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I am submitting herewith a thesis written by Carrie Hedio Salyers entitled "Occupancy of Small Mammals on Private Lands in the Emory/ Obed Watershed, Tennessee." I have examined the final electronic copy of this thesis for form and content and recommend that it be accepted in partial fulfillment of the requirements for the degree of Master of Science, with a major in Wildlife and Fisheries Science.

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OCCUPANCY OF SMALL MAMMALS ON PRIVATE LANDS IN THE EMORY/OBED WATERSHED, TENNESSEE

A Thesis
Presented for the
Master of Science Degree
The University of Tennessee, Knoxville

Carrie Hedio Salyers
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DEDICATION

I dedicate this thesis to my dad, mom, and sister, Richard, Linda, and Lauren Hedio, and to my grandfather Floyd Lockhart for their continued support and love throughout my entire life. Everyone deserves a family as supportive as you. And to the three most important things that I have gained throughout this project--my husband Brac, who started this journey with me in Wartburg, and to our dogs Mazie and Blue….who knew what "treasures" east Tennessee woods held.

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ABSTRACT

The Emory/Obed watershed of the Cumberland Plateau area of Tennessee is an important area for wildlife conservation and has recently been subjected to land-use changes. This study was conducted to determine if occupancy of selected mammalian species was affected by land-use and habitat characteristics, and to provide baseline data before further land-use changes occur in the region. Small mammal trapping was conducted in a total of 132 sample sites from June through August in 2002, 2003, and 2004 using live traps. A total of 11 mammalian species was trapped. Three species were trapped in sufficient numbers to evaluate occupancy and habitat characteristics including eastern chipmunks (*Tamias striatus,* n = 69*),* eastern gray squirrels (*Sciurus carolinensis,* n = 95*)*, and white-footed mice (*Peromyscus leucopus,* n = 343*).* Vegetation sampling was also completed at each site to measure diameter at breast height (dbh), number of logs of downed woody debris (DWD), number and height of snags (SNAGS), number and species of woody stems (STEMS), visual estimates of overstory height (OVERHGT), total basal area and basal area of mast producing species including oak (OAK), hickory (HICKORY) and hickory and oak (HICKORY+ OAK), severity of any disturbances (DIST), the time since that disturbance (DISTAGE), and succession of the stand (SUCCESSION). We used occupancy models to determine what site factors affected detection and occupancy. White-footed mice had lower occupancy as the season progressed, eastern chipmunks occurred more frequently in areas with low basal area, and eastern gray squirrels had higher occurrence in areas with low stem density. The occupancy rate determined with model averaging was 0.82 (SE = 0.06) for white-footed mice, 0.38 (SE = 0.14) for eastern chipmunks, and 0.37 (SE = 0.08) for eastern gray

squirrels. Small mammal population densities and species richness are crucial to wildlife conservation. Populations of these small mammals should continue to be monitored using occupancy models to determine if rates are stable or decreasing due to management of private lands. Future effort should be directed towards trapping habitat-sensitive species to gain a better understanding of the effects of fragmentation on mammalian species.

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PART I

INTRODUCTION

INTRODUCTION

Perceived as extensive, diverse, and vital, the forests in the southern United States are driven by development and environmental changes. More than 5 million private landowners control 89 % of the southern forests. Therefore, landowner interests and objectives influence forest conditions, resulting in an ever-changing forest patchwork (Weir and Greis 2002).

Fragmentation has the potential to alter aspects of the ecology at an individual (Shepard and Swihart 1995), population (Verboom et al. 1991), and community (Laurance 1991) level. The Cumberland Plateau has one of the highest concentrations of interior forests in the South and lies in the heart of the central hardwood region. The majority of forests have become fragmented, and many converted into agriculture, urban areas, and roads.

Due to this fragmentation, many concerns have been raised regarding the accelerating rate of change and its effects on the sustainability of southern forests and the values they provide. Little is known how fragmented lands within the southeast affect small mammal populations. At this time, no regional-level models exist for forecasting the effects of land use change on southeastern wildlife.

Objectives

This study was designed to evaluate multi-scale effects of habitat fragmentation in the Cumberland Plateau area of Tennessee on mammalian community structure. The primary objectives were to:

1. Determine if occupancy of selected mammalian species in the Emory/Obed watershed of the Cumberland Plateau Area of Tennessee is affected by land-use and habitat characteristics.
2. Provide baseline data on selected mammalian species before further land-use changes occur in the Cumberland Plateau Area of Tennessee.

PART II

LITERATURE REVIEW

LITERATURE REVIEW

Fragmentation

Within the past 100 years, many ecosystems across the country have been altered by human development and growth and have become fragmented. Since the development of agriculture, the natural vegetation of every continent except Antarctica has been extensively modified (Saunders et al. 1991). Multiple land uses, infrastructure, and parcelization of land causes fragmentation of forests, affecting the size and amount of contiguous forest patches as well as the loss of interior habitat and wildlife species (Wear and Greis 2002).

