29 locations.

The second individual (.708) was a 165-gram female collared in SW1. Her 50% (core) and 95% home range sizes were 0.04 ha and 0.19 ha, respectively (Fig. A27). A smoothing factor of 8 was used to summarize her 30 locations.

The third individual (.345) was a 110-gram female collared in S1. Her 50% (core) and 95% home range sizes were 0.09 ha and 0.33 ha, respectively (Fig. A28). A smoothing factor of 10 was used to summarize her 30 locations.

The fourth individual (.932) was a 135-gram female collared in WS1. Her 50% (core) and 95% home range sizes were 0.09 ha and 0.42 ha, respectively (Fig. A29). A smoothing factor of 12 was used to summarize her 30 locations.

The fifth individual (.996) was a 121-gram female collared in WS1. Her 50% (core) and 95% home range sizes were 0.10 ha and 0.48 ha, respectively (Fig. A30). A smoothing factor of 14 was used to summarize her 30 locations.

The sixth individual (.982) was a 130-gram male collared in WS1. His 50% (core) and 95% home range sizes were 0.35 ha and 1.53 ha, respectively (Fig. A31). A smoothing factor of 17 was used to summarize his 30 locations.

The seventh individual (.807) was a 145-gram male collared in SW1. His 50% (core) and 95% home range sizes were 0.28 ha and 1.67 ha, respectively (Fig. A32). A smoothing factor of 20 was used to summarize his 29 locations.

The eighth individual (.758) was a 104-gram male collared in SW1. His 50% (core) and 95% home range sizes were 0.15 ha and 1.22 ha, respectively (Fig. A33). A smoothing factor of 22 was used to summarize his 30 locations.

Table 5. Home range results analyzed in ArcMap 9.3.1 using the fixed kernel estimation method.

	Sex	Number of Individuals		Smoothing Factor	50% Range (ha)	95% Range (ha)
Archibald (Spring)	Female	5	Average (Std. Dev.)	11 (2)	0.08 (0.03)	0.36 (0.11)
	Male	3	Average (Std. Dev.)	20 (3)	0.26 (0.10)	1.47 (0.23)
	Total	8	Average (Std. Dev.)	14 (5)	0.15 (0.11)	0.78 (0.60)
Pine Tree (Summer)	Female	2	Average (Std. Dev.)	20 (8)	0.32 (0.17)	1.39 (0.64)
	Male	5	Average (Std. Dev.)	44 (8)	1.33 (0.15)	5.86 (1.17)
	Total	7	Average (Std. Dev.)	37 (14)	1.04 (0.51)	4.58 (2.40)
Rohwer (Fall)	Female	4	Average (Std. Dev.)	15 (4)	0.11 (0.11)	0.61 (0.50)
	Male	2	Average (Std. Dev.)	12 (4)	0.16 (0.02)	0.75 (0.12)
	Total	6	Average (Std. Dev.)	14 (4)	0.13 (0.09)	0.66 (0.40)
Females (All Sites)		11	Average (Std. Dev.)	14 (5)	0.14 (0.12)	0.64 (0.52)
Males (All Sites)		10	Average (Std. Dev.)	30 (6)	0.78 (0.60)	3.52 (2.60)
Both Sexes (All Sites)		21	Average (Std. Dev.)	22 (14)	0.44 (0.52)	2.01 (2.31)

Habitat:

Pine Tree

In general, across all seasons and treatments, Pine Tree was characterized by bare ground (34.2%) with adequate litter (27.8%) and live graminoids (23.5%), with tall-growing herbaceous vegetation (20.6%) that yielded exceptional cover (44.5%) up to 0.25m (Table 5). Percent cover of bare ground, live graminoid, live tree, vertical structure density at to 0.25, 1.25, and 2.25m, canopy cover, and height of vegetation tended to increase from winter to summer, and then begin decreasing by the fall sampling period (Table 6). Litter and live vine coverage peaked in fall, dead graminoids and shrubs in winter, dead trees in spring, and herbaceous vegetation in summer (Table 5). Soybeans were planted late as the result of unseasonably wet conditions, therefore, they were only present during the fall sampling period (Table 6).Throughout the course of the year, C1 was characterized by bare ground, S1 by live graminoids, W1 by herbaceous vegetation, SW1 by bare ground and live graminoids, and WS1 by bare ground and herbaceous vegetation, with C1 having substantially less vertical vegetation structure at 0.25m compared to all other treatments (Table 7).

All 2 x 2 habitat variables were tested for normality by looking at the skewness and kurtosis of each variable. Based on results of the normality tests (deviations from 0), most habitat variables proved to be non-parametric (Table 8). Study sites were then compared using a Kruskal-Wallis test on all 2 x 2 habitat variables. Of all variables considered, only soybeans, dead vines, shrubs, and vertical structure density at 1.25m were not statistically different across sites (Table 9).

Capture and non-capture sites, when compared across all seasons and treatments, for all species combined, differed in regards to percent cover of live graminoids, dead trees, and live vines (Table 10). On average, captures sites were associated with 8.5% more live graminoids, 1.0% more dead trees, and 1.3% less live vines (Table 11).

Table 6. Percent values of habitat characteristics summarized by season for all treatments combined at the Pine Tree Branch Experimental Station, St. Francis County, Arkansas, 2011.

Variable		**Winter**	**Spring**	**Summer**	**Fall**	**Total**
Bare Ground	Average (Std. Dev.)	36.6 (22.8)	34.1 (23.8)	39.3 (32.3)	27.1 (23.4)	34.2 (26.1)
Litter	Average (Std. Dev.)	35.9 (23.9)	21.8 (19.7)	15.6 (15.8)	38.1 (27.5)	27.8 (23.9)
Live Graminoid	Average (Std. Dev.)	3.5 (4.4)	31.6 (36.9)	37.5 (46.7)	21.2 (27.0)	23.5 (34.9)
Dead Graminoid	Average (Std. Dev.)	27.5 (27.4)	2.0 (6.7)	0	0	7.4 (18.2)
Herbaceous	Average (Std. Dev.)	6.6 (9.8)	13.0 (18.6)	32.6 (37.9)	30.3 (37.2)	20.6 (30.4)
Soybeans	Average (Std. Dev.)	0	0	0	14.5 (30.3)	3.6 (16.3)
SB Stubb	Average (Std. Dev.)	0	0	0	0	0
SG Stubb	Average (Std. Dev.)	0	0	0	0	0
Live Tree	Average (Std. Dev.)	8.2 (13.6)	5.4 (11.6)	9.2 (17.9)	7.7 (15.0)	7.6 (14.7)
Dead Tree	Average (Std. Dev.)	0	1.5 (4.5)	0	0	0.4 (2.3)
Live Vine	Average (Std. Dev.)	0	0.1 (0.5)	2.2 (4.4)	2.8 (6.9)	1.3 (4.3)
Dead Vine	Average (Std. Dev.)	0	0	0	0	0
Shrub	Average (Std. Dev.)	5.5 (11.3)	0	0	0	1.4 (6.1)
0.25m Density	Average (Std. Dev.)	9.0 (11.9)	29.0 (24.4)	74.8 (39.8)	65.2 (37.7)	44.5 (40.4)
1.25m Density	Average (Std. Dev.)	0.4 (2.1)	10.8 (21.2)	66.1 (43.0)	22.4 (37.6)	24.9 (39.3)
2.25m Density	Average (Std. Dev.)	0	0.3 (1.7)	13.8 (28.6)	7.1 (21.6)	5.3 (18.7)
Canopy Cover	Average (Std. Dev.)	0	0.3 (1.3)	5.2 (16.8)	1.2 (4.5)	1.7 (8.9)
VgHt (cm)	Average (Std. Dev.)	4.2 (4.6)	11.1 (7.6)	73.2 (69.8)	42.4 (40.8)	32.7 (48.8)
WdyHt (m)	Average (Std. Dev.)	0.5 (0.6)	0.3 (0.6)	0.5 (0.8)	0.5 (0.8)	0.5 (0.7)

Table 7. Percent values of habitat characteristics summarized by treatment for all seasons combined at the Pine Tree Branch Experimental Station, St. Francis County, Arkansas, 2011.

Variable		**C1**	**S1**	**W1**	**SW1**	**WS1**
Bare Ground	Average (Std. Dev.)	62.2 (29.9)	24.7 (18.3)	19.9 (14.4)	35.2 (18.7)	29.2 (23.4)
Litter	Average (Std. Dev.)	32.3 (28.3)	32.8 (27.5)	24.3 (14.8)	24.9 (24.3)	24.8 (22.1)
Live Graminoid	Average (Std. Dev.)	2.3 (4.2)	52.3 (36.7)	1.4 (1.3)	36.2 (38.6)	25.1 (37.4)
Dead Graminoid	Average (Std. Dev.)	1.3 (3.6)	10.4 (21.1)	8.7 (20.5)	9.5 (20.6)	7.0 (18.4)
Herbaceous	Average (Std. Dev.)	3.4 (5.6)	5.5 (11.0)	42.8 (34.2)	18.7 (30.2)	32.7 (36.1)
Soybeans	Average (Std. Dev.)	18.2 (33.0)	0	0	0	0
SB Stubb	Average (Std. Dev.)	0	0	0	0	0
SG Stubb	Average (Std. Dev.)	0	0	0	0	0
Live Tree	Average (Std. Dev.)	0	0	26.4 (17.8)	2.7 (5.8)	9.1 (15.5)
Dead Tree	Average (Std. Dev.)	0	0	0	1.3 (4.3)	0.6 (2.6)
Live Vine	Average (Std. Dev.)	2.6 (7.5)	0	2.1 (4.3)	0.3 (0.8)	1.4 (3.6)
Dead Vine	Average (Std. Dev.)	0	0	0	0	0
Shrub	Average (Std. Dev.)	0	0	2.6 (7.4)	0.5 (2.6)	3.7 (10.8)
0.25m Density	Average (Std. Dev.)	27.9 (40.5)	45.8 (38.2)	54.6 (43.0)	44.4 (38.8)	49.7 (38.7)
1.25m Density	Average (Std. Dev.)	0	24.3 (42.9)	51.1 (40.9)	21.7 (38.7)	27.6 (39.1)
2.25m Density	Average (Std. Dev.)	0	0	21.0 (32.4)	2.1 (12.5)	3.5 (15.9)
Canopy Cover	Average (Std. Dev.)	0	0	8.4 (18.6)	0	0 (0.2)
VgHt (cm)	Average (Std. Dev.)	4.9 (5.6)	49.0 (65.6)	31.7 (36.4)	40.1 (53.9)	38.1 (49.8)
WdyHt (m)	Average (Std. Dev.)	0	0	1.5 (0.7)	0.3 (0.5)	0.5 (0.7)

Table 8. Normality test results for all 2x2 habitat variables combined across all seasons and treatments.

Variable		Pine Tree	Rohwer	Archibald
Bare Ground	Skewness Kurtosis	1.0 0.2	0.8 -0.2	1.9 4.0
Litter	Skewness Kurtosis	1.0 0	0.1 -1.3	1.1 0.1
Live Graminoid	Skewness Kurtosis	1.2 -0.1	1.1 -0.1	0.3 -1.5
Dead Graminoid	Skewness Kurtosis	2.7 6.8	1.8 1.8	1.6 1.2
Herbaceous	Skewness Kurtosis	1.4 0.4	3.3 15.8	2.3 4.7
Soybeans	Skewness Kurtosis	4.4 18.5	4.2 15.5	4.9 23.5
SB Stubb	Skewness Kurtosis	0	4.2 15.5	4.1 15.5
SG Stubb	Skewness Kurtosis	0	0	3.5 12.2
Live Tree	Skewness Kurtosis	2.2 4.5	1.2 0.1	2.4 5.8
Dead Tree	Skewness Kurtosis	6.4 39.5	0	0
Live Vine	Skewness Kurtosis	5.3 34.8	5.0 28.6	3.9 13.5
Dead Vine	Skewness Kurtosis	0	13.0 170.9	0
Shrub	Skewness Kurtosis	5.2 27.6	7.9 66.9	5.9 39.2
0.25m Density	Skewness Kurtosis	0.4 -1.6	0.6 -1.0	0 -1.5
1.25m Density	Skewness Kurtosis	1.1 -0.5	1.2 -0.3	1.8 1.6
2.25m Density	Skewness Kurtosis	3.7 12.5	1.2 -0.2	2.7 6.3
Canopy Cover	Skewness Kurtosis	7.0 56.5	1.5 0.7	3.8 15.4
VgHt (cm)	Skewness Kurtosis	1.8 2.1	1.3 1.9	2.2 4.2
WdyHt (m)	Skewness Kurtosis	1.4 0.8	0.7 -1.4	1.5 1.4

Table 9. Kruskal-Wallis test results comparing all 2x2 habitat variables across sites for all seasons and treatments combined.

Variable	**P-Value**
Bare Ground	< .0001
Litter	0.0016
Live Graminoid	< .0001
Dead Graminoid	0.0059
Herbaceous	< .0001
Soybeans	0.9955
SB Stubb	0.0096
SG Stubb	< .0001
Live Tree	0.0109
Dead Tree	0.0008
Live Vine	< .0001
Dead Vine	0.1348
Shrub	0.7475
0.25m Density	0.0001
1.25m Density	0.3907
2.25m Density	< .0001
Canopy Cover	< .0001
VgHt (cm)	0.0003
WdyHt (m)	0.0013

Table 10. Percent values of habitat characteristics for all species, seasons, and treatments combined at the Pine Tree Branch Experimental Station, St. Francis County, Arkansas, 2011.

Variable		**Capture**	**Non-Capture**	**P-Value**
Bare Ground	Average (Std. Dev.)	32.2 (21.2)	34.6 (26.9)	0.9984
Litter	Average (Std. Dev.)	22.5 (19.6)	28.8 (24.6)	0.3131
Live Graminoid	Average (Std. Dev.)	30.6 (37.8)	22.1 (34.4)	0.0199
Dead Graminoid	Average (Std. Dev.)	6.8 (17.6)	7.5 (18.4)	0.998
Herbaceous	Average (Std. Dev.)	22.0 (29.1)	20.4 (30.7)	0.1618
Soybeans	Average (Std. Dev.)	0	4.3 (17.7)	0.1896
SB Stubb	Average (Std. Dev.)	0	0	1
SG Stubb	Average (Std. Dev.)	0	0	1
Live Tree	Average (Std. Dev.)	6.5 (12.4)	7.9 (15.1)	0.9923
Dead Tree	Average (Std. Dev.)	1.2 (4.1)	0.2 (1.8)	0.043
Live Vine	Average (Std. Dev.)	0.2 (0.7)	1.5 (4.6)	0.0692
Dead Vine	Average (Std. Dev.)	0	0	1
Shrub	Average (Std. Dev.)	3.8 (10.5)	0.9 (4.8)	0.2288
0.25m Density	Average (Std. Dev.)	45.9 (39.8)	44.2 (40.7)	0.6387
1.25m Density	Average (Std. Dev.)	27.1 (40.7)	24.5 (39.2)	0.6165
2.25m Density	Average (Std. Dev.)	0.5 (2.1)	6.2 (20.2)	0.3697
Canopy Cover	Average (Std. Dev.)	0.1 (0.5)	2.0 (9.7)	0.9161
VgHt (cm)	Average (Std. Dev.)	43.9 (61.0)	30.7 (46.2)	0.4416
WdyHt (m)	Average (Std. Dev.)	0.4 (0.6)	0.5 (0.8)	0.8513

Table 11. Percent values of statistically different habitat characteristics comparing capture and non-capture locations for all species, seasons, and treatments combined at the Pine Tree Branch Experimental Station, St. Francis County, Arkansas, 2011.

Variable		Capture	Non-Capture	P-Value
Live Graminoid	Average (Std. Dev.)	30.6 (37.8)	22.1 (34.4)	0.0199
Dead Tree	Average (Std. Dev.)	1.2 (4.1)	0.2 (1.8)	0.0430
Live Vine	Average (Std. Dev.)	0.2 (0.7)	1.5 (4.6)	0.0692

Rohwer

In general, across all seasons and treatments, Rohwer was characterized by abundant bare ground (36.1%) and litter (39.3%) with a fair amount of live graminoids (19.1%) and live trees (16.0) that yielded adequate cover (39.1%) up to 0.25m (Table 12). Percent cover of live trees and vertical structure density at 0.25m tended to increase from winter to summer, and then begin decreasing by the fall sampling period (Table 12). Litter and herbaceous vegetation coverage peaked in fall, bare ground and dead graminoid in spring, and live graminoid, live tree, live vine, and vertical structure density at 0.25m in summer (Table 12). Soybeans were planted as per routine, therefore, they were only present during the summer sampling period (Table 12).Throughout the course of the year, C1 and S1 were characterized by bare ground, W1 by litter, SW1 by bare ground and litter, and WS1 by litter, with W1 having substantially more vertical vegetation structure at 0.25m compared to all other treatments (Table 13).

All 2 x 2 habitat variables were tested for normality by looking at the skewness and kurtosis of each variable. Based on results of the normality tests (deviations from 0), most habitat variables proved to be non-parametric (Table 8). Study sites were then compared using a Kruskal-Wallis test on all 2 x 2 habitat variables. Of all variables considered, only soybeans, dead vines, shrubs, and vertical structure density at 1.25m were not statistically different across sites (Table 9).

Capture and non-capture sites, when compared across all seasons and treatments, for all species combined, differed in regards to percent cover of dead vines and vertical structure densities at 0.25, 1.25, and 2.25m (Table 14). On average, capture sites were associated with 0.5% more dead vines, 7.7% more vertical structure density at 0.25m, 7.5% more vertical structure density at 1.25m, and 8.9% more vertical structure density at 2.25m (Table 15).

Table 12. Percent values of habitat characteristics summarized by season for all treatments combined at the (Rohwer) SE Research and Extension Center, Desha County, Arkansas, 2011.

Variable		**Winter**	**Spring**	**Summer**	**Fall**	**Total**
Bare Ground	Average (Std. Dev.)	46.5 (22.0)	50.5 (28.9)	30.3 (21.1)	16.9 (13.1)	36.1 (25.6)
Litter	Average (Std. Dev.)	31.5 (29.8)	15.9 (20.7)	42.9 (19.8)	67.1 (22.1)	39.3 (29.8)
Live Graminoid	Average (Std. Dev.)	22.9 (28.3)	3.1 (7.2)	32.9 (27.3)	17.4 (21.8)	19.1 (25.0)
Dead Graminoid	Average (Std. Dev.)	9.2 (12.7)	25.9 (30.8)	0	10.5 (16.9)	11.4 (20.7)
Herbaceous	Average (Std. Dev.)	3.0 (5.1)	8.8 (13.9)	7.2 (8.3)	9.0 (14.6)	7.0 (11.4)
Soybeans	Average (Std. Dev.)	0	0	7.6 (15.4)	0	1.9 (8.3)
SB Stubb	Average (Std. Dev.)	0	0	0	3.1 (6.3)	0.7 (3.4)
SG Stubb	Average (Std. Dev.)	0	0	0	0	0
Live Tree	Average (Std. Dev.)	11.9 (16.7)	14.4 (23.0)	21.5 (30.0)	16.1 (22.3)	16.0 (23.5)
Dead Tree	Average (Std. Dev.)	0	0	0	0	0
Live Vine	Average (Std. Dev.)	0	1.3 (6.1)	6.0 (13.4)	1.7 (3.2)	2.3 (7.8)
Dead Vine	Average (Std. Dev.)	0.4 (2.3)	0	0	0	0.1 (1.2)
Shrub	Average (Std. Dev.)	1.2 (3.3)	0.1 (0.4)	0	0	0.3 (1.7)
0.25m Density	Average (Std. Dev.)	18.7 (14.6)	27.7 (33.4)	69.1 (25.1)	40.9 (28.8)	39.1 (32.4)
1.25m Density	Average (Std. Dev.)	3.8 (5.2)	32.8 (42.1)	29.2 (39.2)	25.2 (35.1)	22.8 (35.4)
2.25m Density	Average (Std. Dev.)	1.6 (3.7)	31.2 (40.8)	29.2 (39.4)	24.8 (33.9)	21.7 (34.9)
Canopy Cover	Average (Std. Dev.)	0	8.5 (12.0)	25.2 (32.8)	25.9 (33.3)	14.9 (26.4)
VgHt (cm)	Average (Std. Dev.)	5.1 (4.0)	12.1 (16.1)	23.8 (15.0)	29.8 (20.9)	17.7 (18.0)
WdyHt (m)	Average (Std. Dev.)	1.2 (1.6)	1.0 (1.5)	1.5 (1.9)	1.6 (2.1)	1.3 (1.8)

Table 13. Percent values of habitat characteristics summarized by treatment for all seasons combined at the (Rohwer) SE Research and Extension Center, Desha County, Arkansas, 2011.

Variable		**C1**	**S1**	**W1**	**SW1**	**WS1**
Bare Ground	Average (Std. Dev.)	52.8 (34.4)	35.4 (18.0)	27.1 (22.7)	32.8 (22.6)	32.1 (20.6)
Litter	Average (Std. Dev.)	40.2 (36.1)	29.8 (30.2)	50.4 (20.9)	36.1 (31.6)	40.3 (25.6)
Live Graminoid	Average (Std. Dev.)	1.7 (1.2)	28.3 (29.2)	23.9 (28.1)	23.7 (27.5)	17.7 (18.9)
Dead Graminoid	Average (Std. Dev.)	3.5 (6.5)	20.3 (26.4)	5.1 (12.8)	19.2 (26.6)	9.1 (18.4)
Herbaceous	Average (Std. Dev.)	3.6 (5.0)	2.0 (3.5)	11.9 (17.6)	6.8 (10.0)	10.8 (11.7)
Soybeans	Average (Std. Dev.)	9.5 (16.7)	0	0	0	0
SB Stubb	Average (Std. Dev.)	3.9 (6.8)	0	0	0	0
SG Stubb	Average (Std. Dev.)	0	0	0	0	0
Live Tree	Average (Std. Dev.)	0	0	36.9 (21.4)	15.6 (23.9)	27.4 (26.3)
Dead Tree	Average (Std. Dev.)	0	0	0	0	0
Live Vine	Average (Std. Dev.)	0	1.9 (4.3)	5.0 (11.0)	0.2 (0.7)	4.2 (12.3)
Dead Vine	Average (Std. Dev.)	0	0	0.5 (2.6)	0	0
Shrub	Average (Std. Dev.)	0	0	1.1 (3.6)	0.2 (0.7)	0.3 (0.8)
0.25m Density	Average (Std. Dev.)	29.0 (41.8)	23.8 (18.8)	65.6 (26.3)	31.4 (23.5)	45.7 (29.2)
1.25m Density	Average (Std. Dev.)	0	0	55.4 (34.9)	17.9 (33.0)	40.4 (39.9)
2.25m Density	Average (Std. Dev.)	0	0	56.1 (37.8)	16.3 (30.6)	36.1 (37.9)
Canopy Cover	Average (Std. Dev.)	0	0	34.1 (28.1)	13.3 (26.2)	27.0 (33.1)
VgHt (cm)	Average (Std. Dev.)	4.8 (2.3)	16.0 (14.6)	25.3 (20.3)	21.6 (22.1)	20.9 (16.6)
WdyHt (m)	Average (Std. Dev.)	0	0	3.1 (1.3)	1.3 (1.9)	2.2 (1.9)

Table 14. Percent values of habitat characteristics for all species, seasons, and treatments combined at the (Rohwer) SE Research and Extension Center, Desha County, Arkansas, 2011.

Variable		**Capture**	**Non-Capture**	**P-Value**
Bare Ground	Average (Std. Dev.)	34.3 (22.3)	36.6 (26.6)	0.8732
Litter	Average (Std. Dev.)	39.0 (27.8)	39.4 (30.5)	0.9734
Live Graminoid	Average (Std. Dev.)	16.9 (22.7)	19.7 (25.7)	0.5393
Dead Graminoid	Average (Std. Dev.)	12.0 (18.4)	11.3 (21.4)	0.166
Herbaceous	Average (Std. Dev.)	10.2 (13.7)	6.1 (10.5)	0.2043
Soybeans	Average (Std. Dev.)	1.9 (8.4)	1.9 (8.3)	1
SB Stubb	Average (Std. Dev.)	0	1.0 (3.8)	0.1026
SG Stubb	Average (Std. Dev.)	0	0	1
Live Tree	Average (Std. Dev.)	17.4 (22.2)	15.6 (24.0)	0.412
Dead Tree	Average (Std. Dev.)	0	0	1
Live Vine	Average (Std. Dev.)	2.0 (6.8)	2.3 (8.1)	0.4574
Dead Vine	Average (Std. Dev.)	0.5 (2.5)	0	0.0087
Shrub	Average (Std. Dev.)	0.6 (2.5)	0.3 (1.4)	0.4327
0.25m Density	Average (Std. Dev.)	45.1 (32.0)	37.4 (32.4)	0.0817
1.25m Density	Average (Std. Dev.)	28.6 (37.6)	21.1 (34.5)	0.0737
2.25m Density	Average (Std. Dev.)	28.6 (38.9)	19.7 (33.5)	0.0897
Canopy Cover	Average (Std. Dev.)	13.4 (23.7)	15.3 (27.2)	0.5196
VgHt (cm)	Average (Std. Dev.)	18.6 (18.4)	17.5 (17.9)	0.7107
WdyHt (m)	Average (Std. Dev.)	1.6 (1.8)	1.3 (1.8)	0.4347

Table 15. Percent values of statistically different habitat characteristics comparing capture and non-capture locations for all species, seasons, and treatments combined at the (Rohwer) Southeast Research and Extension Center, Desha County, Arkansas, 2011.

Variable		Capture	Non-Capture	P-Value
Dead Vine	Average (Std. Dev.)	0.5 (2.5)	0	0.0087
0.25m Density	Average (Std. Dev.)	45.1 (32.0)	37.4 (32.4)	0.0817
1.25m Density	Average (Std. Dev.)	28.6 (37.6)	21.1 (34.5)	0.0737
2.25m Density	Average (Std. Dev.)	28.6 (38.9)	19.7 (33.5)	0.0897

Archibald

In general, across all seasons and treatments, Archibald was characterized by an abundance of live graminoids (40.2%) with adequate litter (28.3%) yielding substantial cover (54.5%) up to 0.25m (Table 16). Percent cover of bare ground, live graminoid, live tree, live vine, vertical structure densities at 0.25, 1.25, and 2.25m, canopy cover, and height of vegetation tended to increase from winter to summer, and then begin decreasing by the fall sampling period (Table 16). Litter coverage peaked in fall, dead graminoids and shrubs in winter, and herbaceous vegetation in spring (Table 16). Soybeans were planted as per routine, therefore, they were only present during the summer sampling period (Table 16). Throughout the course of the year, C1 was characterized by herbaceous vegetation, S1 and SW1 by litter and live graminoids, and W1 and WS1 by live graminoids, with C1 having substantially less vertical vegetation structure at 0.25m compared to all other treatments (Table 17).

All 2 x 2 habitat variables were tested for normality by looking at the skewness and kurtosis of each variable. Based on the results of the normality tests (deviations from 0), most habitat variables proved to be non-parametric (Table 8). Study sites were then compared using a Kruskal-Wallis test on all 2 x 2 habitat variables. Of all variables considered, only soybeans, dead vines, shrubs, and vertical structure density at 1.25m were not statistically different across sites (Table 9).

Capture and non-capture sites, when compared across all seasons and treatments, for all species combined, differed with regard to percent cover of bare ground, live graminoids, dead graminoids, canopy cover, and vertical structure density at 0.25 and 2.25m (Table 18). Of these, live graminoids and vertical structure at 0.25m were correlated. On average, capture sites were associated with 1.0% more bare ground, 20.6% more live graminoids, 7.1% less dead graminoids, 4.7% less canopy cover, 18.9% more vertical structure density at 0.25m, and 7.9% less vertical structure density at 2.25m (Table 19).

Table 16. Percent values of habitat characteristics summarized by season for all treatments combined at (Archibald) Stevenson Farms, Richland Parish, Louisiana, 2011.

Variable		Winter	Spring	Summer	Fall	Total
Bare Ground	Average (Std. Dev.)	2.7 (4.2)	4.9 (7.4)	7.1 (7.0)	2.5 (4.7)	4.3 (6.2)
Litter	Average (Std. Dev.)	27.4 (30.9)	16.6 (13.3)	24.1 (17.4)	44.9 (33.5)	28.3 (27.1)
Live Graminoid	Average (Std. Dev.)	16.3 (27.2)	54.9 (31.5)	58.2 (35.3)	31.4 (32.9)	40.2 (36.0)
Dead Graminoid	Average (Std. Dev.)	49.2 (42.8)	8.6 (18.2)	13.6 (19.9)	5.6 (10.7)	19.3 (31.1)
Herbaceous	Average (Std. Dev.)	16.7 (27.3)	19.9 (23.2)	6.9 (13.5)	13.0 (21.0)	14.1 (22.2)
Soybeans	Average (Std. Dev.)	0	0	12.4 (27.5)	0	3.1 (14.7)
SB Stubb	Average (Std. Dev.)	0	0	0	0.5 (1.0)	0.1 (0.5)
SG Stubb	Average (Std. Dev.)	0	0	0	17.2 (24.9)	4.3 (14.4)
Live Tree	Average (Std. Dev.)	4.1 (6.6)	6.5 (13.3)	9.1 (17.1)	6.2 (12.9)	6.5 (13.0)
Dead Tree	Average (Std. Dev.)	0	0	0	0	0
Live Vine	Average (Std. Dev.)	0	0.2 (0.6)	0.3 (0.9)	0.1 (0.4)	0.1 (0.6)
Dead Vine	Average (Std. Dev.)	0	0	0	0	0
Shrub	Average (Std. Dev.)	1.9 (6.4)	1.5 (6.4)	0.7 (3.2)	0	1.1 (4.8)
0.25m Density	Average (Std. Dev.)	25.4 (20.1)	60.9 (36.0)	83.4 (22.9)	48.1 (32.8)	54.5 (35.4)
1.25m Density	Average (Std. Dev.)	0.1 (0.7)	10.3 (19.9)	56.1 (44.5)	2.3 (4.6)	17.2 (33.3)
2.25m Density	Average (Std. Dev.)	0	9.8 (19.7)	23.4 (36.3)	3.2 (6.8)	9.1 (22.6)
Canopy Cover	Average (Std. Dev.)	0	2.6 (11.0)	7.6 (18.6)	6.6 (12.9)	4.2 (12.8)
VgHt (cm)	Average (Std. Dev.)	11.3 (5.4)	29.6 (18.7)	73.0 (68.2)	26.1 (26.9)	35.0 (44.1)
WdyHt (m)	Average (Std. Dev.)	0.6 (0.9)	0.4 (0.9)	0.6 (1.1)	0.7 (1.3)	0.6 (1.0)

Table 17.Percent values of habitat characteristics summarized by treatment for all seasons combined at (Archibald) Stevenson Farms, Richland Parish, Louisiana, 2011.

Variable		**C1**	**S1**	**W1**	**SW1**	**WS1**
Bare Ground	Average (Std. Dev.)	7.1 (6.9)	4.9 (5.8)	0.9 (2.7)	6.3 (8.1)	2.4 (4.2)
Litter	Average (Std. Dev.)	18.4 (19.0)	44.1 (31.7)	14.9 (12.0)	41.1 (29.9)	22.8 (25.0)
Live Graminoid	Average (Std. Dev.)	19.2 (24.3)	42.2 (40.4)	53.3 (29.6)	42.3 (37.3)	43.9 (38.7)
Dead Graminoid	Average (Std. Dev.)	9.0 (18.8)	8.7 (23.2)	31.3 (35.9)	17.2 (30.5)	30.1 (36.5)
Herbaceous	Average (Std. Dev.)	25.3 (29.5)	17.0 (23.3)	9.2 (17.9)	9.3 (16.0)	9.7 (17.8)
Soybeans	Average (Std. Dev.)	15.5 (30.1)	0	0	0	0
SB Stubb	Average (Std. Dev.)	0.6 (1.1)	0	0	0	0
SG Stubb	Average (Std. Dev.)	0	9.2 (18.8)	0	7.1 (17.5)	5.2 (18.3)
Live Tree	Average (Std. Dev.)	0	0	11.2 (10.9)	8.4 (16.4)	12.9 (18.0)
Dead Tree	Average (Std. Dev.)	0	0	0	0	0
Live Vine	Average (Std. Dev.)	0.1 (0.4)	0.1 (0.4)	0	0.4 (0.9)	0.1 (0.6)
Dead Vine	Average (Std. Dev.)	0	0	0	0	0
Shrub	Average (Std. Dev.)	0	0	1.5 (4.3)	0.1 (0.4)	3.7 (9.5)
0.25m Density	Average (Std. Dev.)	24.6 (33.3)	57.5 (37.5)	60.6 (24.1)	61.7 (32.2)	68.1 (32.8)
1.25m Density	Average (Std. Dev.)	0	22.2 (42.2)	14.9 (23.4)	24.7 (39.1)	24.3 (37.2)
2.25m Density	Average (Std. Dev.)	0	2.2 (13.3)	17.6 (29.6)	9.2 (23.1)	16.5 (27.6)
Canopy Cover	Average (Std. Dev.)	0	0	3.2 (7.4)	7.3 (18.7)	10.5 (18.8)
VgHt (cm)	Average (Std. Dev.)	8.7 (6.2)	48.1 (59.3)	29.6 (16.9)	45.9 (58.1)	42.7 (40.5)
WdyHt (m)	Average (Std. Dev.)	0	0	1.3 (1.1)	0.7 (1.2)	1.1 (1.2)

Table 18. Percent values of habitat characteristics for all species, seasons, and treatments combined at (Archibald) Stevenson Farms, Richland Parish, Louisiana, 2011.

Variable		Capture	Non-Capture	P-Value
Bare Ground	Average (Std. Dev.)	5.2 (5.9)	4.2 (6.3)	0.0746
Litter	Average (Std. Dev.)	22.9 (23.2)	29.0 (27.6)	0.4973
Live Graminoid	Average (Std. Dev.)	55.6 (39.5)	38.1 (35.2)	0.0561
Dead Graminoid	Average (Std. Dev.)	13.0 (30.5)	20.1 (31.2)	0.0979
Herbaceous	Average (Std. Dev.)	12.4 (19.1)	14.3 (22.6)	0.8021
Soybeans	Average (Std. Dev.)	6.0 (18.9)	2.7 (14.0)	0.3201
SB Stubb	Average (Std. Dev.)	0	0.1 (0.6)	0.2661
SG Stubb	Average (Std. Dev.)	0	4.9 (15.3)	0.1186
Live Tree	Average (Std. Dev.)	4.8 (9.8)	6.7 (13.4)	0.499
Dead Tree	Average (Std. Dev.)	0	0	1
Live Vine	Average (Std. Dev.)	0.2 (0.8)	0.1 (0.5)	0.4007
Dead Vine	Average (Std. Dev.)	0	0	1
Shrub	Average (Std. Dev.)	0.2 (0.8)	1.2 (5.1)	0.9712
0.25m Density	Average (Std. Dev.)	71.2 (36.2)	52.3 (34.8)	0.0168
1.25m Density	Average (Std. Dev.)	12.4 (30.3)	17.9 (33.8)	0.3746
2.25m Density	Average (Std. Dev.)	2.1 (6.8)	10.0 (23.8)	0.0993
Canopy Cover	Average (Std. Dev.)	0	4.7 (13.6)	0.0259
VgHt (cm)	Average (Std. Dev.)	44.9 (45.3)	33.7 (44.0)	0.1218
WdyHt (m)	Average (Std. Dev.)	0.5 (0.9)	0.6 (1.1)	0.5406

Table 19. Percent values of statistically different habitat characteristics comparing capture and non-capture locations for all species, seasons, and treatments combined at (Archibald) Stevenson Farms, Richland Parish, Louisiana, 2011.

Variable		**Capture**	**Non-Capture**	**P-Value**
Bare Ground	Average (Std. Dev.)	5.2 (5.9)	4.2 (6.3)	0.0746
Live Graminoid	Average (Std. Dev.)	55.6 (39.5)	38.1 (35.2)	0.0561
Dead Graminoid	Average (Std. Dev.)	13.0 (30.5)	20.1 (31.2)	0.0979
0.25m Density	Average (Std. Dev.)	71.2 (36.2)	52.3 (34.8)	0.0168
2.25m Density	Average (Std. Dev.)	2.1 (6.8)	10.0 (23.8)	0.0993
Canopy Cover	Average (Std. Dev.)	0	4.7 (13.6)	0.0259

DISCUSSION

Although originally planning for study sites to be replicates as required for experimental design, latitudinal distances coupled with varied management timing and techniques produced both apparent and statistical compositional differences between sites. As the result of this lack of replication, I was unable to compare descriptive statistics. Also, because comparisons by species, treatments, and seasons require many captures, poor trapping success prevented comparisons of capture and non-capture sites by species and comparisons of home ranges by sex and season. Although not as ambitious as planned, this study has provided valuable insight on the effects of differing agroforest treatments on small mammals inhabiting marginal agricultural land located within the LMAV and will be a valuable comparison tool for future studies.

Trapping:

While the feasibility of using switchgrass and cottonwood trees as biofuel feedstocks have been studied separately, their impacts as an integrated agroforest system have received little attention in the literature. In regards to the impacts on small mammals in hybrid popular (*Populus* sp.) plantations, abundance and diversity is higher in plantations than in row crop fields, but lower in plantations when compared to heterogeneously forested habitats (Christian et al. 1997). However, little research currently exists regarding the impacts of switchgrass plantations on small mammal communities.

As land use practices become increasingly complicated, the importance and urgency of understanding the ecology of all species in these affected environs should subsequently increase in order to preserve biological diversity (Bellows et al. 2001). Such is especially true for keystone small mammal communities that affect the diversity of the ecosystems in which they inhabit (Coppeto et al. 2006). Although the literature yields conflicting results, macrohabitat affinities tend to be better predictors of small mammal species distribution than microhabitat affinities (Morris 1987, Coppeto et al. 2006).

As noted by Klaa et al. (2005), the distributions and densities of small mammals in agroforest settings across seasons are attributable to the stochasticity of vegetative growth within plots. Switchgrass, being a warm-season perennial, and being harvested in late summer as biofuel feedstock, is only available for use by wildlife during the spring and summer months. Similar to switchgrass, the nature of row cropping only provides vertical structure exploitable by wildlife for a short period of time throughout the year (typically only during the summer). In the absence of these crops, the land consists of either mowed or ploughed fields uninhabited by most other vegetation. Therefore, as noted by Giordano and Meriggi (2009) and Moser et al. (2002), the year-round presence of trees offering over-story vegetation and abundant understory vegetation (at least until canopy closure at about 4 years of age), should be utilized by small mammals, especially during the autumn months. Although I originally postulated noticeable capture patterns across sites by season and treatment, that simply was not the case. However, patterns of abundance were likely best explained by habitat structure and, possibly, by species interactions (Dueser and Porter 1986). Peaks in abundance, species diversity, and capture rates varied by season and treatment between sites, consistent with the findings of Swihart and Slade (1990).

Important to note, red imported fire ants were abundantly present at two of the three study sites (Rohwer and Archibald). While present at Pine Tree, they were certainly not problematic, as was the experience at the other two sites. Not only were ants pests in terms of consuming bait (oatmeal), but they were also pests in terms of harassing, and even killing, captured animals. As can be expected of most any insect, activity was much more pronounced during the warmer trapping seasons, as compared to the cooler trapping seasons. Although ant densities were not quantified, I believe their presence adversely affected small mammal community dynamics of this study. Not only has previous research reported small mammal avoidance of areas where *S. invicta* is abundant (Killion and Grant 1993), but personal observations throughout the course of this project lend numerous examples of avoidance of traps located in close proximity to ant mounds. While certain precautions were taken to relocate traps upon discovery of a nearby ant mound, high densities in certain areas prevented complete isolation of traps.

Pine Tree

Community characteristics of small mammals varied temporally at this site. Overall, small mammal abundance was highest in summer and lowest in the fall. Supported by the fact that S1 produced the most individuals during the summer, peak abundance is likely attributable to the presence of a dense stand of well-established switchgrass during the summer trapping season. On the other hand, the lowest abundance in the fall is likely attributable to the lack of switchgrass during the fall trapping season (switchgrass had already been harvested). I believe the fact that those treatments containing switchgrass (S1, SW1, and WS1) produced 80% of all individuals captured throughout the year, coupled with the fact that, of all habitat types under investigation, switchgrass produced 55% of all captures, is a testament to the ability of switchgrass to provide viable small mammal habitat.

Peak in abundance of small mammal species did not occur simultaneously; *Peromyscus* spp. captures were greatest during the winter trapping season and *S. hispidus* during the summer trapping season. In fact, the presence of one seemed to exclude the presence of the other. I hypothesize that *S.hispidus* was the primary culprit driving variable species occurrence throughout the year; (1) they are much larger rodents than *Peromyscus* spp. and (2) they are known to be aggressive toward other small mammals inhabiting the same area (Schwartz and Schwartz 2001).

Rohwer

Community characteristics of small mammals varied temporally at this site. Overall, small mammal abundance was highest in fall and lowest in the summer. However, peak in abundance of small mammal species did not occur simultaneously; *M. musculus* and *S. hispidus* captures were greatest during the fall trapping season and *O. palustris* during the winter and spring trapping seasons. The abundance of *O. palustris* during the winter and spring trapping seasons can be attributed to the inundation nature of the site as the result of abundant rainfall (Abuzeineh 2007). Their subsequent decline in numbers during the following trapping seasons can be attributed to the severe lack of rain, and, consequently, lack of water.

As opposed to the other two sites, switchgrass was never established in any treatment at this site. As a result, of all habitat types under investigation, cottonwood trees produced a majority of captures (61%). This was likely attributable to the diversity of understory structure and plant species, properties not found in any other habitat type. Although this site supported the finest specimens of cottonwood trees, I hypothesize that, had switchgrass been established, small mammal community characteristics would be different than those presented.

Archibald

Community characteristics of small mammals varied temporally at this site. Overall, small mammal abundance was highest in spring and lowest in the fall. However, peak in abundance of small mammal species did not occur simultaneously; *M. musculus* captures were greatest during the winter trapping season and *S. hispidus* during the spring trapping season. Supported by the fact that S1 produced the most individuals during the spring, peak abundance is likely attributable to the presence of a dense stand of well-established switchgrass during the spring trapping season. On the other hand, the lowest abundance in the fall is likely attributable to the lack of switchgrass during the fall trapping season (switchgrass had already been harvested). I believe the fact that those treatments containing switchgrass (S1, SW1, and WS1) produced 75% of all individuals captured throughout the year, coupled with the fact that, of all habitat types under investigation, switchgrass produced 74% of all captures, is a testament to the ability of switchgrass to provide viable small mammal habitat.