Habitat fragmentation generally refers to two components of land transformation: habitat loss and isolation (Collinge1996). Two theories in community and population ecology, island biogeography (MacArthur and Wilson 1967) and metapopulation dynamics (Levins 1969) have served as the framework for studies on habitat fragmentation. The theory of island biography was initially proposed to explain species composition of animal communities on oceanic islands (MacArthur and Wilson 1967). The size and distance of the island from a continental source of potentially colonizing species determines the number of species present on the island. Thus, large islands close to continents would have a higher number of species than small islands distant from continents. Although this theory focused on oceanic islands, the authors suggested that the predictions may be consistent for both plant and animal communities inhabiting terrestrial “islands” (MacArthur and Wilson 1967).

A metapopulation is a group of spatially separated populations of the same species, which interact at some level (Levins 1969). Local populations undergo periodic colonization and extinction, while the whole metapopulation persists indefinitely (Collinge 1996). This theory has been applied to predicting the persistence of species that occur in human-induced habitat fragments (Hanski et al. 1995).

Depending on severity and location, fragmentation can be viewed as having both positive and negative attributes. Fragmentation of environments is not always undesirable. On some scale, nearly all environments and species-specific habitats are fragmented, because they occur on different continents or land masses. Naturally occurring events including floods, fires, and glaciation have disrupted what would otherwise be continuous expanses of both plant and animal populations throughout time (Collinge 1996). In some circumstances, new morphs or life forms are formed in response to natural spatial and temporal fragmentation of environments or resources (Morrison et al. 1998).

Fragmentation also results in changes in the physical characteristics across the landscape. Alterations of radiation, wind, and water can all have important effects on remnants of native vegetation. Shade-tolerant species may become restricted to the interior with other species requiring different distances from the edge (Saunders 1991). Distinct "interior" and "edge" eastern tree species sets have been recognized in landscapes fragmented for some time (Ranney et al. 1981). Removal of trees can cause increased heating of soils, which can affect soil microorganism and invertebrate numbers and activity (Klein 1989). Changes in soil microorganisms and invertebrates affects litter decomposition and soil moisture retention (Saunders 1991). Trees exposed to the edge of

the fragmented parcel will have increased exposure to wind, which could result in damage to the vegetation.

The type of landscape also plays a significant part in determining how populations will react to fragmentation. Previous fragmentation studies and theories have been conducted and hypothesized in tropical communities (MacArthur and Wilson 1967, Lovejoy et al. 1984, 1986, Klein 1989). However, temperate communities may be more resistant to fragmentation than tropical ones. Species in temperate communities should be able to continue in smaller patches of suitable habitat because of their better dispersal capabilities and tendency to occur in higher densities (Wilcove et al. 1986).

Both dispersal behavior and demography of a species may affect individual response to fragmentation (Wilcove et al. 1986, Kareiva 1987). The extent of the landscape change including the size (area), connectivity (corridors), shape (perimeter/area ratio of the habitat fragment; Groom and Schumaker 1993), and heterogeneity of the remaining habitat fragments may also affect the response.

Fragmentation causes a reduction in the total area of habitat available, and breaks remaining habitat into isolated remnants. Increased densities of surviving fauna could occur in these remnants because of a species' low dispersal rate, or if the surrounding landscape is considered uninhabitable by that species (Wilcove et al. 1986). Insularization, the process of isolate formation of a species through fragmentation (Wilcox 1980), can occur to the remaining species on these "habitat islands". Extinction can be caused by insularization through the reduction of total habitat area (Wilcove et al. 1986). The most rapid extinctions are likely for species that depend entirely on native vegetation, those that require large territories, and those that exist at low densities

(Saunders 1991). A species may be able to temporarily exist in a highly fragmented landscape, but be headed to extinction (ter Braak et al. 1998). Also a species able to maintain in a disturbed landscape at some level may disappear if slight additional fragmentation occurs (Fahrig 2001). Therefore, an understanding of the effects of habitat fragmentation on communities and populations of organisms has resulted in increased importance for conservation and management of biotas, as human-dominated landscapes become more prevalent (Collinge 1996).

A growing number of studies determining the effects of fragmentation on mammalian populations have been conducted across the mid-western states including Illinois, Indiana, Iowa, Minnesota, Missouri, Ohio, and Wisconsin (Nupp and Swihart, 1996, Rosenblatt et al. 1999, Moore and Swihart 2005). These studies have focused on the relationship between habitat area and number of species (Rosenblatt et al. 1999) or the effects of fragmentation on individual species (Nupp and Swihart 1996, 1998). Little work has been conducted within the southeastern states, particularly Tennessee, in determining the effects of fragmentation on small mammal populations.

Occupancy Models

Occupancy is defined as the proportion of area, patches, or sample units that are occupied by a species (MacKenzie et al. 2006). A unit is occupied if the species is always present physically somewhere within that unit over a set period of time. Use of a unit occurs when the species is present only at random points of time (MacKenzie et al. 2005).