Theoretically, W1 and WS1 should produce comparable results, because they are composed of a majority of the same habitat features. However, interestingly, W1 produced the fewest number of individuals throughout the year, and WS1 was one individual shy of being tied with the most productive treatment. Clearly, there is some factor other than vegetative composition of plots driving species occurrence and distribution. I predict this phenomenon is the product of plot arrangement, influencing landscape composition. Perhaps, under such small-scale settings, "ideal" treatments are only explainable relative to their proximity to other habitats.

Telemetry:

Radiocollars have been used extensively in wildlife research. They are a primary tool utilized to assess the spatial orientation of a variety of species (Johannesen et al. 1997). Under certain circumstances, anesthetizing captured individuals destined for collar fitting is a valid alternative to physical restraint. Chemical immobilization can effectively be used to ensure animal and handler safety, reduce animal stress, reduce handling time, and ensure proper execution of desired field procedures (McColl and Boonstra 1999). Considered less toxic than other inhalation anesthetics, Halothane has a wide safety margin, is fast-acting, and has a rapid recovery time (Blanchette 1989). However, its application in the field to wild, small mammals is relatively unknown (Blanchette 1989, McColl and Boonstra 1999).

In regards to the use of Halothane, I found this anesthetic to be irreplaceable during collar fitting. By sedating individuals destined for collar fitting, I was able to dramatically reduce handling time and dramatically increase collaring success. Sedated individuals were less likely to be injured and more likely to retain collars than were non-sedated individuals. As a word of caution, if attempting to use Halothane in future studies, be sure to remove individuals from the bag shortly after they become sedated, while ensuring the cotton ball is never located directly near the individual's face. As was my experience, drug-induced mortality via overexposure occurred when the saturated cotton ball was left in close proximity to the individual's face for any length of time. However, upon realizing this, I was able to complete anesthetizing procedures confidently and successfully without fear of harming the individual.

Radiotelemetry equips researchers with the unique ability to repeatedly relocate individuals fitted with radiotransmitters. These relocations provide valuable insight about such aspects of wildlife management as wildlife behavior, population biology, and ecology (Fuller et al. 2005). Because radiotelemetry allows exploration beyond the confines of a trapping grid, this approach yields a better estimation of home range characteristics of small mammals when compared to information gained solely from trapping (Ribble et al. 2002, Gottesman et al. 2004).

Home range is most commonly defined as the "area transversed by the individual in its normal activities of food gathering, mating, and caring for young" (Burt 1943). Estimating home range parameters (i.e. size and shape) provides important information that can be utilized to ensure population viability and to facilitate appropriate management decisions (Cutrera et al. 2006). In the hispid cotton rat, size of home ranges varies by sex, season, body mass, and population density (averaging 0.247 hectares) (Cameron and Spencer 1985).

Important to note is the reason why I chose *S.hispidus* for home range analysis. A pilot study conducted before I took over this project revealed *S. hispidus* was a prime candidate for study. Not only was this species present at each site, but it was also very abundant at Archibald. Widespread abundance, presumably the result of its generalist nature (Cameron and Spencer 1981), together with its large body size allowing use of larger collars with extended battery life to be used, made it an ideal study animal. Although I originally planned to use cable-tie tubing collars attached using monofilament fishing line, several failed collaring attempts leading to stress-induced mortality of rats selected for collar-fitting, coupled with poor collar-retention of "successfully" collared rats, forced exploration of alternative equipment. I discovered zip-tie collars, which dramatically increased collaring efficiency, leading to improved collar fitting and retention and decreased handling time.

However, on several occasions and for reasons unbeknownst to me, collared rats became entangled and trapped in vegetation as the result of a frayed antenna (Fig. 11). I presume this was the result of an excessively long antenna that was either damaged by trap closure upon recapture or chewed on by collared rats or conspecifics. Whatever the cause, this was an obstacle that led to several mortalities (presumably stress-induced), reducing sample size, and should be a serious consideration for future telemetry studies involving small mammals.

Consistent with the literature, *S. hispidus* home range size varied by sex, with male home ranges typically being larger than female home ranges (Cameron and Spencer 1981). However, my results are dramatically inflated, with an average home range size of 1.93 ha, for all sexes, seasons, and sites combined. In addition to variation between sexes, there was also dramatic variability between sites. This is likely the result of two factors: (1) seasonal differences during home range analyses, as reproductive stage and habitat structure can influence movement patterns (Fleharty and Mares 1973) and (2) landscape composition (plot layout), as proximity of "suitable" habitat can either facilitate or hinder dispersal (Giordano and Meriggi 2009).

Unlike the other two sites, in which male home range size was roughly four times that of female home range size, Rohwer produced more consistent results between sexes, with male home range sizes less than 1.5 times greater than those of females. As previously mentioned, I hypothesize this is the product of seasonal differences and differences in landscape composition, as Pine Tree and Archibald supported well-established, dense stands of switchgrass, were comprised of more "suitable" habitat surrounding experimental treatments, and were analyzed more during the breeding season. Rohwer, on the other hand, was sampled late in fall, when males were likely more concerned with winter survival than searching for a mate.

Also worth mentioning is the extremely large home range estimates for individuals located at Pine Tree compared to all others. I believe this is the product of three factors: (1) a male dominated sample, (2) season, and (3) the habitat matrix. The sample being comprised mainly of males skewed the combined sex estimation toward average male home range size (the opposite is true for the other two sites). Further compounding this situation is the fact that this site was sampled in the middle of the summer, a time when males were likely frantically pursuing all prospective mates. In addition to the previously mentioned, the experimental treatments at this site were arranged in a way that was highly conducive to safe long-distance travel. For instance, the 90 x 30-meter plots were located in very close proximity to the 90 x 90-meter wildlife plots in which I conducted my research, providing ample cover and food in the form of switchgrass.

Habitat:

According to Coppeto et al. (2006), “effective strategies for conservation of small mammals in heavily managed systems require an understanding of how organisms use their habitat and resources.” Habitat characteristics, as can be expected given the amount of variability, differed substantially within treatments across seasons and sites. With these differing characteristics comes differing benefits. For example, those areas providing habitat dominated by dense grasses are likely to support greater populations of *S. hispidus* than those areas providing more bare ground (Cameron and Spencer 1981). The wildlife beneficiaries among differing agroforest treatments can also be expected to change over time as vegetation structure changes as the result of biomass crop plot maturation and management intensity (Schiller and Tolbert 2010). Therefore, in order to further understand the ecological impacts of each treatment, future research should be conducted over a longer period of time, encompass variable plot sizes, and standardize the habitat matrix.

Unlike other studies that have documented niche partitioning by species (Dueser and Shugart, Jr. 1978), small sample sizes of this study prevented inferential distinctions. Therefore, differences in capture versus non-capture sites are only interpretable to the small mammal level. Also, while some reported differences are statistically significant, there likely exists no biological significance. This, again, is the result of poor trapping success. While microhabitat affinities have been cited as the driving factors influencing small mammal community characteristics (Bellows et al. 2001), others contend that small mammal population dynamics are better explained by macrohabitat characteristics (Coppeto et al. 2006). I suggest that variation in small mammal community composition by treatment throughout the course of this study is perhaps best left out of the macro-micro habitat debate. I believe that small plot and sample sizes, coupled with varying habitat matrices and management practices, constrain interpretability. For example, small plot size compromises the integrity of the definition of macrohabitat. The value of these results lies in their applicability to future management of agroforest systems. Simply put, while not treatment specific, future management objectives should, at the very least, be focused on providing more of the habitat parameters characterizing capture sites, while controlling the parameters strongly associated with non-capture sites.

Figure 10. Collared rat entangled and trapped in vegetation as the result of a frayed antenna.

RECOMMENDATION

Throughout the course of this study, I have learned one very valuable lesson, which leads me make the following recommendation. Whenever planning a research project of this nature, make sure replication is at the foremost of planning objectives. Replication is essential for true experimental design. Without replication, statistical comparisons are impossible, depriving the research of the ability to make valid inferences. Although this project fulfilled the replication requirement on the forestry end, vast latitudinal differences and inconsistent management efforts compromised the legitimacy of replication on the wildlife end. I suggest that future research investigating the effects of varying agroforest treatments on small communities ensure replication by planting all treatments and blocks at the same geographic location, as opposed to 200 miles apart, as was the case for my study. In addition to planting all treatments and blocks at the same location, I suggest that plot layout be identical between blocks, ensuring an identical habitat matrix available for wildlife use. Finally, in addition to the previously mentioned, I recommend ensuring all treatments and blocks receive identical management efforts, ensuring a more homogenous mixture of within plot vegetation.

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APPENDIX

Table A1. Small mammal community characteristics by treatment during the winter trapping season at the Pine Tree Branch Experimental Station, St. Francis County, Arkansas, 2011.

	Treatment					
Species	**(W1)**	**(S1)**	**(WS1)**	**(SW1)**	**(C1)**	**Total**
Sigmodon hispidus	0	0	0	0	0	0
Peromyscus spp.	4	3	3	4	0	14
Mus musculus	0	0	0	0	1	1
Reithrodontomys spp.	0	0	0	0	0	0
Oryzomys palustris	0	0	0	0	0	0
Microtus pinetorum	0	0	0	0	0	0
Cryptotis parva	0	0	0	0	0	0
Total	**4**	**3**	**3**	**4**	**1**	**15**
Number of ind./100 TNs	2.22	1.67	1.67	2.22	0.56	1.67
Shannon Index	0.00	0.00	0.00	0.00	0.00	0.24

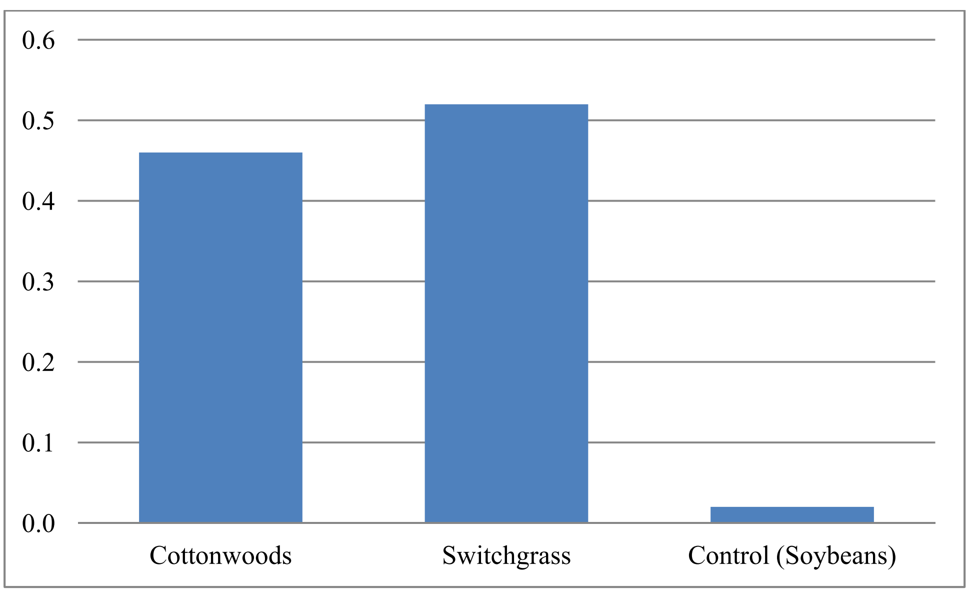


Figure A1. Proportion of captures by habitat type during the winter trapping season for all species and treatments combined at the Pine Tree Branch Experimental Station, St. Francis County, Arkansas, 2011.

Table A2. Small mammal community characteristics by treatment during the spring trapping season at the Pine Tree Branch Experimental Station, St. Francis County, Arkansas, 2011.

	Treatment					
Species	**(W1)**	**(S1)**	**(WS1)**	**(SW1)**	**(C1)**	**Total**
Sigmodon hispidus	0	0	0	1	0	1
Peromyscus spp.	2	4	1	2	2	11
Mus musculus	0	0	1	0	0	1
Reithrodontomys spp.	0	0	0	0	0	0
Oryzomys palustris	0	0	0	0	0	0
Microtus pinetorum	0	0	0	0	0	0
Cryptotis parva	0	0	0	0	0	0
Total	**2**	**4**	**2**	**3**	**2**	**13**
Number of ind./100 TNs	1.11	2.22	1.11	1.67	1.11	1.44
Shannon Index	0.00	0.00	0.69	0.64	0.00	0.54

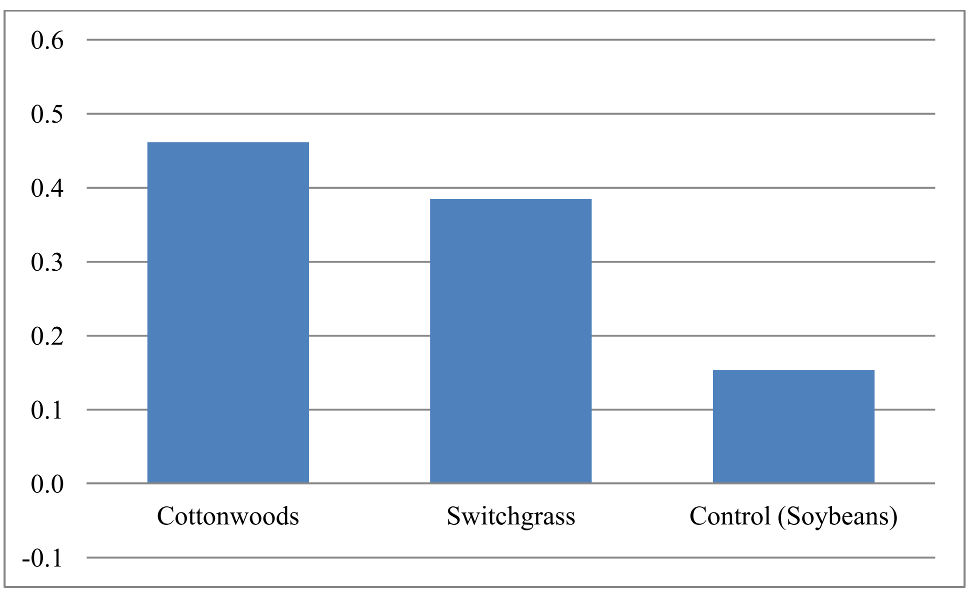


Figure A2. Proportion of captures by habitat type during the spring trapping season for all species and treatments combined at the Pine Tree Branch Experimental Station, St. Francis County, Arkansas, 2011.

Table A3. Small mammal community characteristics by treatment during the summer trapping season at the Pine Tree Branch Experimental Station, St. Francis County, Arkansas, 2011.

	Treatment					
Species	**(W1)**	**(S1)**	**(WS1)**	**(SW1)**	**(C1)**	**Total**
Sigmodon hispidus	0	11	1	2	0	14
Peromyscus spp.	0	0	0	0	1	1
Mus musculus	0	0	0	0	0	0
Reithrodontomys spp.	0	0	0	0	0	0
Oryzomys palustris	0	0	0	2	0	2
Microtus pinetorum	0	0	0	0	0	0
Cryptotis parva	0	0	0	0	0	0
Total	**0**	**11**	**1**	**4**	**1**	**17**
Number of ind./100 TNs	0.00	6.11	0.56	2.22	0.56	1.89
Shannon Index	0.00	0.00	0.00	0.69	0.00	0.58

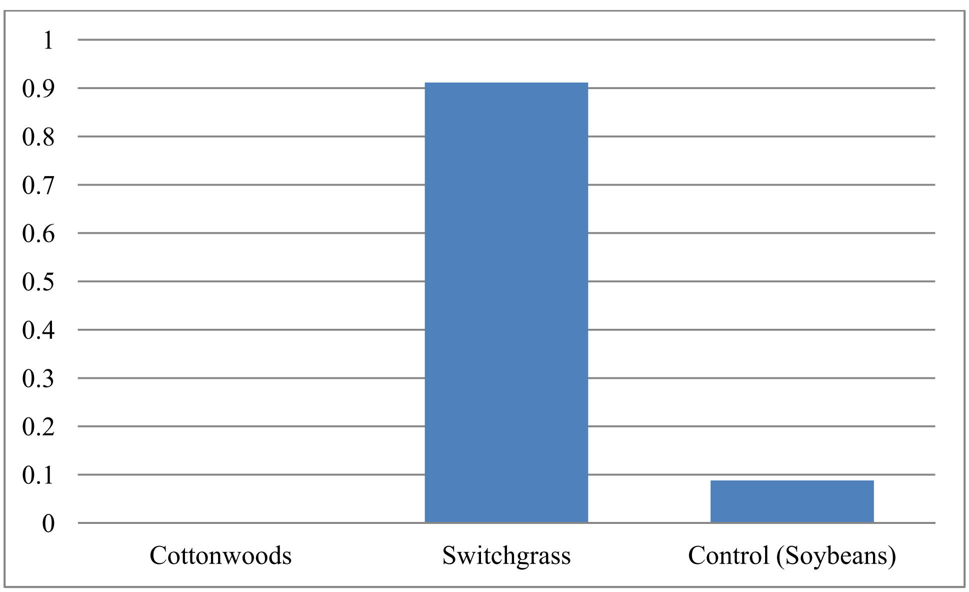


Figure A3. Proportion of captures by habitat type during the summer trapping season for all species and treatments combined at the Pine Tree Branch Experimental Station, St. Francis County, Arkansas, 2011.

Table A4. Small mammal community characteristics by treatment during the fall trapping season at the Pine Tree Branch Experimental Station, St. Francis County, Arkansas, 2011.

	Treatment					
Species	**(W1)**	**(S1)**	**(WS1)**	**(SW1)**	**(C1)**	**Total**
Sigmodon hispidus	0	0	0	0	0	0
Peromyscus spp.	0	3	2	1	1	7
Mus musculus	0	0	0	0	0	0
Reithrodontomys spp.	0	0	0	1	0	1
Oryzomys palustris	0	0	2	0	0	2
Microtus pinetorum	0	0	0	0	0	0
Cryptotis parva	0	0	0	0	0	0
Total	**0**	**3**	**4**	**2**	**1**	**10**
Number of ind./100 TNs	0.00	1.67	2.22	1.11	0.56	1.11
Shannon Index	0.00	0.00	0.69	0.69	0.00	0.80

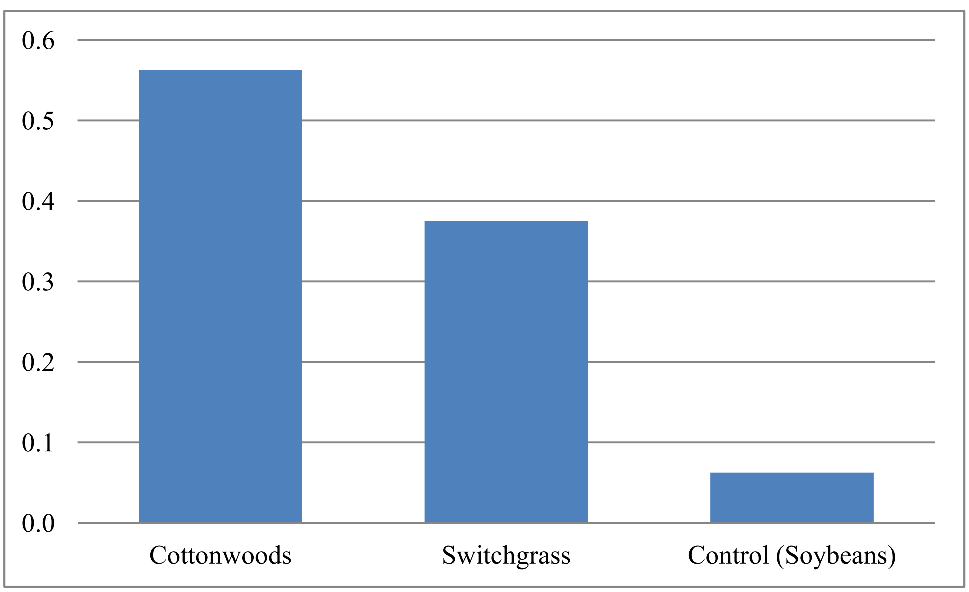


Figure A4. Proportion of captures by habitat type during the fall trapping season for all species and treatments combined at the Pine Tree Branch Experimental Station, St. Francis County, Arkansas, 2011.

Table A5. Small mammal community characteristics by treatment during the winter trapping season at the (Rohwer) Southeast Research and Extension Center, Desha County, Arkansas, 2011.

	Treatment					
Species	**(W1)**	**(S1)**	**(WS1)**	**(SW1)**	**(C1)**	**Total**
Sigmodon hispidus	0	0	0	0	0	0
Peromyscus spp.	0	0	0	0	0	0
Mus musculus	5	17	4	4	14	44
Reithrodontomys spp.	0	0	0	0	0	0
Oryzomys palustris	7	0	7	2	1	17
Microtus pinetorum	0	0	0	0	0	0
Cryptotis parva	2	0	0	0	0	2
Total	**12**	**17**	**11**	**6**	**15**	**61**
Number of ind./100 TNs	7.78	9.44	6.11	3.33	8.33	7.00
Shannon Index	0.99	0.00	0.66	0.64	0.24	0.71

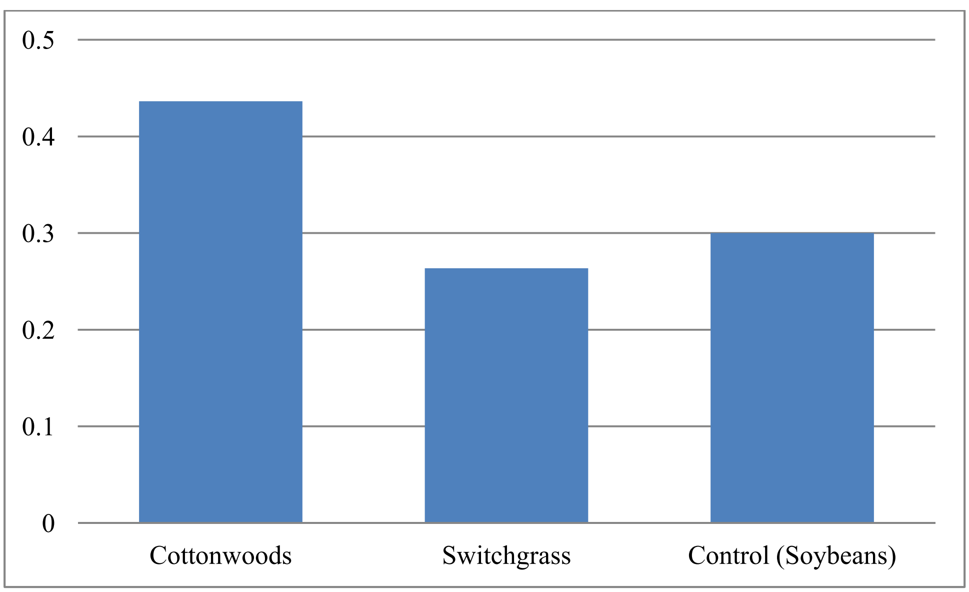


Figure A5. Proportion of captures by habitat type during the winter trapping season for all species and treatments combined at the (Rohwer) Southeast Research and Extension Center, Desha County, Arkansas, 2011.

Table A6. Small mammal community characteristics by treatment during the spring trapping season at the (Rohwer) Southeast Research and Extension Center, Desha County, Arkansas, 2011.

	Treatment					
Species	**(W1)**	**(S1)**	**(WS1)**	**(SW1)**	**(C1)**	**Total**
Sigmodon hispidus	0	0	0	0	0	0
Peromyscus spp.	0	0	0	0	0	0
Mus musculus	0	0	1	0	0	1
Reithrodontomys spp.	0	0	0	0	0	0
Oryzomys palustris	7	6	1	4	0	18
Microtus pinetorum	0	0	0	0	0	0
Cryptotis parva	0	0	0	0	0	0
Total	**7**	**6**	**2**	**4**	**0**	**19**
Number of ind./100 TNs	3.89	3.33	1.11	2.22	0.00	2.11
Shannon Index	0.00	0.00	0.69	0.00	0.00	0.21

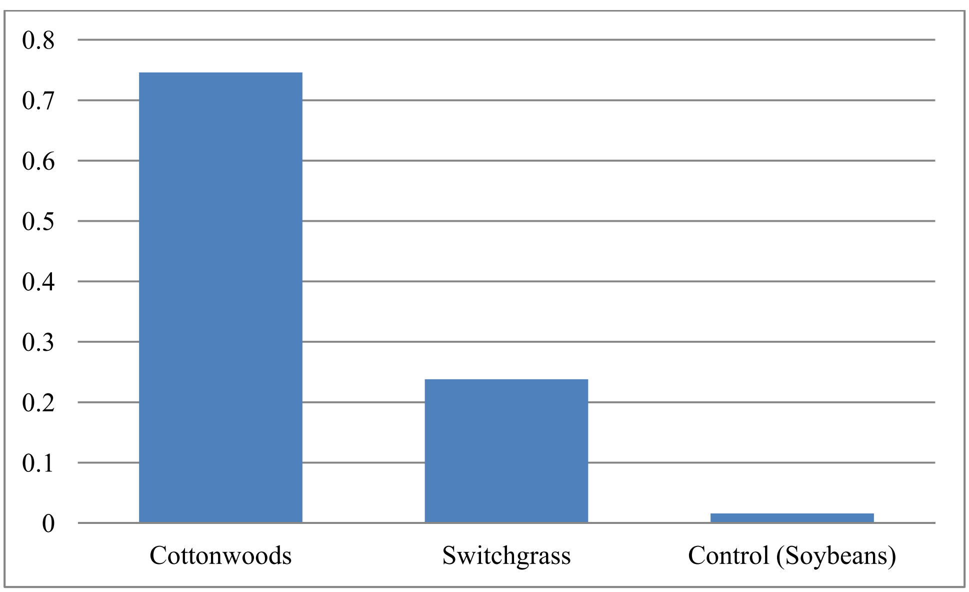


Figure A6. Proportion of captures by habitat type during the spring trapping season for all species and treatments combined at the (Rohwer) Southeast Research and Extension Center, Desha County, Arkansas, 2011.

Table A7. Small mammal community characteristics by treatment during the summer trapping season at the (Rohwer) Southeast Research and Extension Center, Desha County, Arkansas, 2011.

	Treatment					
Species	**(W1)**	**(S1)**	**(WS1)**	**(SW1)**	**(C1)**	**Total**
Sigmodon hispidus	1	0	0	0	0	1
Peromyscus spp.	0	0	0	0	0	0
Mus musculus	2	2	2	3	4	13
Reithrodontomys spp.	0	0	0	0	0	0
Oryzomys palustris	0	0	0	0	0	0
Microtus pinetorum	0	0	0	0	0	0
Cryptotis parva	0	0	0	0	0	0
Total	**3**	**2**	**2**	**3**	**4**	**14**
Number of ind./100 TNs	1.67	1.11	1.11	1.67	2.22	1.56
Shannon Index	0.64	0.00	0.00	0.00	0.00	0.26

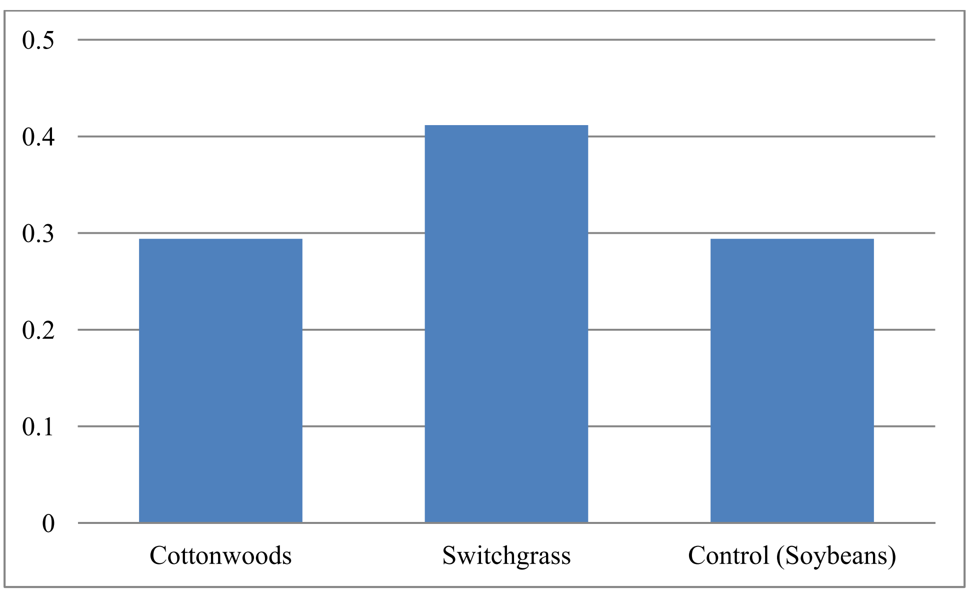


Figure A7. Proportion of captures by habitat type during the summer trapping season for all species and treatments combined at the (Rohwer) Southeast Research and Extension Center, Desha County, Arkansas, 2011.

Table A8. Small mammal community characteristics by treatment during the fall trapping season at the (Rohwer) Southeast Research and Extension Center, Desha County, Arkansas, 2011.

	Treatment					
Species	**(W1)**	**(S1)**	**(WS1)**	**(SW1)**	**(C1)**	**Total**
Sigmodon hispidus	21	0	1	2	0	24
Peromyscus spp.	0	0	0	0	0	0
Mus musculus	8	6	18	17	8	57
Reithrodontomys spp.	3	0	0	0	0	3
Oryzomys palustris	1	0	2	0	0	3
Microtus pinetorum	0	0	0	0	0	0
Cryptotis parva	0	0	0	0	0	0
Total	**33**	**6**	**21**	**19**	**8**	**87**
Number of ind./100 TNs	21.67	3.33	11.67	10.56	4.44	10.33
Shannon Index	0.96	0.00	0.50	0.34	0.00	0.86

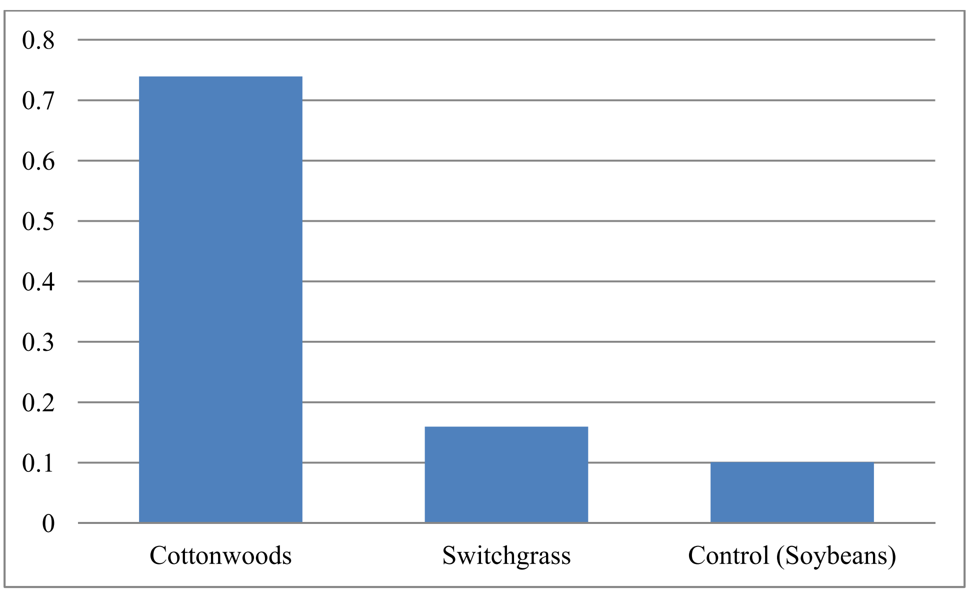


Figure A8. Proportion of captures by habitat type during the fall trapping season for all species and treatments combined at the (Rohwer) Southeast Research and Extension Center, Desha County, Arkansas, 2011.

Table A9. Small mammal community characteristics by treatment during the winter trapping season at (Archibald) Stevenson Farms, Richland Parish, Louisiana, 2011.

	Treatment					
Species	**(W1)**	**(S1)**	**(WS1)**	**(SW1)**	**(C1)**	**Total**
Sigmodon hispidus	0	0	2	0	0	2
Peromyscus spp.	0	0	2	0	0	2
Mus musculus	3	3	2	1	3	12
Reithrodontomys spp.	0	0	0	0	0	0
Oryzomys palustris	0	0	0	0	0	0
Microtus pinetorum	0	0	2	2	0	4
Cryptotis parva	0	0	0	0	0	0
Total	**3**	**3**	**8**	**3**	**3**	**20**
Number of ind./100 TNs	1.67	1.67	4.44	1.67	1.67	2.22
Shannon Index	0.00	0.00	1.39	0.64	0.00	1.09

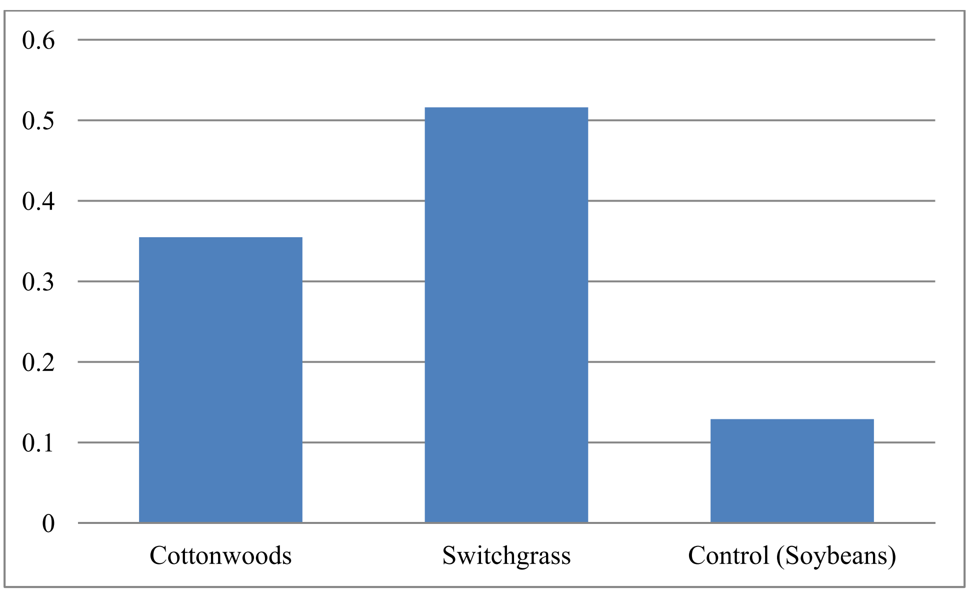


Figure A9. Proportion of captures by habitat type during the winter trapping season for all species and treatments combined at (Archibald) Stevenson Farms, Richland Parish, Louisiana, 2011.

Table A10. Small mammal community characteristics by treatment during the spring trapping season at (Archibald) Stevenson Farms, Richland Parish, Louisiana, 2011.

	Treatment					
Species	**(W1)**	**(S1)**	**(WS1)**	**(SW1)**	**(C1)**	**Total**
Sigmodon hispidus	0	3	4	5	0	12
Peromyscus spp.	0	0	0	0	0	0
Mus musculus	0	6	1	0	1	8
Reithrodontomys spp.	0	0	0	0	0	0
Oryzomys palustris	0	0	0	0	0	0
Microtus pinetorum	1	0	0	0	0	1
Cryptotis parva	0	0	0	0	0	0
Total	**1**	**9**	**5**	**5**	**1**	**21**
Number of ind./100 TNs	0.56	5.00	2.78	2.78	0.56	2.33
Shannon Index	0.00	0.64	0.50	0.00	0.00	0.83

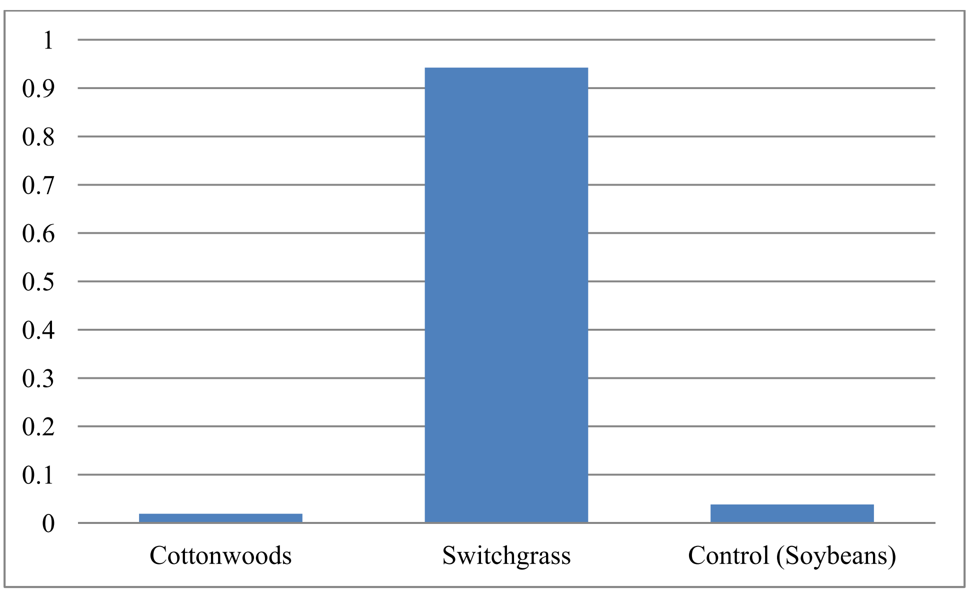


Figure A10. Proportion of captures by habitat type during the spring trapping season for all species and treatments combined at (Archibald) Stevenson Farms, Richland Parish, Louisiana, 2011.

Table A11. Small mammal community characteristics by treatment during the summer trapping season at (Archibald) Stevenson Farms, Richland Parish, Louisiana, 2011.

	Treatment					
Species	**(W1)**	**(S1)**	**(WS1)**	**(SW1)**	**(C1)**	**Total**
Sigmodon hispidus	0	0	0	0	0	0
Peromyscus spp.	0	0	0	0	0	0
Mus musculus	0	2	0	1	4	7
Reithrodontomys spp.	0	0	0	0	0	0
Oryzomys palustris	0	0	0	0	0	0
Microtus pinetorum	1	0	0	0	0	1
Cryptotis parva	0	0	0	0	0	0
Total	**1**	**2**	**0**	**1**	**4**	**8**
Number of ind./100 TNs	0.56	1.11	0.00	0.56	2.22	0.89
Shannon Index	0.00	0.00	0.00	0.00	0.00	0.38

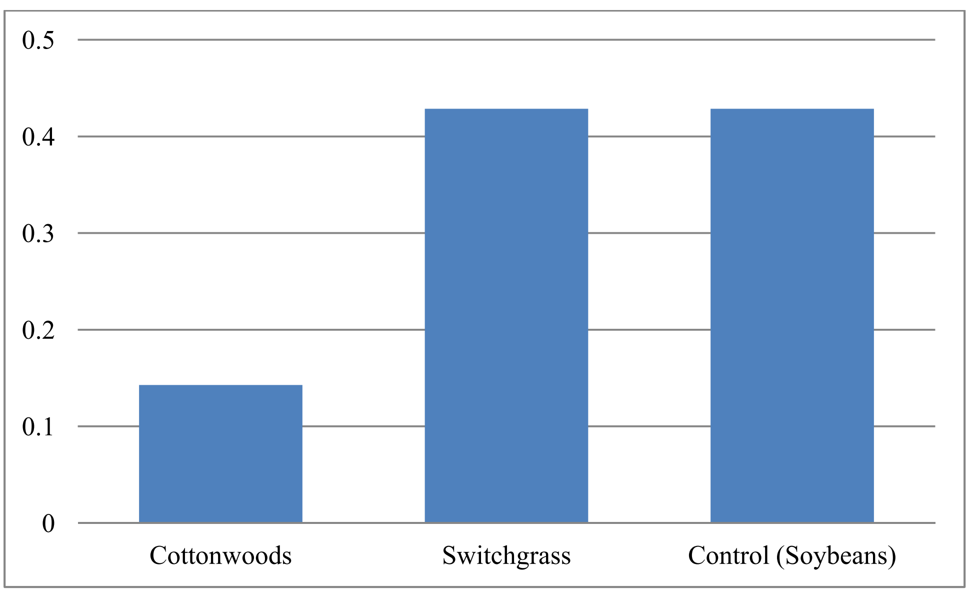


Figure A11. Proportion of captures by habitat type during the summer trapping season for all species and treatments combined at (Archibald) Stevenson Farms, Richland Parish, Louisiana, 2011.

Table A12. Small mammal community characteristics by treatment during the fall trapping season at (Archibald) Stevenson Farms, Richland Parish, Louisiana, 2011.