Presence-absence data are used by biologists in a variety of situations ranging from monitoring populations on large scales to identifying habitats of high value to

specific species (MacKenzie 2005). The presence of a species can be confirmed by trapping or observation, however it is difficult to confirm a species is absent (MacKenzie 2005). A species declared absent may occur at a site but not be detected because of trap avoidance or habitat use in another portion of the home range during trapping. Detectability is not constant in time or space for either a species or an individual (Vojta 2005). Terms such as "presence-not detected" have been used to acknowledge that nondetection of a species does not necessarily equate to a true species absence (MacKenzie et al. 2005). However, MacKenzie (2005), suggested detection-nondetection as a more appropriate description for such studies because surveyors are actually measuring the observed outcome and not whether the species is actually a resident at a particular location

Unfortunately, imperfect detection can bias parameter estimates (Tyre et al. 2003, Gu and Swihart 2004, MacKenzie 2005). When detection-nondetection data were regarded as presence-absence data, Tyre et al. (2003) showed that habitat-related effects on presence (occupancy) were underestimated by simple logistic regression. Likewise, Gu and Swihart (2004) concluded that logistic regression on "presence-absence" data lead to erroneous conclusions concerning habitat suitability, even when levels of nondetection were small. However, MacKenzie et al. (2002) found detection probabilities and occupancy rates could be estimated by incorporating detection histories directly into maximum likelihood estimation models (Vojta 2005). By determining detection probabilities for target species, one could allow unbiased estimates of occupancy (McKenzie et al. 2005). Repeated surveying of landscape units within a

season allows detection probabilities to be directly incorporated into inferential procedures (MacKenzie 2005).

Occupancy models have been used to understand habitat requirements for a variety of species. Ball et al. (2005) used occupancy models to re-evaluate an existing habitat model for the Palm Springs ground squirrel (*Spermophilus tereticaudus chlorus*). Accounting for imperfect detectability, the authors were able to determine that occupancy rates for the squirrels differed by vegetation and substrate types; these factors were not considered important predictors in the original model. Moore and Swihart (2005) were able to determine the effects of fragmentation on five granivorous rodent species with the use of occupancy models. Using a likelihood approach and multi-model inference, the authors were able to obtain unbiased estimates of species when detection rates were low or varying. They were able to show that detectability estimates could be used to correct simple presence-absence indices. Finely et al. (2005) were able to design a monitoring plan for the threatened swift fox (*Vulpes velox*) of Colorado using occupancy models. They incorporated detection probability based on number of trapping occasions and grids into a monitoring system with nearly an 80 % power to detect varying declines in the population.

Small Mammal Populations in Tennessee

Mammalian habitats in the south central states are both diverse, complex, and in general have exceptionally rich flora (Watts 1983, Choate et al., 1994). According to Choate et al. (1994), approximately 95 species of mammals are native to the south central states. Of that number, a reported 77 species occur throughout Tennessee, which is the greatest total number of mammalian species of any state within the region (Choate et al.,

1994). However, the effect of changing environments on mammalian distribution in the south-central states is not well known (Choate et al. 1994).

Because of low trapping numbers for most species of small mammals in the south central states, we focused our attention on three species of interest, the white-footed mouse (*Peromyscus leucopus*), eastern chipmunk (*Tamias striatus*), and the eastern gray squirrel (*Sciurus carolinensis*). Choate et al. (1994) classified all three of these species as occurring in the eastern faunal element. The term faunal element has been applied to groups, which may have evolved in the same region, may have followed similar routes of dispersal, or may have similar ecological requirements (Armstrong et al. 1986, Choate et al. 1994). All range southward into the south-central states, however none are found throughout the entire region (for example, the coastal marshes of Louisiana; Choate et al. 1994).

White-footed mice, eastern chipmunks, and eastern gray squirrels are members of the order Rodentia. The Rodentia are represented by more native species (35) in the south-central region than any other mammalian order (Choate et al. 1994). Rodents comprise around 33 % of the mammal species in each state within the region. The number of rodent species present is greater in states containing mountains than in states bordering the Gulf of Mexico. Tennessee contains the most rodent species of any other regional state, and its 26 rodent species comprise about 34% of its mammals (Choate et al. 1994).

White-Footed Mouse (*Peromyscus leucopus*)

The white-footed mouse is a common species in the eastern United States and it occurs throughout the south-central region except for southern Alabama, Georgia, South Carolina, and all of Florida (Dickson 2001). White-footed mice are generalists that

primarily inhabit deciduous forests and their borders. Considered as one of the most abundant small mammals of southern forests (Whitaker and Hamilton 1998), they are very abundant in a wide variety of different stand types ranging from eastern mountain hardwoods to bottomland hardwoods. They inhabit stands of all ages, but are particularly prominent in mature stands (Dickson 2001). White-footed mice are also found in a variety of other habitat types, including hedgerows, grasslands, cultivated fields, and brushy areas (Iverson et al. 1967, Whitaker 1967). They are often associated with structures such as rocks, downed logs, stumps, and logging slash. They feed on a variety of vegetative matter including seeds and berries, and on invertebrates (Hall 1981, Dickson 2001). In the south-central region, the breeding season of white-footed mice extends throughout the year, with reduced activity in the summer (Choate et al. 1994). The annual population turnover is almost 100 % (Whitaker and Hamilton 1998).

Henein et al. (1998) and Nupp and Swihart (1998) consider this species as a possible benefactor of forest fragmentation, expected to thrive in highly fragmented landscapes, due to their small spatial requirements, generalist nature, and tolerance of marginal habitats (Linzey and Kesner 1991). Responses of white-footed mice to fragmentation are of special interest because they are an important prey item for many predators, a primary disperser of seeds, and an important host species for the black-legged tick (*Ixodes scapularis*), the primary vector of Lyme disease (Wolf and Batzli 2004).