	Treatment					
Species	**(W1)**	**(S1)**	**(WS1)**	**(SW1)**	**(C1)**	**Total**
Sigmodon hispidus	0	0	0	0	0	0
Peromyscus spp.	0	0	0	0	0	0
Mus musculus	0	0	0	2	0	2
Reithrodontomys spp.	0	0	0	0	0	0
Oryzomys palustris	0	0	0	0	0	0
Microtus pinetorum	0	0	0	0	0	0
Cryptotis parva	0	0	0	0	0	0
Total	**0**	**0**	**0**	**2**	**0**	**2**
Number of ind./100 TNs	0.00	0.00	0.00	1.11	0.00	0.22
Shannon Index	0.00	0.00	0.00	0.00	0.00	0.00

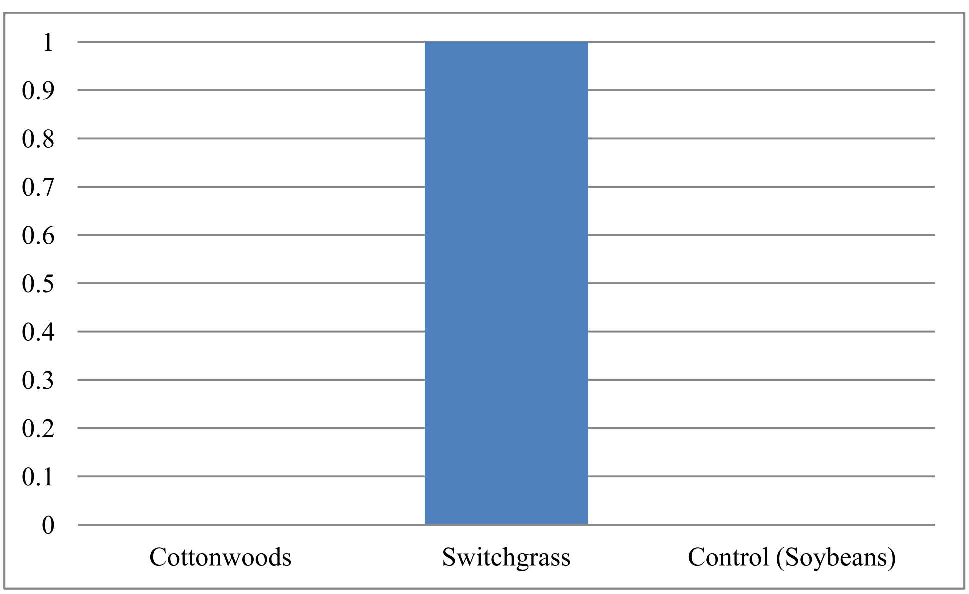


Figure A12. Proportion of captures by habitat type during the fall trapping season for all species and treatments combined at (Archibald) Stevenson Farms, Richland Parish, Louisiana, 2011.

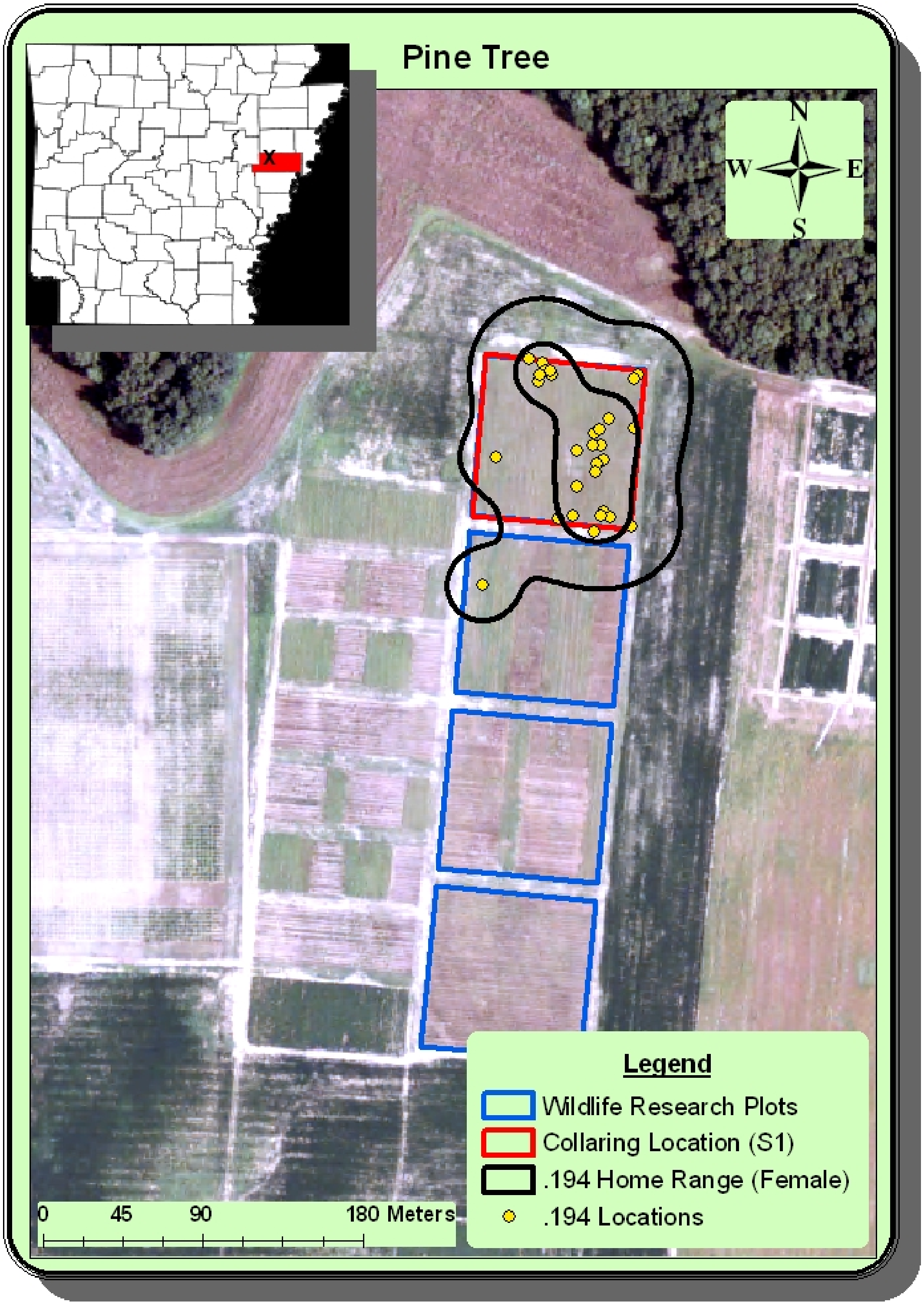
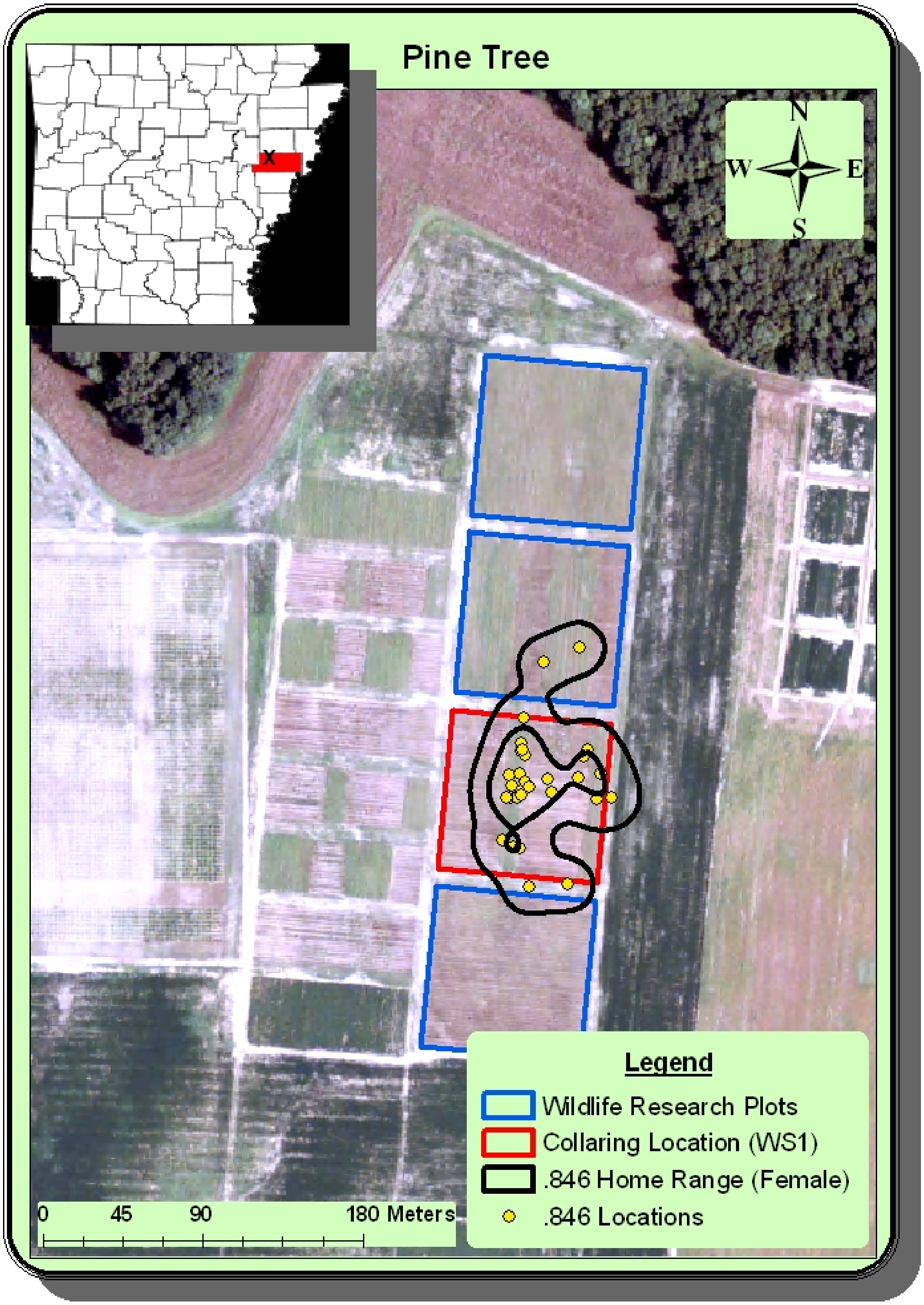


Figure A13. Home range results of individual .194 collared at the Pine Tree Branch Experimental Station, St. Francis County, Arkansas, 2011. The exterior line represents the 95% home range, while the interior line represents the 50% (core) home range.



FigureA14. Home range results of individual .846 collared at the Pine Tree Branch Experimental Station, St. Francis County, Arkansas, 2011. The exterior line represents the 95% home range, while the interior line represents the 50% (core) home range.

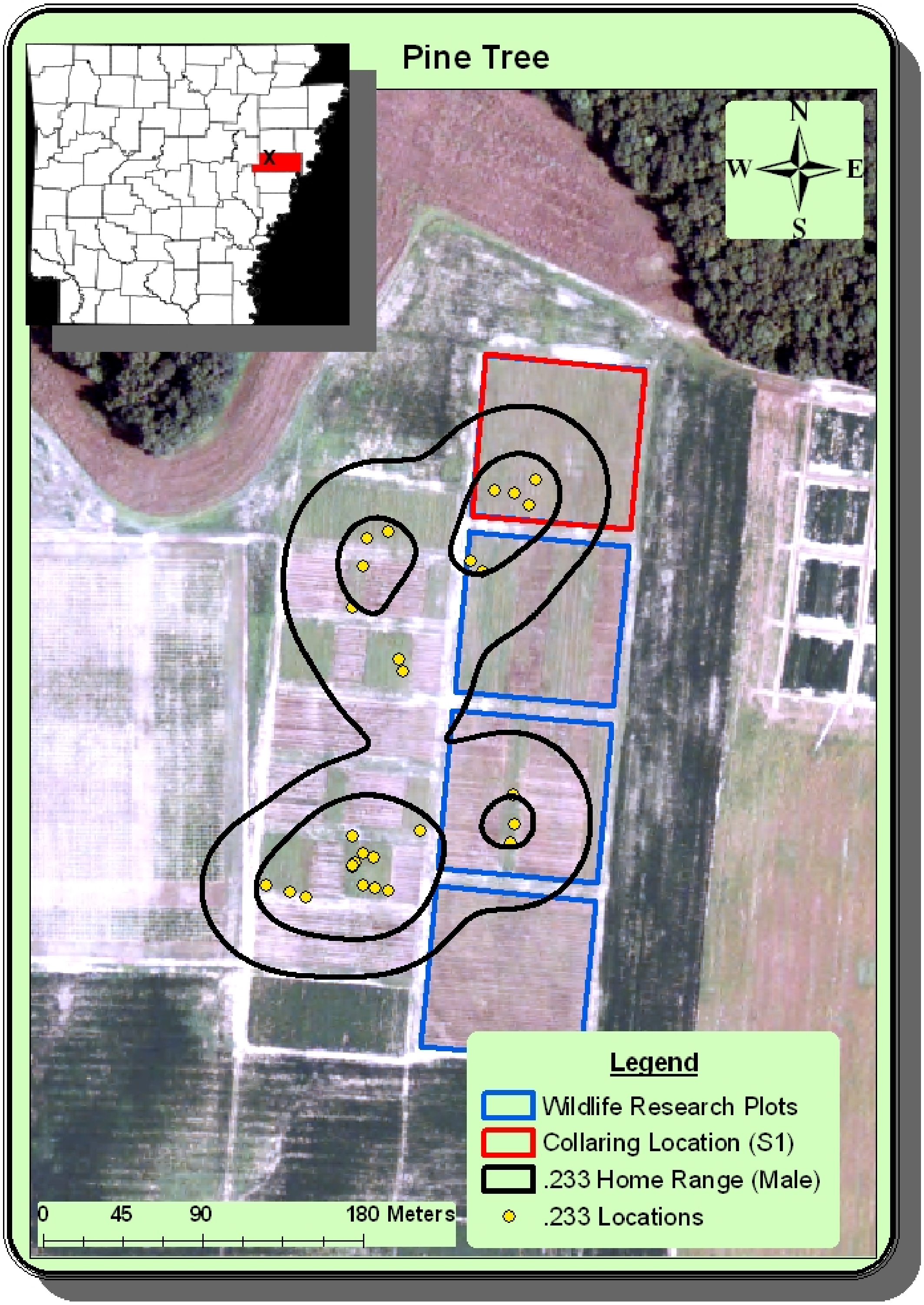


Figure A15. Home range results of individual .233 collared at the Pine Tree Branch Experimental Station, St. Francis County, Arkansas, 2011. The exterior line represents the 95% home range, while the interior lines represent the 50% (core) home ranges.

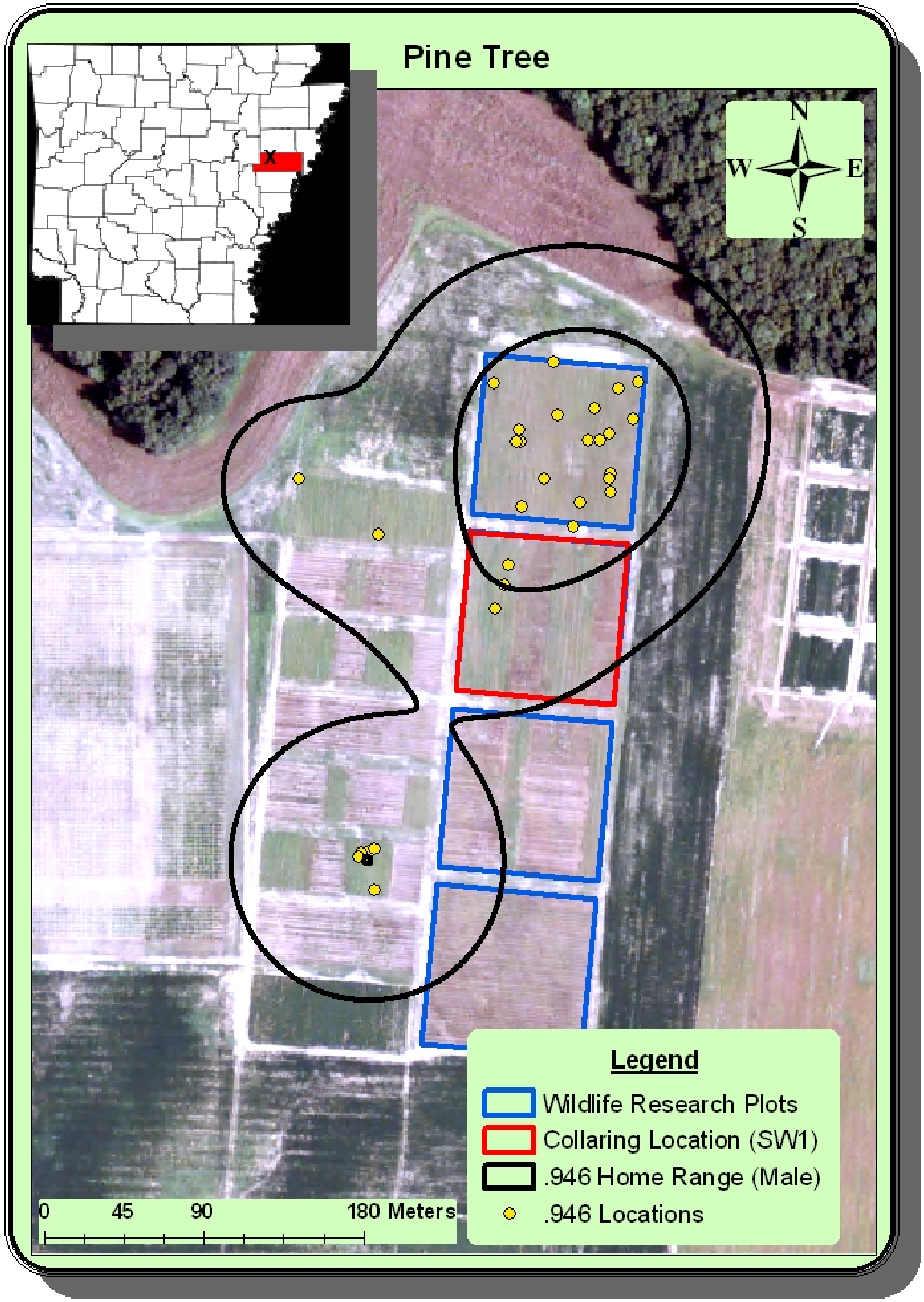


Figure A16. Home range results of individual .946 collared at the Pine Tree Branch Experimental Station, St. Francis County, Arkansas, 2011. The exterior line represents the 95% home range, while the interior lines represent the 50% (core) home ranges.

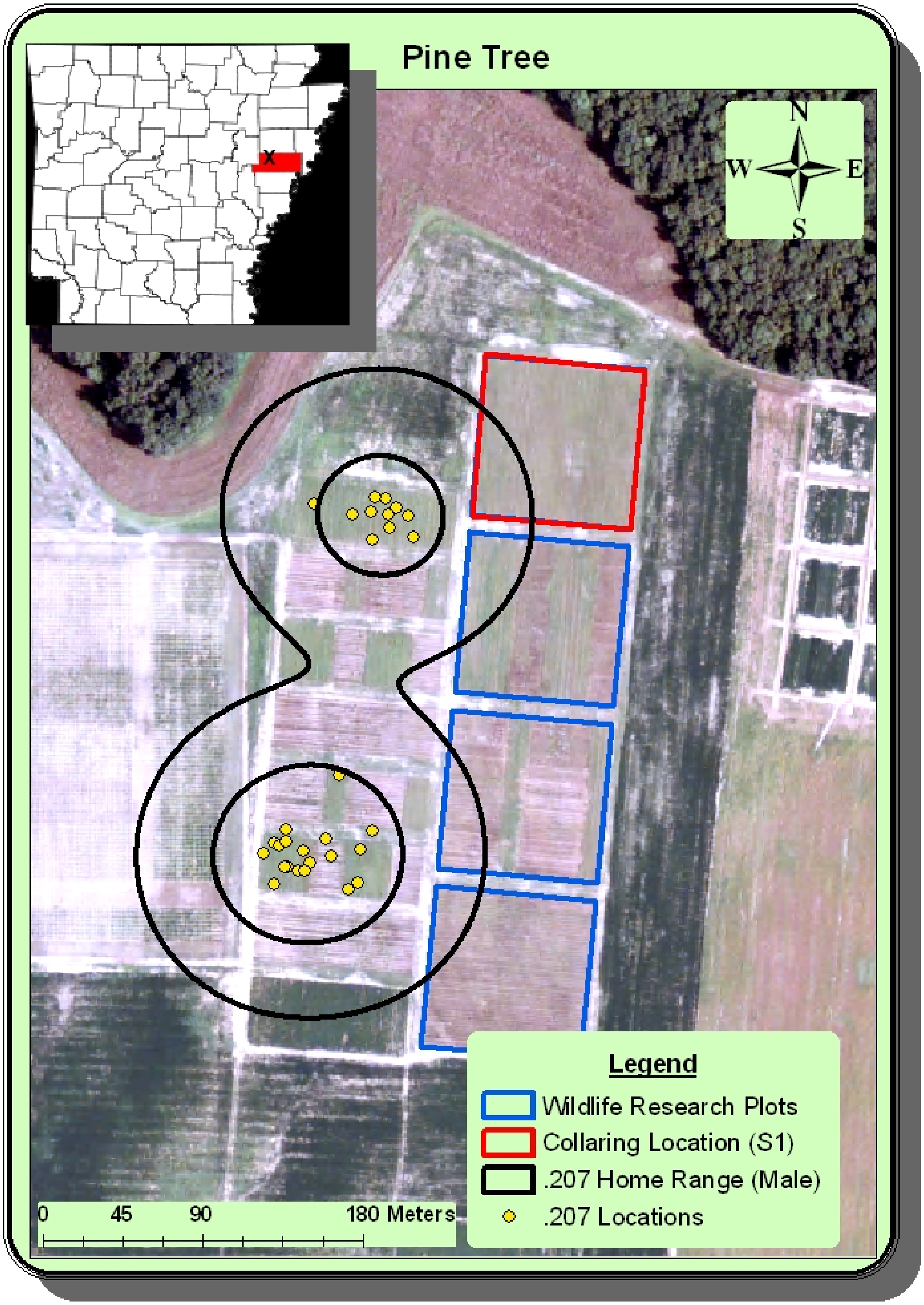


Figure A17. Home range results of individual .207 collared at the Pine Tree Branch Experimental Station, St. Francis County, Arkansas, 2011. The exterior line represents the 95% home range, while the interior lines represent the 50% (core) home ranges.