Eastern Chipmunk (*Tamias striatus)*

The eastern chipmunk generally occurs in the central and northwest portion of the southern United States, and is mostly absent from the costal plain (Hall 1981, Dickson

2001). Favored habitat includes the edges of oak (*Quercus* spp.)/hickory (*Carya* spp.) or beech (*Fagus grandifolia*)/maple (*Acer* spp.) forests (Whitaker and Hamilton 1998). Chipmunks are also known to inhabit a variety of habitats including open brushy areas, wooded lots with a sparsely covered forest floor, half-rotted logs, and stone walls (Choate et al. 1994, Whitaker and Hamilton 1998). In Tennessee, chipmunks are commonly captured in mature hardwood and pine (*Pinus* spp.) stands (Dickson 2001). Their diet consists principally of seeds, nuts, insects, and fungi. Chipmunks are active from May through October, and consume and store large quantities of seeds primarily acorn and hickory nuts (Lowery 1974, Wolff 1996, Dickson 2001). Females bear one to two litters of usually four to five young in late March and April and midsummer (Choate et al. 1994).

Eastern chipmunks have been described as fragmentation-sensitive in previous studies (Henein et al. 1998, Nupp and Swihart 1998, 2000, Rosenblatt et al. 1999) because of lower apparent survival rates observed in smaller woodlots (Nupp and Swihart 1998) and a reported intolerance of non-wooded habitat (Bennett et al. 1994). Further confirming this dependency of wooded habitat was a 14-year study conducted by Wolff (1996) in which episodic production of mast was strongly correlated with reproduction and population fluctuations.

Eastern Gray Squirrel (*Sciurus carolinensis)*

Gray squirrel habitat is typically hardwood forests with dense woody understories. Gray squirrels also use mixed forests and city parks in urban areas throughout the southeast (Choate et al. 1994). They are most common in mature continuous woodlands with a diverse woody understory. The distribution of gray

squirrels coincides strikingly with that of oak and hickory forests (Whitaker and Hamilton 1998), habitats that produce winter-storable foods. Their diet consists of seeds, fruits, buds, flowers, innerbark, insects, and bird eggs (Choate et al. 1994). Females produce two litters annually, one in late winter and the other in the summer (Choate et al. 1994). As prime dispersers of mast-producing trees, gray squirrels serve an important role in forest regeneration (Steele and Smallwood 2002). They generate considerable revenue and sport, and serve as a recognizable wildlife species to many people (Dickson 2001).

Previous studies have indicated that squirrel densities are influenced by mast crop availability (Nixon et al. 1978), tree-canopy development (Goodrum 1961), availability of suitable nest cavities (Barkalow and Soots 1965), diversity of trees, and distance to water and cultivated crops (Perry et al. 1977, Moore and Swihart 2005). Gray squirrels may be negatively affected by habitat fragmentation, due to their reliance on large, continuous habitat sites (Rosenblatt et al. 1999, Nupp and Swihart 1998, 2000), and dependency on dense understory (Koprowski 1994). However, Brown and Batzli (1984) found that density of understory trees was not important in influencing gray squirrel distribution in Illinois.

Few studies have addressed gray squirrel habitat use in the southeastern United States (Fischer and Holler 1991). Information is needed on gray squirrel populations, habitat characteristics of major forest types in the southeast, and habitat use by squirrels within these forest types. This data would facilitate squirrel management practices (Fischer and Holler 1991).

PART III

MANUSCRIPT

INTRODUCTION

More than 5 million private landowners control 89 % of southern forests. Due to this high percentage, landowner interests and objectives have the potential to greatly influence forest conditions. Weir and Greis (2002) argue that three parts of the South, including the Cumberland Plateau, may be especially susceptible to fragmentation in the future. Though the Cumberland Plateau is heavily forested, localized areas of urbanization and increased road density could alter the structure of its forested communities

There are varying levels of fragmentation, as well as many causes. Weir and Greis (2002) identified several forces that have shaped and continue to shape the southern forests including (1) land markets that determine the total area of forest (2) timber markets that influence location, extent of harvesting, management approaches, and the condition of the forests and timber within (3) the behaviors of individuals who own, manage, or use the forests (4) insects and disease which affect the structure of the forest and lastly (5) physical factors including wind, fire, and ice which can also affect the structure. Weir and Greis (2002) felt three parts of the south including the Cumberland Plateau maybe especially susceptible to fragmentation in the future. Though the Cumberland Plateau is heavily forested, localized areas of urbanization and increased road density could alter the structure of its forested communities.

The Cumberland Plateau has one of the highest concentrations of interior forests in the South and lies in the heart of the central hardwood region. This eco-region considered by ecologists as being a globally outstanding, critically endangered ecosystem, has seen a 95 % conversion from forests to another cover over the last 200

years (Ricketts et al. 1999). The majority of forests have become fragmented, and many converted into agriculture, urban areas, and roads.

The process of fragmentation has the potential to alter aspects of the ecology at an individual (Shepard and Swihart 1995), population (Verboom et al. 1991), and community (Laurance 1991) level. Many concerns have been raised regarding the accelerating rate of change and its effects on the sustainability of southern forests and the values they provide. Little is known how fragmented lands within the southeast affect small mammal populations. At this time, no regional-level models exist for forecasting the effects of land use change on southeastern wildlife.