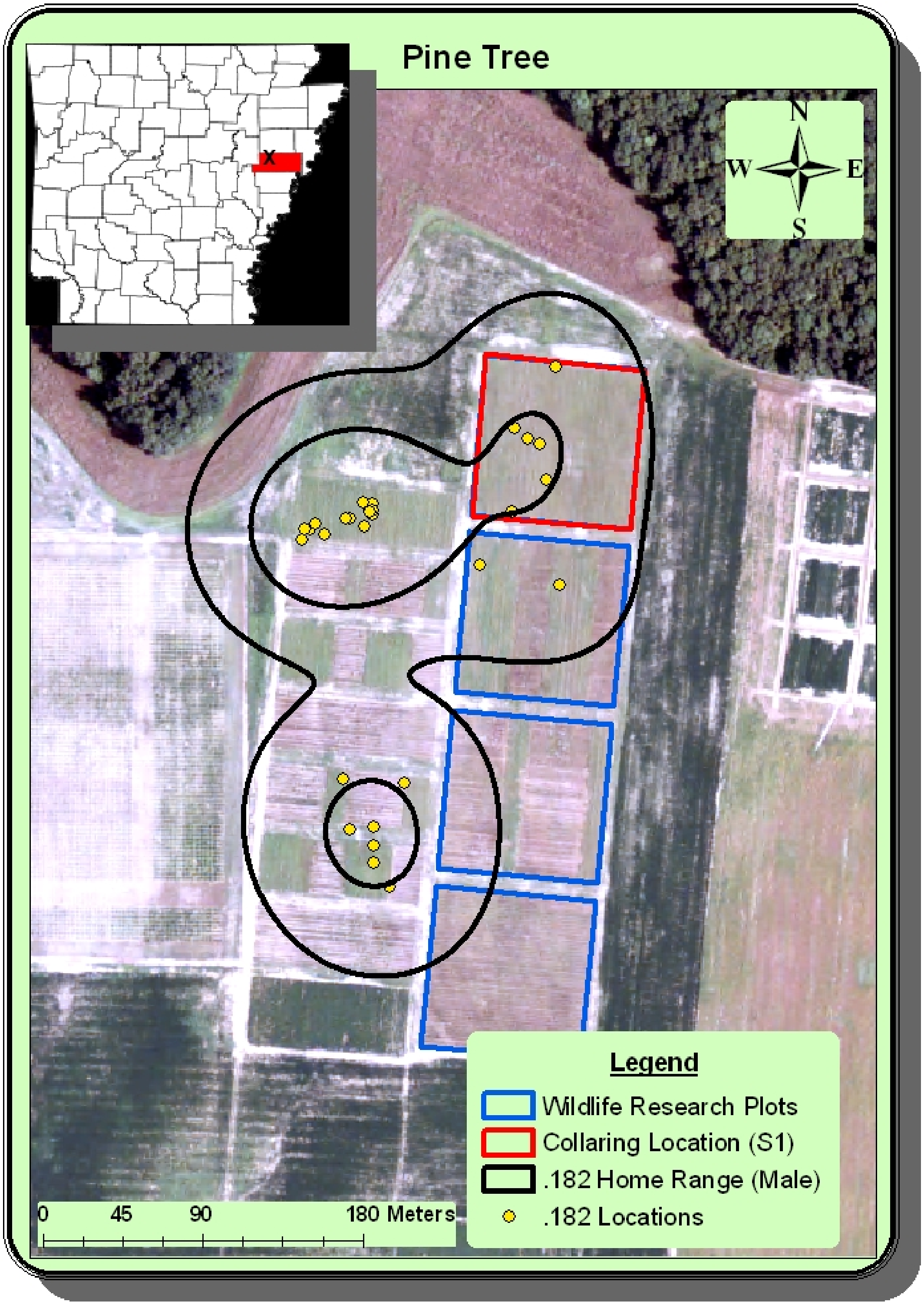


Figure A18. Home range results of individual .182 collared at the Pine Tree Branch Experimental Station, St. Francis County, Arkansas, 2011. The exterior line represents the 95% home range, while the interior lines represent the 50% (core) home ranges.

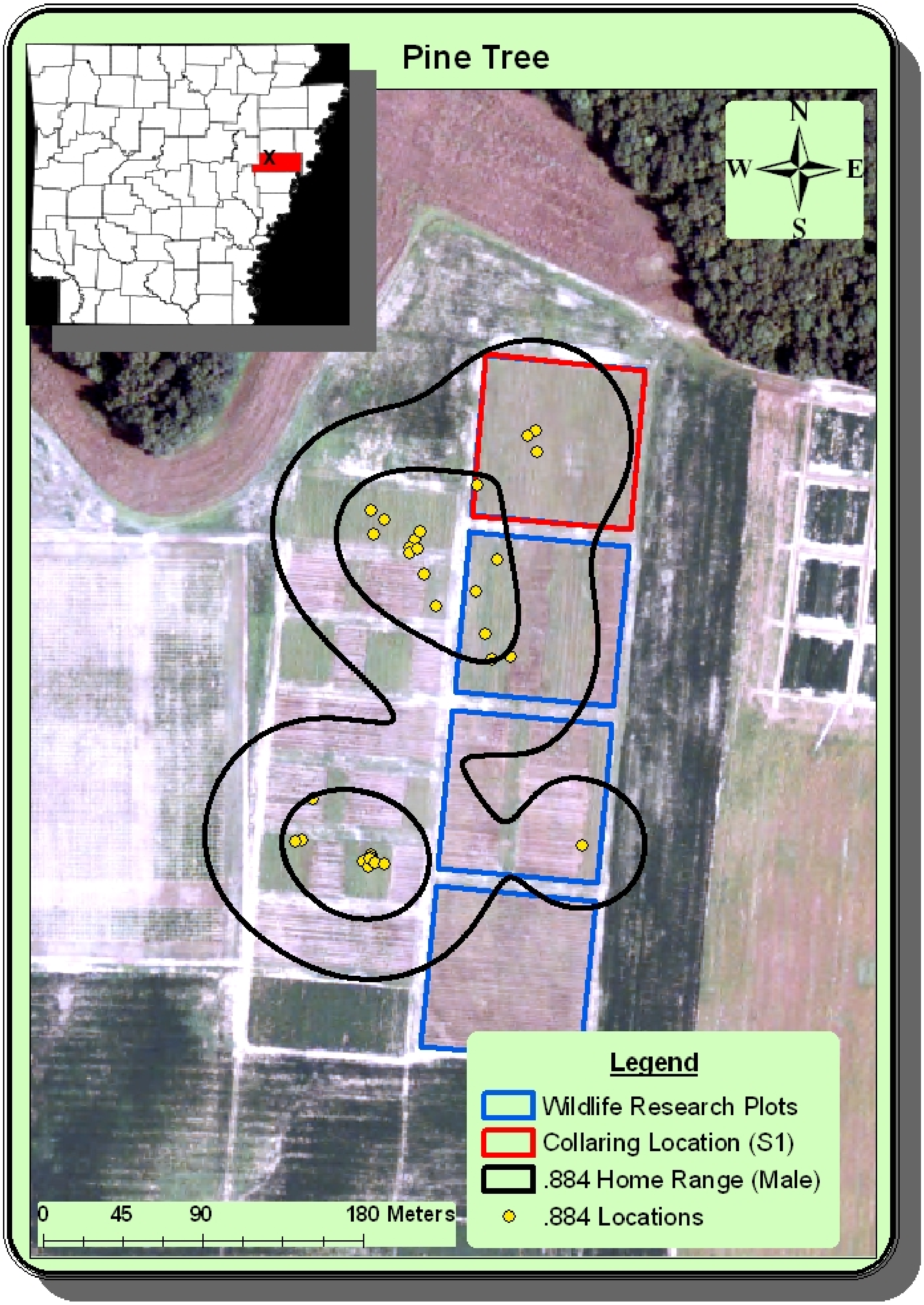


Figure A19. Home range results of individual .884 collared at the Pine Tree Branch Experimental Station, St. Francis County, Arkansas, 2011. The exterior line represents the 95% home range, while the interior lines represent the 50% (core) home ranges.

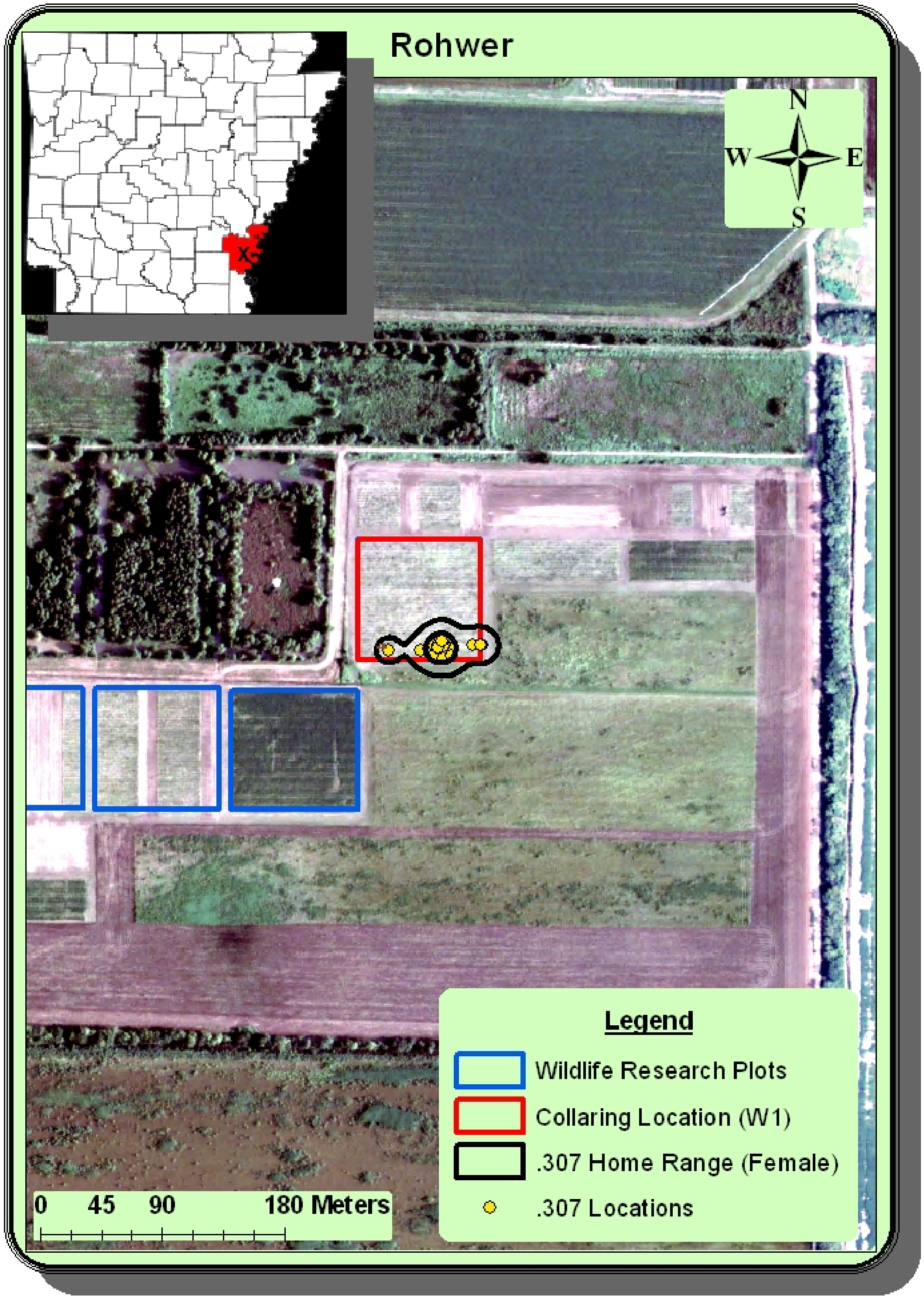


Figure A20. Home range results of individual .307 collared at the (Rohwer) Southeast Research and Extension Center, Desha County, Arkansas, 2011. The exterior line represents the 95% home range, while the interior line represents the 50% (core) home range.

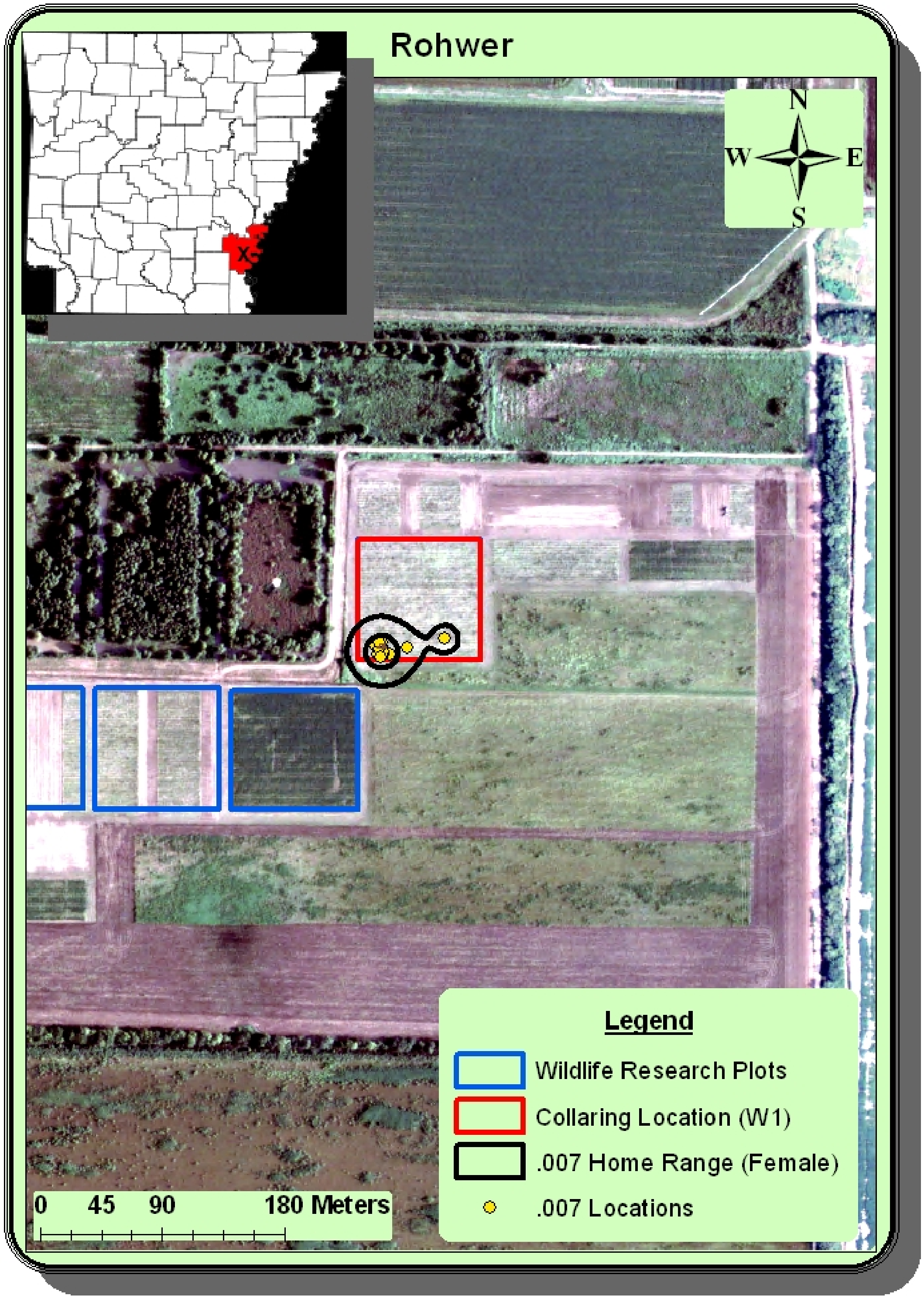


Figure A21. Home range results of individual .007 collared at the (Rohwer) Southeast Research and Extension Center, Desha County, Arkansas, 2011. The exterior line represents the 95% home range, while the interior line represents the 50% (core) home range.

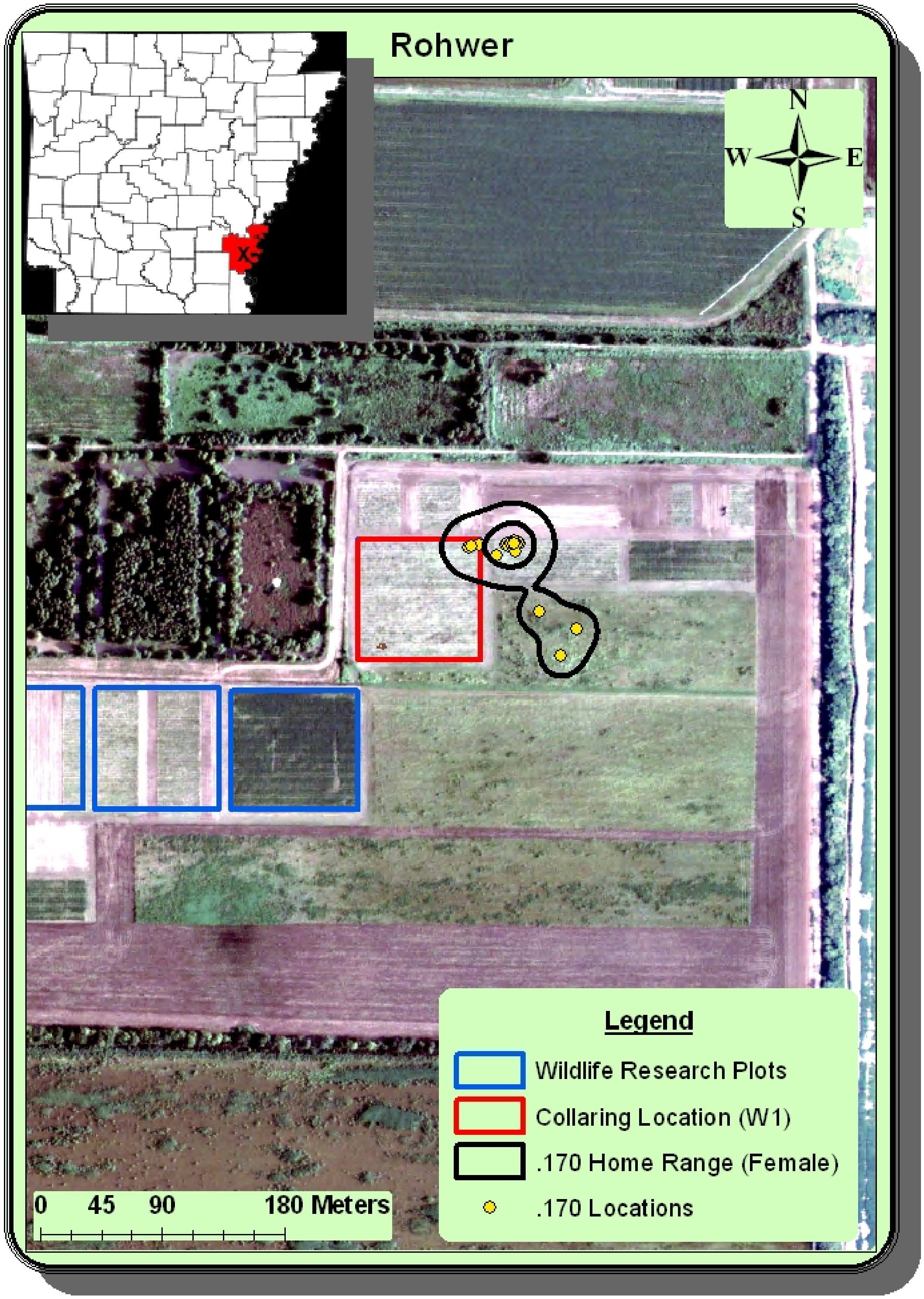


Figure A22. Home range results of individual .170 collared at the (Rohwer) Southeast Research and Extension Center, Desha County, Arkansas, 2011. The exterior line represents the 95% home range, while the interior line represents the 50% (core) home range.

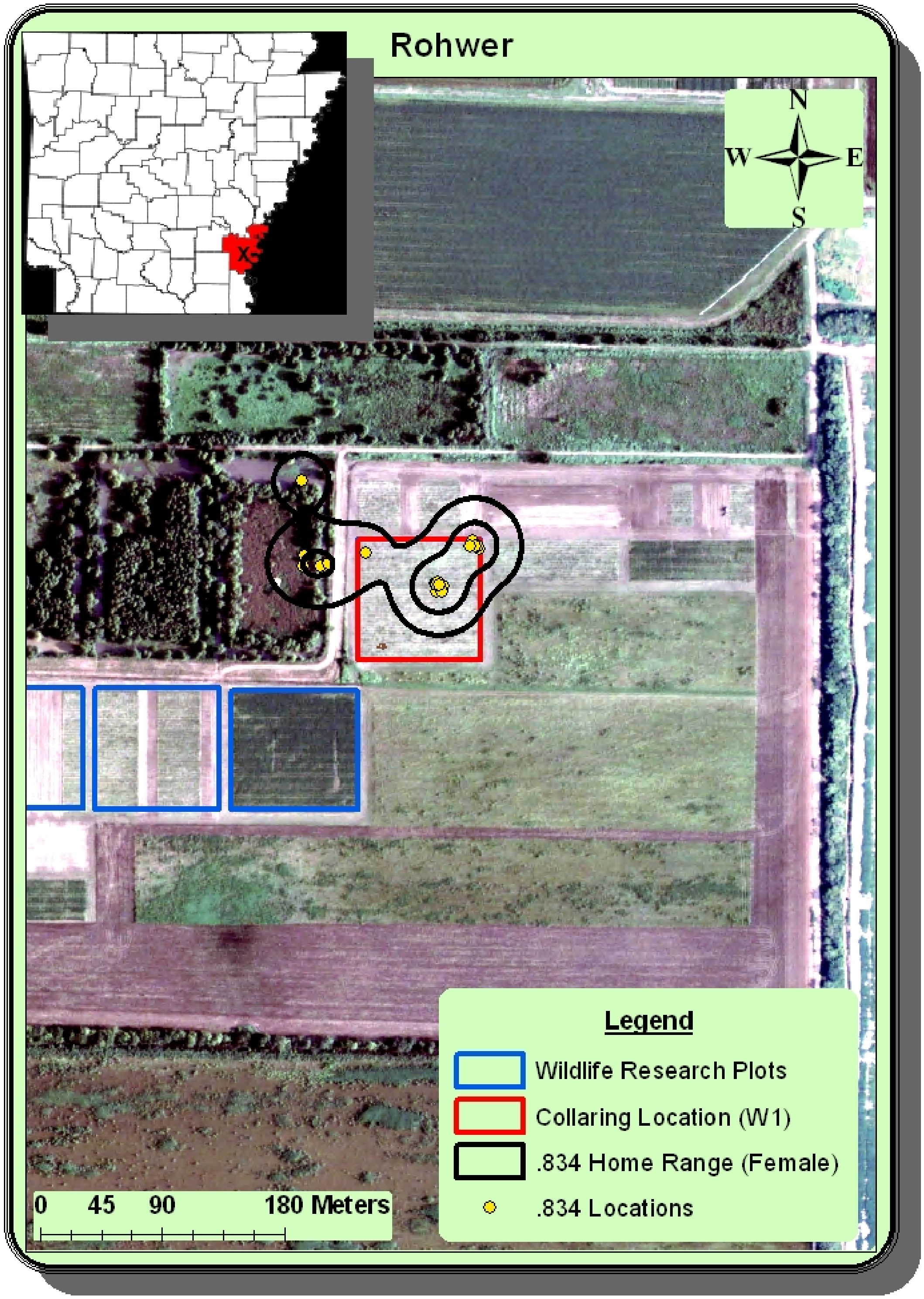


Figure A23. Home range results of individual .834 collared at the (Rohwer) Southeast Research and Extension Center, Desha County, Arkansas, 2011. The exterior line represents the 95% home range, while the interior lines represent the 50% (core) home ranges.

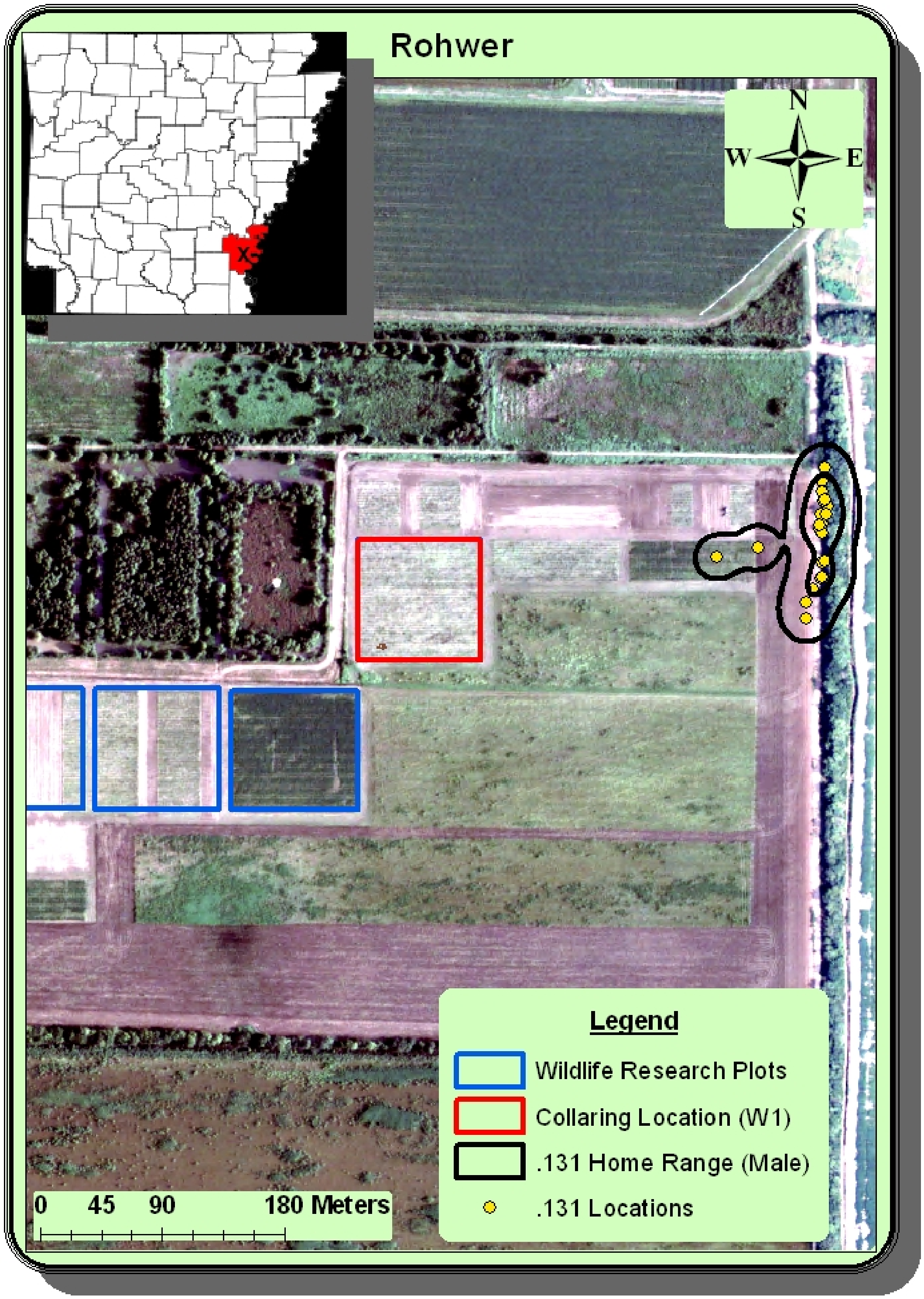


Figure A24. Home range results of individual .131 collared at the (Rohwer) Southeast Research and Extension Center, Desha County, Arkansas, 2011. The exterior line represents the 95% home range, while the interior line represents the 50% (core) home range.

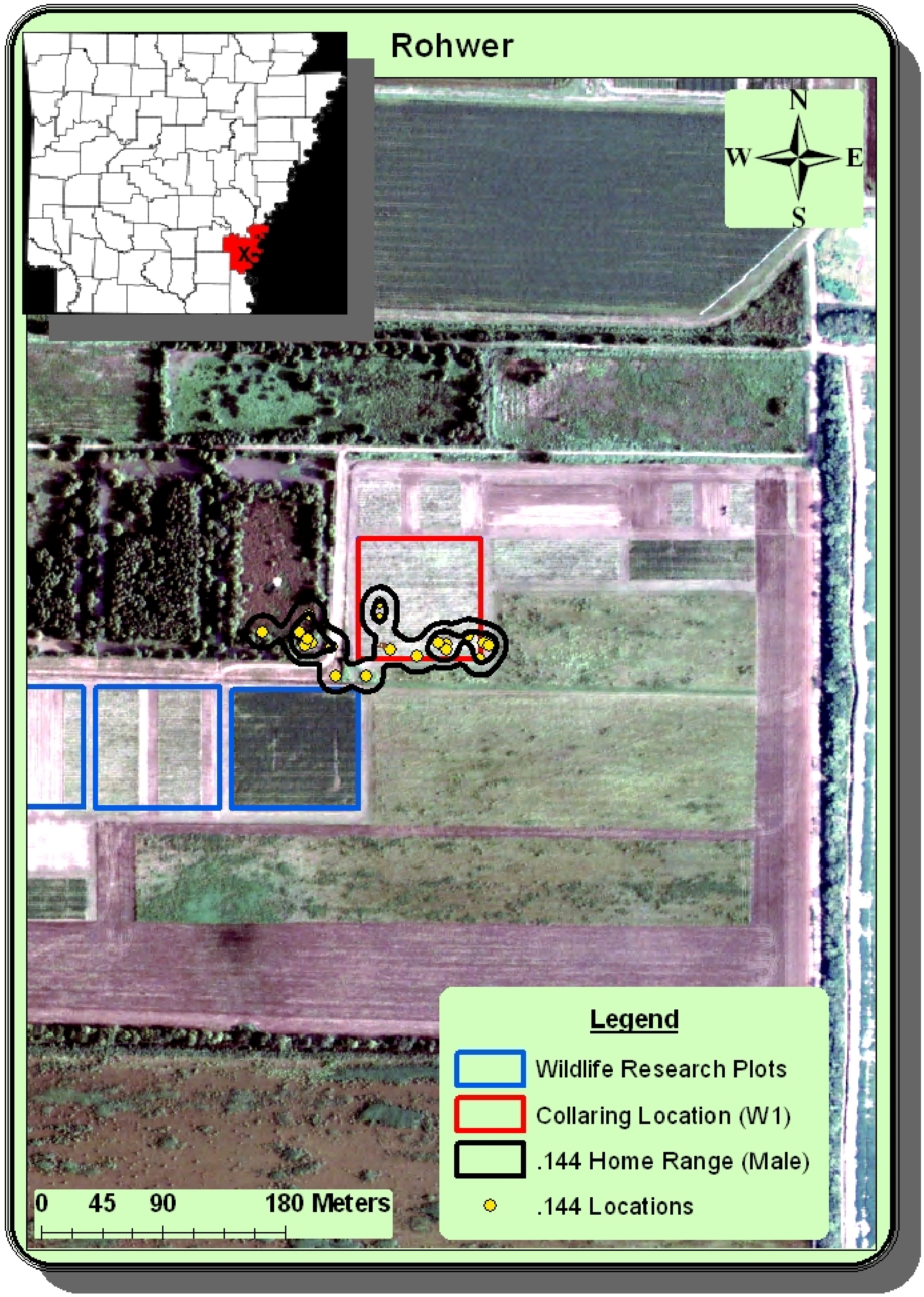


Figure A25. Home range results of individual .144 collared at the (Rohwer) Southeast Research and Extension Center, Desha County, Arkansas, 2011. The exterior line represents the 95% home range, while the interior lines represent the 50% (core) home ranges.

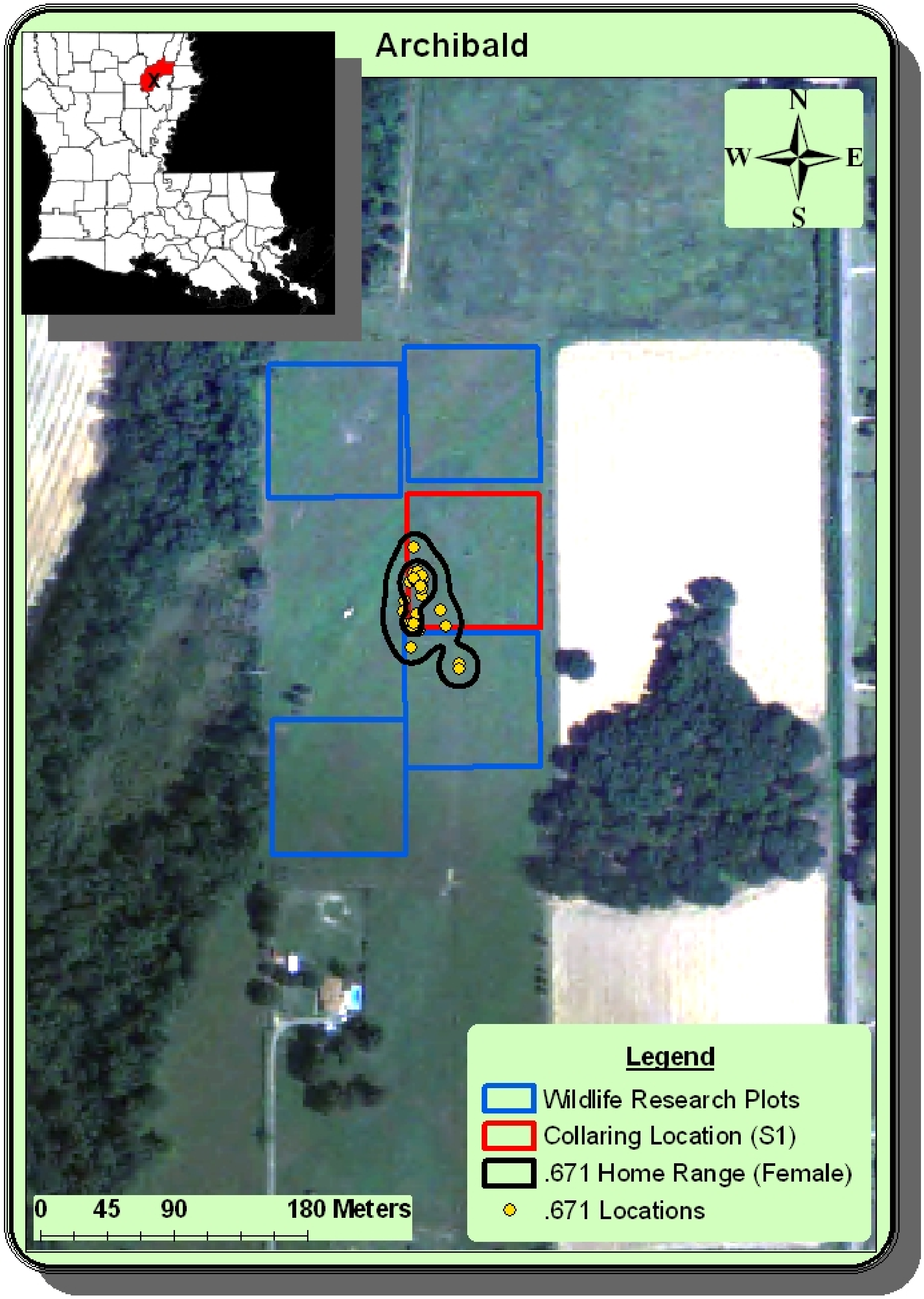


Figure A26. Home range results of individual .671 collared at (Archibald) Stevenson Farms, Richland Parish, Louisiana, 2011. The exterior line represents the 95% home range, while the interior line represents the 50% (core) home range.

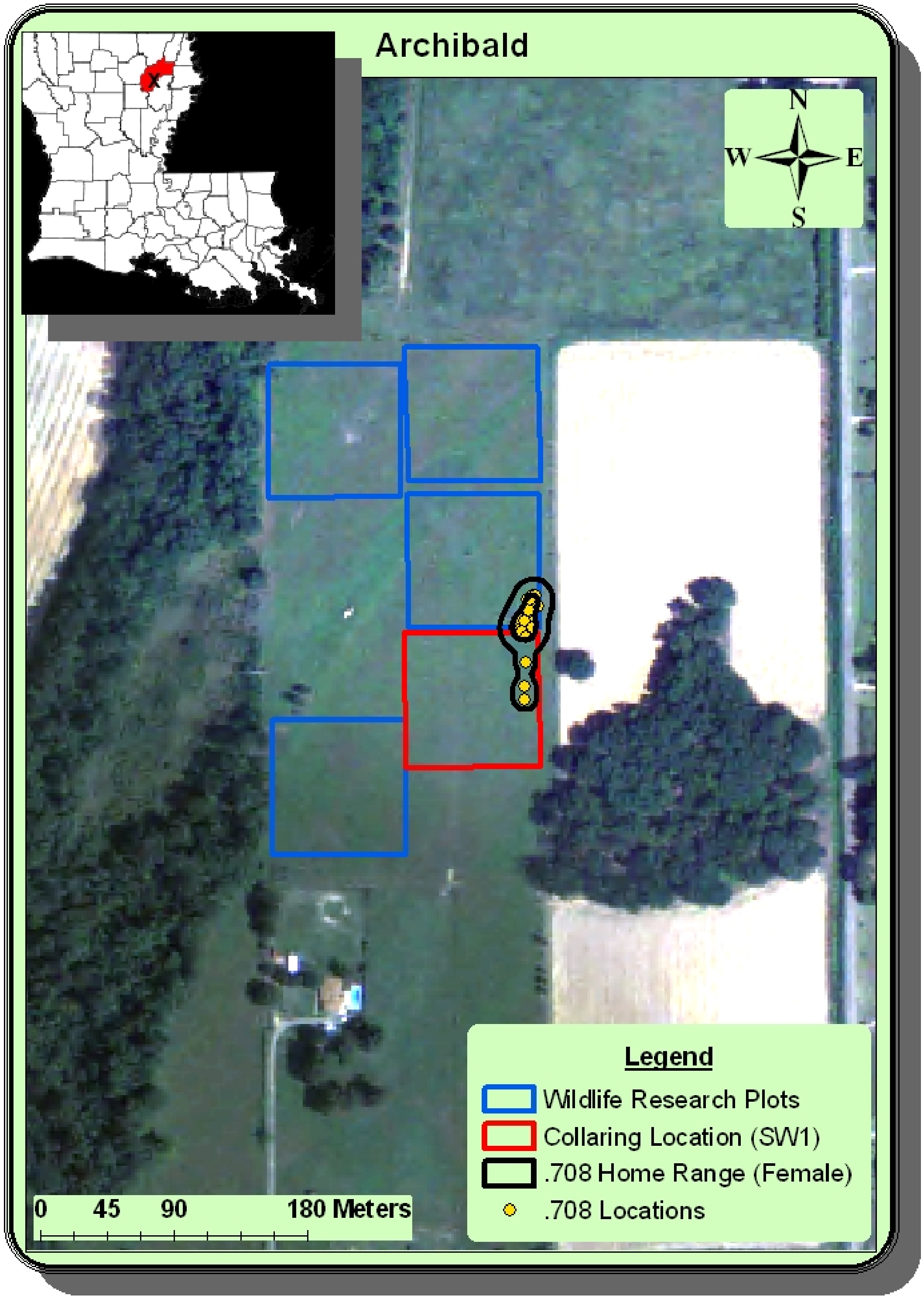


Figure A27. Home range results of individual .708 collared at (Archibald) Stevenson Farms, Richland Parish, Louisiana, 2011. The exterior line represents the 95% home range, while the interior line represents the 50% (core) home range.

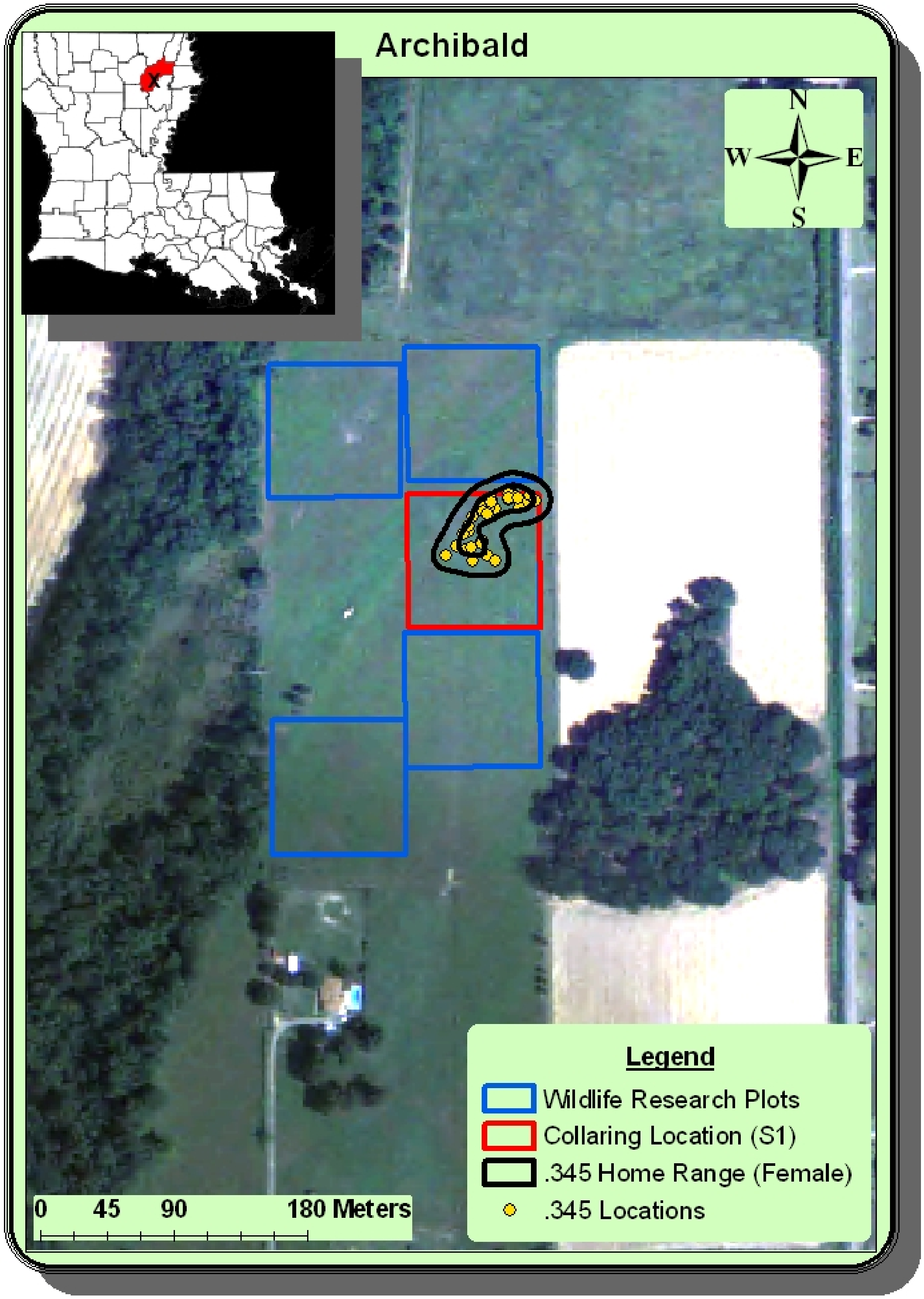


Figure A28. Home range results of individual .345 collared at (Archibald) Stevenson Farms, Richland Parish, Louisiana, 2011. The exterior line represents the 95% home range, while the interior line represents the 50% (core) home range.