This study was designed to evaluate multi-scale effects of habitat fragmentation in the Cumberland Plateau area of Tennessee on mammalian community structure. The primary objectives were to: (1) Determine if occupancy of selected mammalian species in the Emory/Obed watershed of the Cumberland Plateau area of Tennessee is affected by land-use and habitat characteristics, and (2) Provide baseline data on selected mammalian species before further land-use changes occur in the Cumberland Plateau area of Tennessee.

STUDY AREA

We conducted both small mammal and vegetation sampling in the summers of 2002, 2003, and 2004 in 132 sites (Table 1)[1] within 2,331-ha^2 (9 mi^2) landscape (cell; Table 2). All landscapes were within the Emory/Obed watershed located on the Cumberland Plateau in Tennessee (Cumberland and Morgan Counties, Tennessee; -84.3 to -85.3^o W; 36.4 to 35.9^o North; Strickland 2003; Figure 1). Each landscape contained a

[1] All tables and figures appear in the Appendix.

minimum of 20 individual sites. Each site was numbered and the location was marked with global positioning system (GPS) coordinates.

Heavily forested areas cover approximately 79 % (247,587 ha) of the two-county region (Schweitzer 2000). The remaining 25 % is designated as public lands and includes Catoosa State Wildlife Management Area, Obed Wild and Scenic River, and Frozen Head State Park. Eleven landscapes were selected using a random number generator from all landscapes contained within the Emory/Obed watershed. The eleven were selected using the following criteria: (1) all landscapes that were less than 50 % privately owned and were not 100 percent within the watershed were eliminated, and (2) Mean $\pm$ SD for population density, growth, road length, and housing were calculated and those landscapes with values > 2 SD from the mean were eliminated. Private landowners in each of the eleven landscapes with at least 40 acres were identified by use of county tax records. Initial contact of landowners included a brief explanation of the scientific purpose and specific objectives that would directly involve their property. All biological sampling conducted was based on individual landowner consent and cooperation. Once permission from the landowner had been established, we assessed the number of study sites that could be conducted on a particular property.

Forests of Cumberland and Morgan Counties lie within the Appalachian mixed mesophytic forest ecoregion and are characterized as temperate broadleaf and mixed (deciduous and conifers) forests. Over 85 % (208,454 ha) of the timberland in Cumberland and Morgan Counties is classified as either mixed or oak (*Quercus* spp.)-hickory (*Carya* spp.) forests. The remaining timberland is classified as either planted loblolly (*Pinus taeda*) or natural shortleaf pine (*Pinus echinata*) (Strickland 2003).

In protected areas, mesic coves, and on northeastern slopes, these forests are composed largely of oaks, hickory, maple (*Acer* spp.), ash (*Fraxinus* spp.), pine (*Pinus* spp.), yellow-popular (*Lirodendron tulipifera*), and American beech (*Fagus grandifolia*). In ravine bottoms, eastern hemlock (*Tsuga canadensis*), river birch (*Betula nigra*), and Fraser magnolia (*Magnolia fraseri*) are the prevalent species (Ricketts et al. 1999).

METHODS

Vegetation Sampling

Vegetation sampling was conducted at each established site. Several forestry variables were measured at each site within a 10 x 30 m plot measured with meter tape and marked by flagging. Variables measured included the following: number of logs of downed woody debris (DWD), length and diameter of all log sections greater than 10 cm dbh (diameter at breast height), number and height of snags classified as standing woody debris greater than 10 cm dbh (SNAGS), number and species of woody stems classified as less than 5 cm dbh and greater than 1 m tall (STEMS),visual estimates of top height of the overstory (OVERHGT), basal area determined with a 10 basal area factor prism (BATOTAL; m^2/ha;Husch et al 1982), basal area of mast producing species were recorded by species and included oak (OAK), hickory (HICKORY), and hickory and oak (HICKORY+ OAK), severity of any disturbances, either assigned a value of 1, 2, or 3 corresponding with either light, moderate, or severe (DIST), the time since that disturbance (0-5 years, 5-25 years, or >25 years corresponding with values 1, 2, or 3; DISTAGE). The time since disturbance 0-5 years was indicated by direct evidence of recent disturbance, where woody plants were just beginning to respond to the specific disturbance of that site (example: charring of trees disturbed by fire). A disturbance time

of 5-25 years was indicated by sparser evidence of disturbance, where woody vegetation was between sapling and pole sized stages. Finally, disturbances greater than 25 years past showed little to no evidence of disturbance, and vegetation characteristics including an even aged stand and at least pole-sized stems were present. Lastly, succession of the stand was measured, assigned values of 1, 2, 3, or 4 corresponding with stand initiation, stem exclusion, transition, or old growth (SUCCESSION). Stand initiation was characterized by short stature trees and shrubs, representing the establishment of new vegetation. Stem exclusion was characterized by canopy closure of maturing trees and increased mortality of smaller individuals. Transition stage was represented by mature forests with dominant overstory trees greater than ~ 15 cm. Lastly, old growth was represented by maple-beech forests with dominant overstory and understory species being the same.