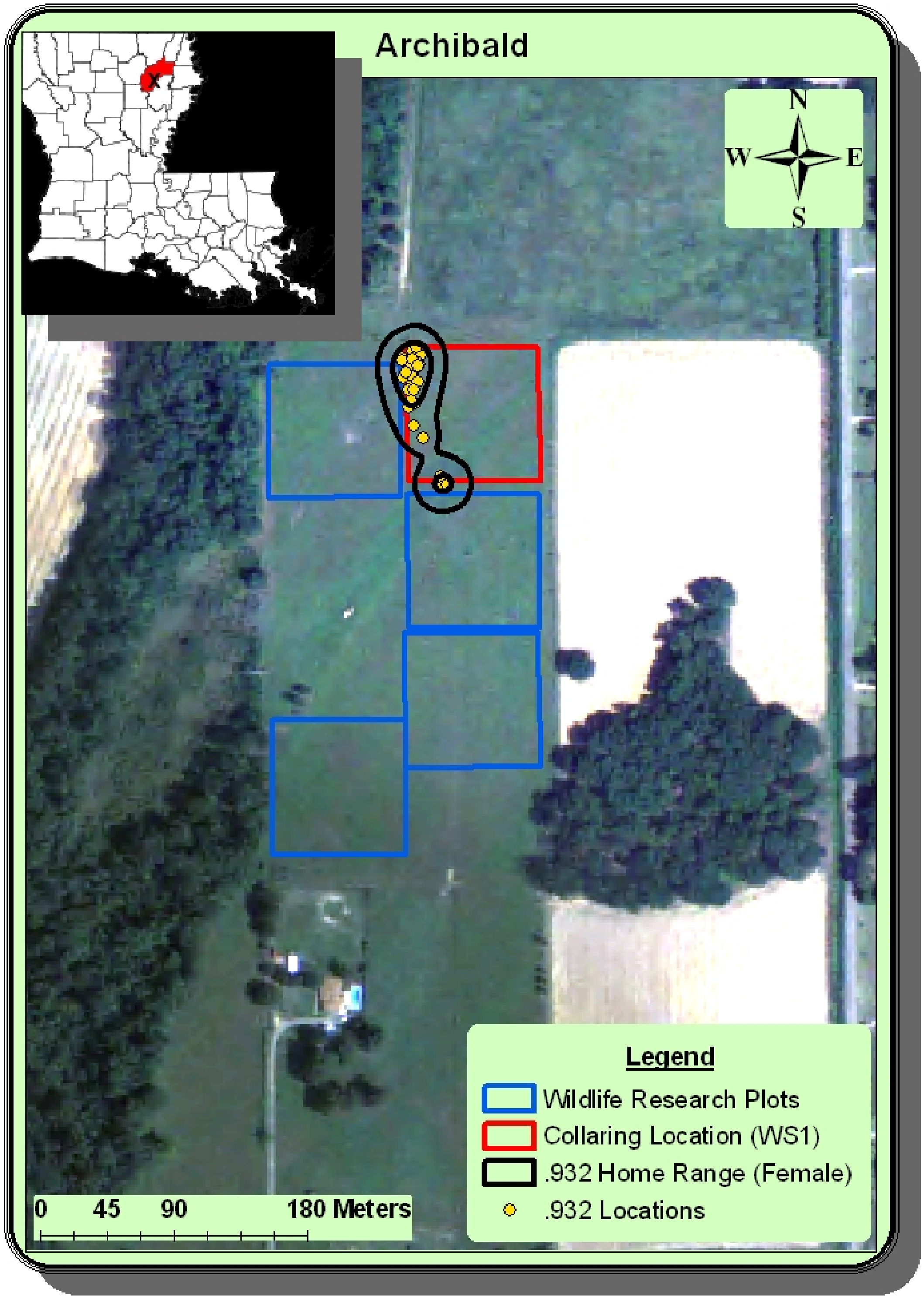


Figure A29. Home range results of individual .932 collared at (Archibald) Stevenson Farms, Richland Parish, Louisiana, 2011. The exterior line represents the 95% home range, while the interior lines represent the 50% (core) home ranges.

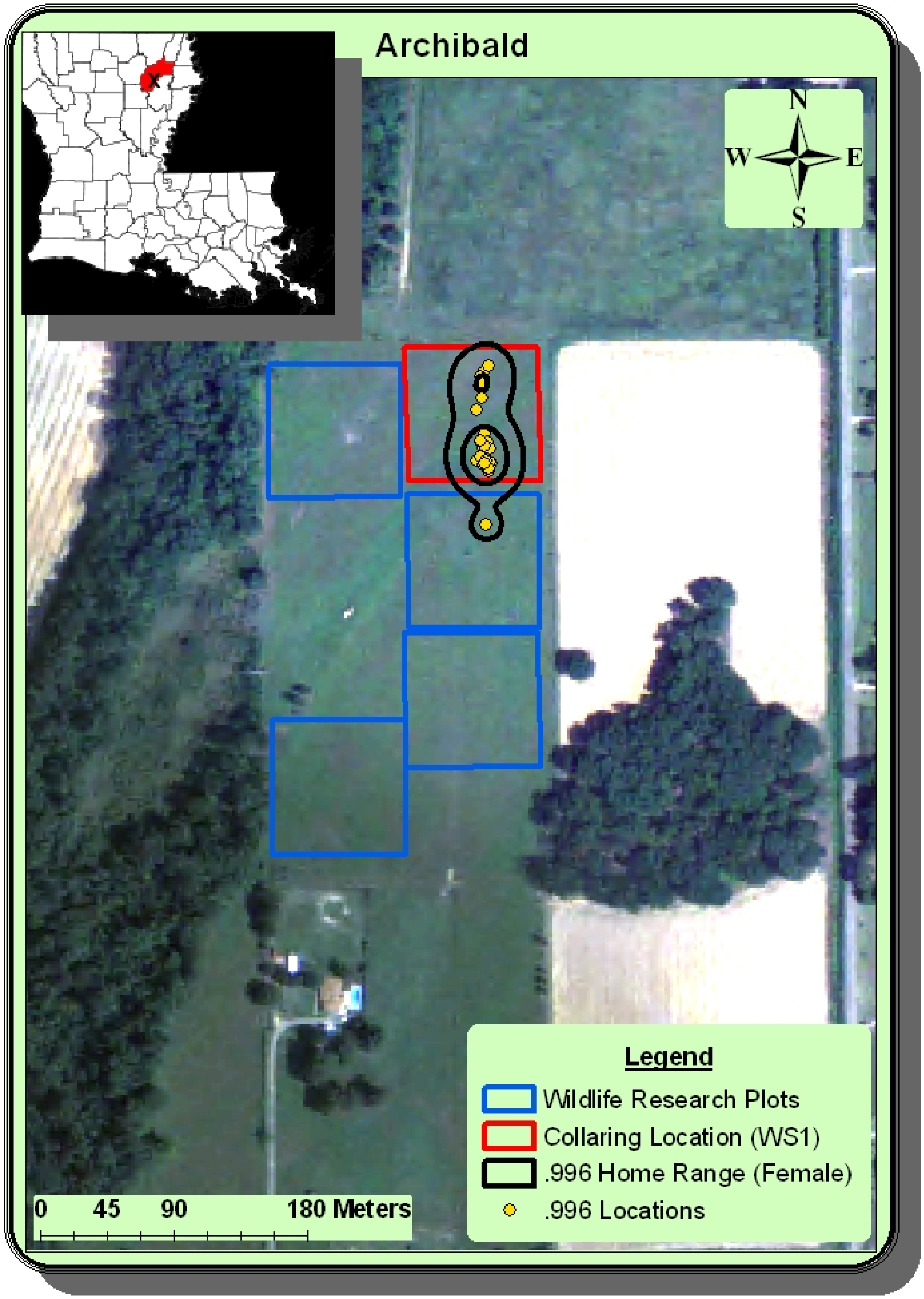


Figure A30. Home range results of individual .996 collared at (Archibald) Stevenson Farms, Richland Parish, Louisiana, 2011. The exterior line represents the 95% home range, while the interior lines represent the 50% (core) home ranges.

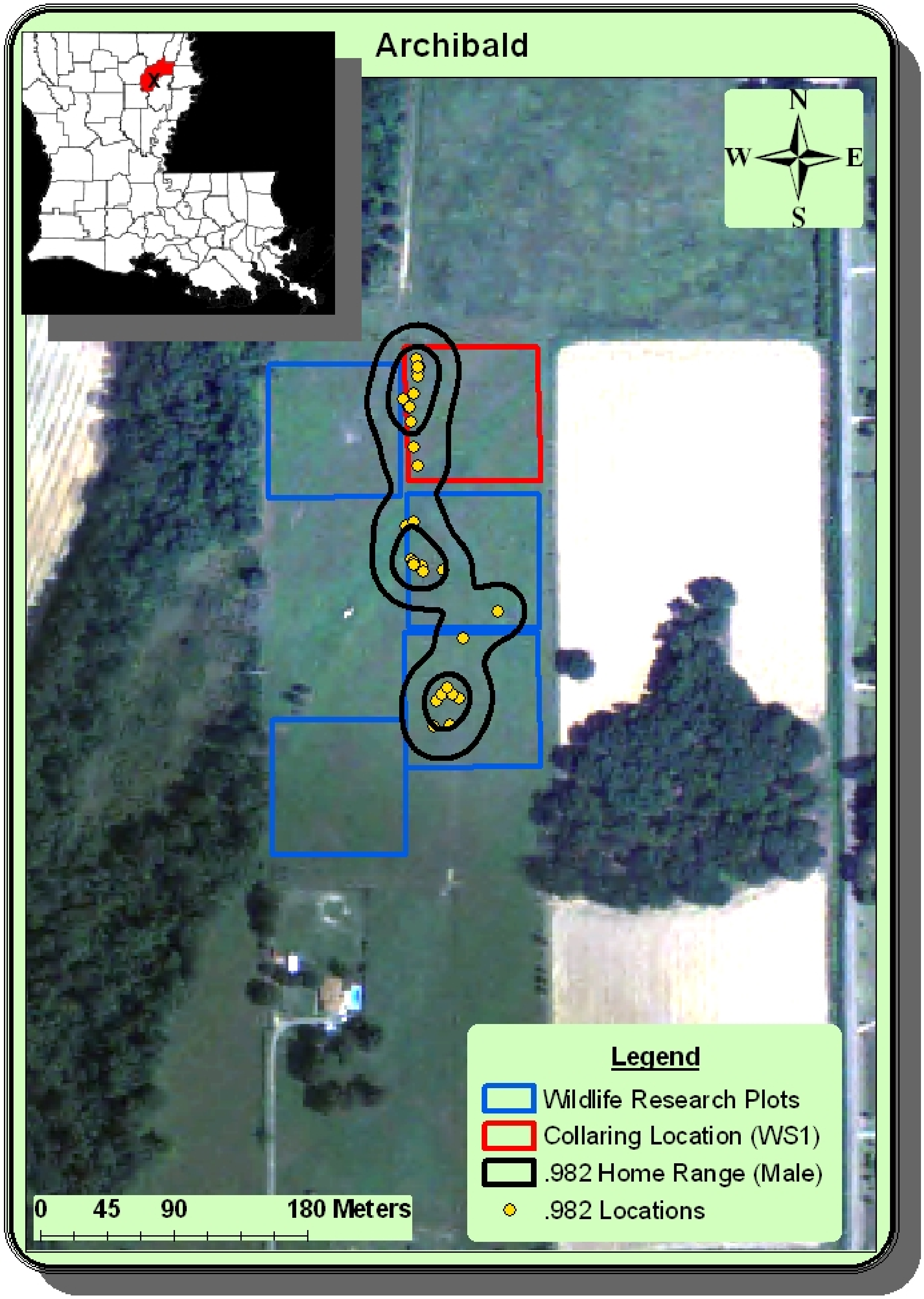


Figure A31. Home range results of individual .982 collared at (Archibald) Stevenson Farms, Richland Parish, Louisiana, 2011. The exterior line represents the 95% home range, while the interior lines represent the 50% (core) home ranges.

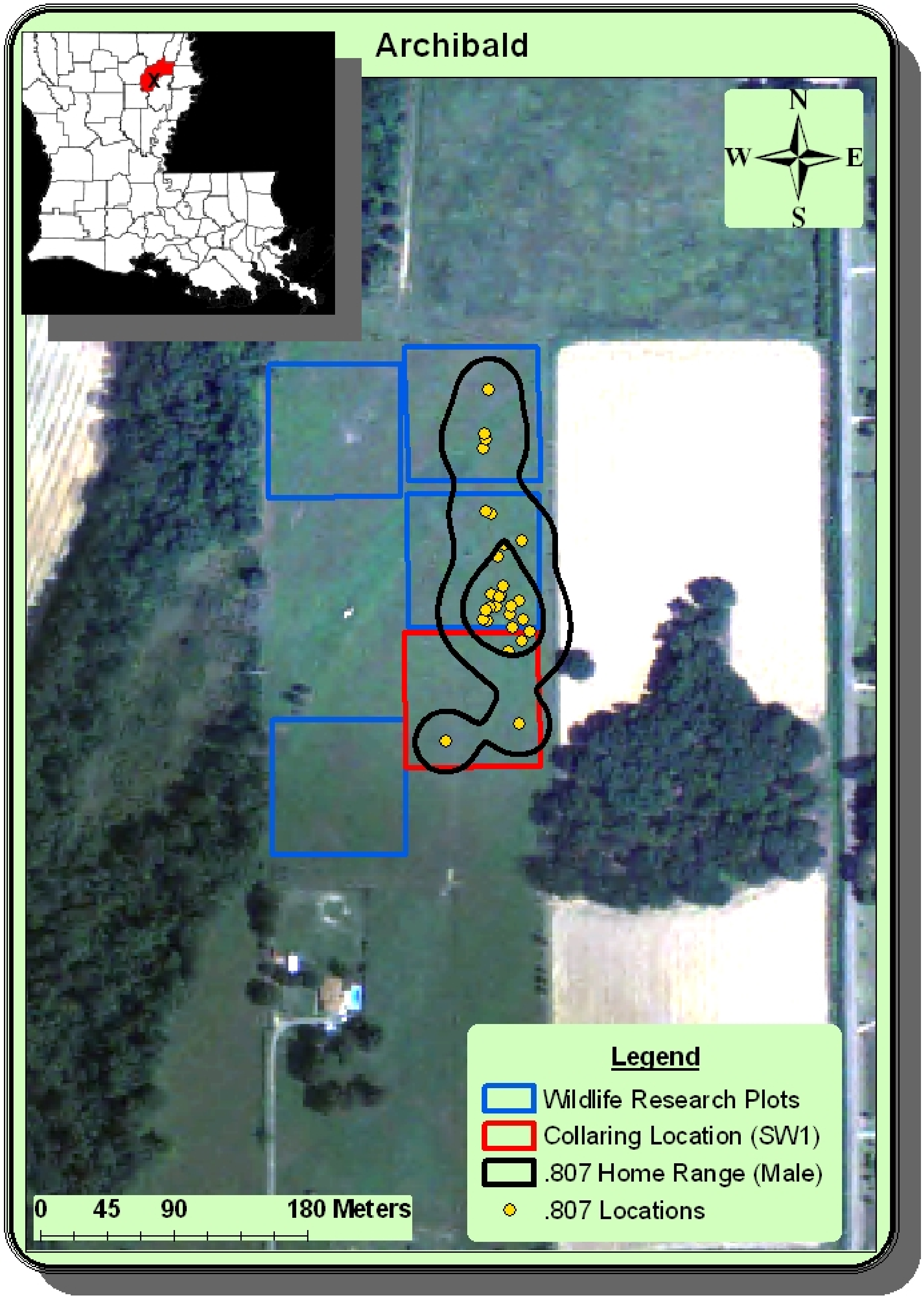


Figure A32. Home range results of individual .807 collared at (Archibald) Stevenson Farms, Richland Parish, Louisiana, 2011. The exterior line represents the 95% home range, while the interior line represents the 50% (core) home range.

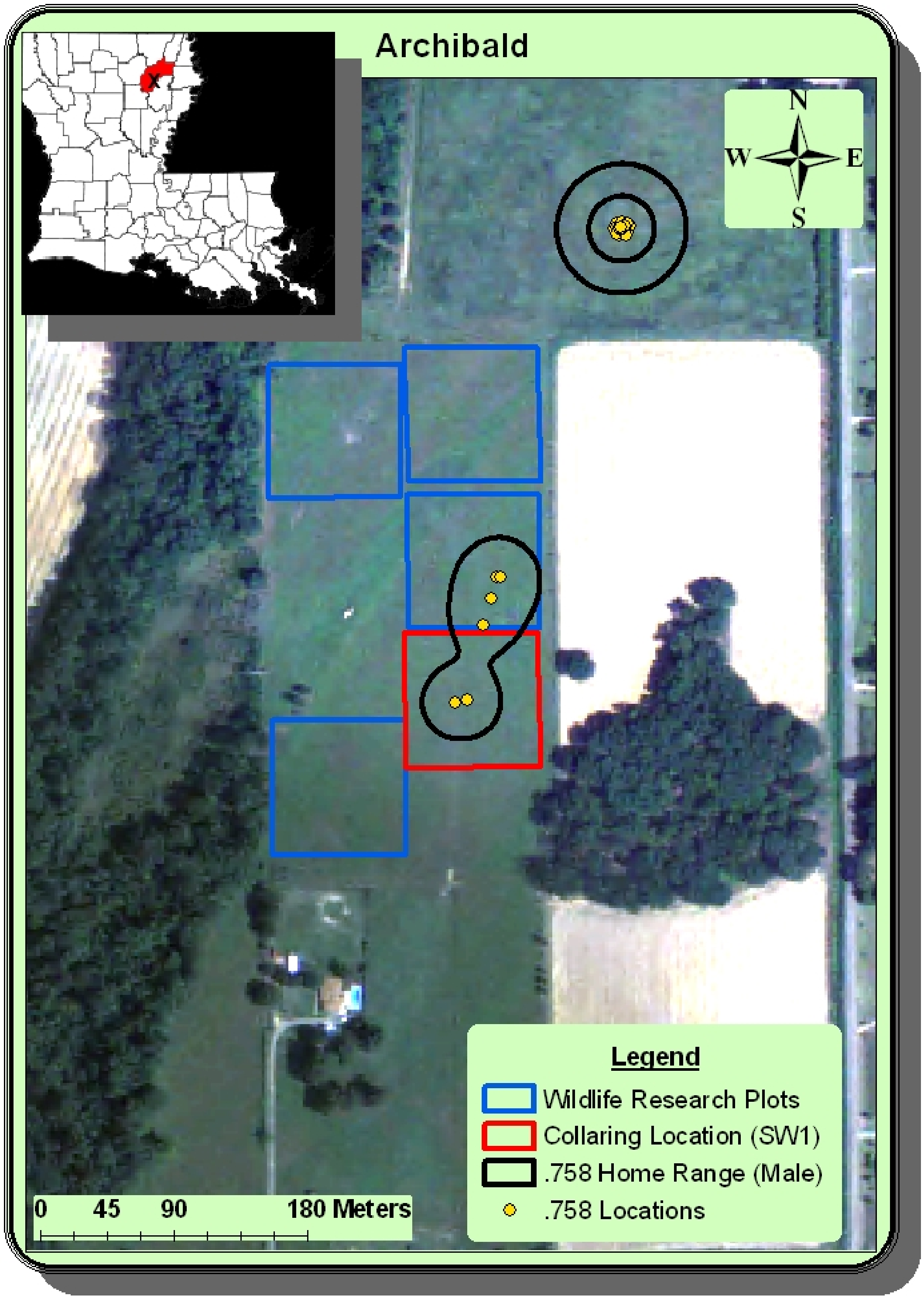


Figure A33. Home range results of individual .758 collared at (Archibald) Stevenson Farms, Richland Parish, Louisiana, 2011. The exterior lines represent the 95% home range, while the interior line represents the 50% (core) home range.