Small Mammal Trapping

All animal procedures were approved by the University of Tennessee Animal Care and Use Committee (UT IACUC # 1201). Small mammal trapping was conducted in 8 of 20 sample sites per landscape, and varied from early June through mid-August in 2002, 2003, and 2004. We determined the number of trapping sites based on both the availability of number of traps and technician support. We placed 25 Sherman traps (Folding Trap, [7.6 x 8.9 x 22.9 cm, 3 x 3.5 x 9 in] H.B. Sherman Traps, Tallahassee, Florida, USA) 15 m apart within a 5 x 5 m^2 grid. Nine Tomahawk traps (TL202, [48.3 x 15.2 x 15.2 cm, 19 x 6 x 6 in] Tomahawk Live Trap, Tomahawk, Wisconsin, USA) were placed within the grid at 30 m spacing to trap squirrels (Figure 3). We also set two Tomahawk (TL 207, [81.3 x 25.4 x 30.5cm, 32 x 10 x 12 in]) traps at opposite corners of

the grid in order to capture raccoons (*Proycon lotor*) to reduce disturbance of the small mammal traps. Sherman traps were baited with sunflower seeds. Tomahawk traps were baited with a mixture of sunflower seeds, peanuts, and corn. A small handful of cotton was placed within all traps, with the exception of raccoon tomahawk traps, to provide bedding material for individuals while confined. We conducted three to six trap nights for each site.

Traps were checked each morning and the fate of each individual trap was recorded. Traps without capture were recorded as: undisturbed, sprung/empty, tipped/moved, or missing. All raccoons, opossums (*Didelphis virginiana*), skunks (*Mephitis mephitis*), shrews (*Blarina brevicauda*), and any non-target species including birds and turtles were released on site. Trapped animals were recorded as either new or recapture along with the fate (released after processing, dead in trap, or escaped before processing). We determined the sex and age of the animals. Recaptured animals were released after the ear tag number was recorded.

Nylon lingerie bags (44.5x35.6 cm, 17.5x14 in) were used to handle the smaller mammals including mice and smaller chipmunks. Larger mammals (including squirrels and chipmunks) were detained using a cone shaped device of heavy cloth that was covering the trap door. The cone had a zipper for manipulation of the animal. Once restrained, we would slowly unzip the tip of the cone, exposing only the head of the animal. The animal was given a uniquely numbered aluminum ear tag.

We also recorded the season of the trapping (weeks of trapping divided into two-week intervals; SEASON), the year of trapping (either 1, 2 or 3 corresponding to 2002, 2003, or 2004, which also included different sites; YEAR/SITE), and the effort of

trapping (equal to the number of traps per grid multiplied by the number of trapping occasions for the grid minus the total number of traps disturbed; EFFORT; Moore and Swihart 2005).

Occupancy Estimation

Analyses for percent occupancy (ψ) and detection probability (p) were calculated for the best-fit model using occupancy models developed by MacKenzie et al. (2002) and run in program MARK (White and Burnham 1999). We used the information theoretic method of Akaike's Information Criteria (AIC_c) and ΔAIC_c (the change in AIC_c value between two sequential models), in order to determine which model, with the least number of parameters, best explained variation in the data (Anderson and Burnham 1999). The AIC_c value was calculated as negative two times the natural log of the model likelihood plus two times the number of parameters. The AIC_c, facilitated finding a balance between model fit and precision. Models with the lowest ΔAICc (< 2) were given equal weight for inference selection (Cooch and White 2006). The above procedures were conducted for all three species.

We compared the deviance of the most parameterized model without covariates to the deviance of the parametric bootstrap simulations in Program MARK (White and Burnham 1999, MacKenzie and Bailey 2004) to determine a variance inflation factor, or $\hat{c}$ (Moore and Swihart 2005). In order to avoid biased estimates, we first determined which variables best explained detection probability (Schmidt and Pellet 2005). We evaluated the effects of YEAR/SITE, trap occasion (t), SEASON, EFFORT, or occupancy held constant (.) on detection probability. These effects were determined a priori as factors that might influence detection. Using the best model for detection, we

then determined if DWD, SNAGS, HICKORY, OAK, HICKORY+ OAK, BATOTAL, OVERHGT, STEMS, DIST, DISTAGE, SUCCESSION, SEASON, YEAR/SITE, EFFORT, or constant occupancy best explained occupancy of the models selected. The occupancy variables were chosen because of their relationship to fragmentation. We used model averaging to account for model uncertainty to estimate detection and occupancy (Cooch and White 2006).

RESULTS

Small mammal trapping

Trapping was conducted in Cumberland County (summer 2003), and Morgan County (summers of 2002 and 2004). Five landscapes were sampled during summer 2002. Five new landscapes were sampled during 2003. Due to low trapping success in 2002, five of the 2002 landscapes were re-sampled in 2004 with the addition of one new landscape. From the summers of 2002 through 2004, we captured a total of 11 species of mammals including the Virginia opossum (n = 40), striped skunk (n = 13), raccoon (n = 10), eastern cottontail (*Sylvilagus floridanus;* n = 8), eastern chipmunk (n = 69), eastern gray squirrel (n = 95), white-footed mouse (n = 343), Allegheny woodrat (*Neotoma magister;* n = 4), northern short-tailed shrew (n = 20), fox squirrel (*Sciurus niger;* n =1), and the pine vole (*Microtus pinetorum*; n = 1). Numbers reported consist of total number of individuals trapped including re-captures.

Only three species (white-footed mouse, eastern chipmunk, and eastern gray squirrel) were detected with sufficient numbers for occupancy estimation and evaluation of habitat variables. We detected white-footed mice at 87 of 130 forested sites (66.9 %, naïve site occupancy), eastern chipmunks at 32 of 130 sites (24.6 %), and eastern gray

squirrels at 31 of 132 sites (23.5 %). Our estimates of ĉ for all species indicated both an adequate fit of the model and no evidence of overdispersion. All ĉ values were < 1, so we did not adjust ĉ for model selection (Cooch and White 2006).

White-footed mouse occupancy

The model containing YEAR/SITE provided the best fit of the models considered for detection (Table 4). The variable YEAR/SITE had a negative relationship with detection (beta value = - 0.79; CI = -1.07 to –0.51; Table 4). The detection probability was 0.46 (SE = 0.03) using model averaging. With YEAR/SITE in the detection probability, the model constraining occupancy as a function of SEASON, had the best fit of models evaluated (AIC_c weight of 0.98; Table 4). There was strong support for a negative effect of SEASON on occupancy, (beta value = -0.91; CI = –1.50 to –0.31; Table 4). Occupancy was 0.82 (SE = 0.06) from model averaging for white-footed mice on a site level.

Eastern chipmunk occupancy

Similar to the occupancy models for the white-footed mouse, the model containing YEAR/SITE provided the best fit of those considered for detection probability (Table 5); however, there was a positive relationship between detection and YEAR/SITE (beta value = 0.86; CI = 0.12 and 1.59; Table 5). Model averaging of detection probability was 0.26 (SE = 0.04). Using YEAR/SITE in the detection probability, the model restricting occupancy as a function of BATOTAL (Table 5) was given the most support and provided moderate support and a negative relationship (AIC_c weight of 0.50; beta value = – 0.02; CI = – 0.04 and – 0.01; Table 5). Modeling averaging of occupancy for eastern chipmunks was 0.38 (SE = 0.14).

Eastern gray squirrel occupancy

The model including EFFORT served as the best model of fit for detection probability (Table 6). The variable EFFORT provided a weak positive relationship (beta value = 0.02; CI = 0.01 to 0.04; Table 6). Model averaging of detection probability at the site level was 0.23 (SE = 0.52). Using EFFORT in the detection probability, the model restricting occupancy as a function of STEMS was the best-fit model, with a weak negative relationship (AIC_c weight = 0.26; beta value = -0.06; CI = -0.12 and -0.01; Table 6). The variable EFFORT for both detection and occupancy also provided predictive value. Occupancy had a positive relationship with EFFORT (AIC_c weight = 0.18; beta value = 0.02; CI = 0.01 and 0.04; Table 6). Occupancy was 0.37 (SE = 0.08) for eastern gray squirrels using model averaging.

DISCUSSION

Southern forests support a diverse wildlife community with a temperate climate, abundant forests, and productive soils (Dickson 2001). Beginning with natural occurrences such as windfall and fire, fragmentation has been constant to southern forests ever since their formation. However, the major current cause of fragmentation is the expansion and intensification of human land use (Burgess and Sharpe 1981). It is reported by Weir and Greis (2002), "that nearly every forested acre in the South has been harvested at least once in the last two centuries". In our study area, Cumberland and Morgan Counties are experiencing above average growth at annual rates of 3.4 and 1.4 %, respectively (U.S. Census Bureau 2002). Therefore, the rate of change has been accelerating, raising questions concerning the sustainability of these forests and the values they provide (Weir and Greis 2002).

Cumberland and Morgan Counties currently contain 243,540 hectares of timberland (Strickland 2003), with approximately 76 % (184,901hectares) of that total owned by non-industrial private forest landowners (Schweitzer 2000). Due to the private ownership, the habitat for most species is controlled by individual landowner interests.

White-footed mice, eastern chipmunks, and eastern gray squirrels serve as vital components to southern forests. Scatter-hoarding animals that bury nuts, such as squirrels, are highly beneficial, if not necessary for regeneration of mast-producing trees (Vander Wall 2001). Although referred to as a generalist species (Henein et al. 1998, Iverson et al. 1967, Whitaker 1967), white-footed mice serve as seed dispersers and as prey items for other larger animals. Eastern chipmunks also are mast-consuming rodents functioning as seed dispersers and prey (Wolff 1996).

I used occupancy models to determine what site factors affected detection probability and occupancy of white-footed mouse, eastern chipmunk, and eastern gray squirrel populations in the Emory/Obed watershed, Tennessee. Model selection showed detection probability was best explained by YEAR/SITE for chipmunks and white-footed mice (Tables 4 and 5), and by EFFORT for gray squirrels (Table 6). However, YEAR/SITE had a negative effect on detection for white-footed mice and a positive effect for eastern chipmunks. Because each year and the different sites were confounded, it was not possible to separately distinguish the effects of these factors. Future studies of small mammals inhabiting the Cumberland Plateau should evaluate different areas across all years. The increased detection of gray squirrels with increased effort also implies that trap success should be considered when conducting occupancy evaluations.

MacKenzie et al. (2002) reported that estimates of occupancy were considered reasonably unbiased when detection probability was ≥ 0.3. Therefore, my detection probabilities for white-footed mice (0.46) were adequate for unbiased occupancy estimates; however, detection for eastern chipmunks (0.26) and eastern gray squirrels (0.23) were low. By incorporating the detection probabilities, estimated occupancy rates for all three species were higher than the calculated naïve occupancy rates that ignored any effects of detection. Using a likelihood approach and multi-model inference, Moore and Swihart (2005) were able to obtain unbiased estimates of species when detection rates were low or varying. They were able to show that detectability estimates could be used to correct simple presence-absence indices. However, for future studies, I recommend repeated sampling of sites within the same season to ensure adequate detection probability for more accurate estimates of occupancy (MacKenzie et al. 2002).

Using detection probabilities explained by YEAR/SITE, constraining occupancy as a function of SEASON provided the best fit of models selected for white-footed mice. There was strong support for an inverse relationship between occupancy and SEASON, indicating that as the summer progressed, white-footed mice were less likely to occupy the trap area (Table 4). Jennison et al. (2006) also reported population declines for white-footed mice in Georgia as the trapping season progressed. The decline was related to the effects of parasitism by botflies (*Cuterebra fontinella)*. I visually observed greater botfly infestation of white-footed mice in Morgan County compared to Cumberland County (C. H. Salyers, University of Tennessee, unpublished data). Despite the rate of occupancy declines as the summer progressed; I found a high occupancy rate of 0.82 for white-footed mice, indicating they were essentially ubiquitous across sites in the highly forested

landscapes. Moore and Swihart (2005) also found high occupancy (0.89) for white-footed mice in forests of Indiana.

Using detection probabilities explained by YEAR/SITE, model selection results indicated that constraining occupancy as a function of BATOTAL provided the best fit of models selected for chipmunks. There was moderate support for an inverse relationship between occupancy and BATOTAL (Table 5). Moore and Swihart (2005) and Nupp (1997) found that the probability of occupancy increased in patches with dense understory. The proportion of trapping sites occupied by eastern chipmunks in Tennessee was determined to be 0.38, in comparison to 0.74 in Indiana (Moore and Swihart 2005). We did not specifically consider understory density as a covariate affecting occupancy models in program MARK; however, because stand basal area is highly correlated with the volume and growth of forest stands (Avery and Burkhart 2002), and is a good measure of stand density and competition (Husch et al. 2003), high basal area has been associated with a less dense understory. I would suggest future studies incorporate specific effects of understory density on occupancy levels.

For eastern gray squirrels, using detection probabilities explained by EFFORT, model selection results indicated that constraining occupancy as a function of STEMS provided the best-fit model of those evaluated. There was weak support for an inverse relationship between occupancy and STEMS (Table 6). These results indicate that as the number of STEMS increased, the occupancy of squirrels decreased. Eastern gray squirrels are known as a mast dependent species and may be expected to occur less frequently when stem-sized trees abound because of the reduced amount of hard mast produced by the younger trees. I assumed an increased number of stems may correlate to

a denser understory. Fischer and Holler (1991) suggest that a moderately open understory may allow squirrels better movement, ground foraging capabilities, and predator avoidance. In addition, Barkalow and Soots (1965) suggested that North Carolina squirrels avoided areas with dense understory cover where predators could hide. Ranging from mixed forests to city parks, eastern gray squirrels have been known to inhabit a variety of habitat types in the southeast ranging from mixed forests to city parks (Choate et al. 1994). I also observed sites occupied by squirrels to have more of an open understory, versus the literature by Koprowski (1994) reporting a preference for areas with thick understory and ground cover. I expected an increase in detection with increased EFFORT. However, there was also a positive effect of EFFORT on occupancy in gray squirrels. Perhaps the initial response of squirrels was to leave the vicinity of traps until they became accustomed to the traps in the environment.

Previously, little information was available regarding small mammal densities or occupancy rates for east Tennessee, especially for the Cumberland Plateau. Small mammal population densities and species richness are crucial to wildlife conservation (Hopkins and Kennedy 2004). Populations of white-footed mice, eastern chipmunks, and eastern gray squirrels should be monitored using occupancy models. Trapping data could be obtained and used to determine if occupancy rates are stable or decreasing due to management of private lands. I suggest future studies use longer trap times and multiple years of trapping. Also, these three species are generalists (Iverson et al. 1967; Whitaker 1967); therefore, future studies should evaluate habitat-sensitive species to gain a better understanding of the effects of fragmentation on small mammalian species on the Cumberland Plateau.

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APPENDIX

Table 1. Latitude and Longitude of landscape boundaries sampled in the Emory/Obed watershed, located in Cumberland and Morgan Counties, Tennessee 2002-2004.

Cell	Latitude	Longitude
172	36°.09.136	-84°.29.554
172	36°.06.530	-84°.29.643
172	36°.06.458	-84°.26.432
172	36°.09.068	-84°.26.341
167	36°.09.454	-84°.45.649
167	36°.06.842	-84°.45.707
167	36°.09.391	-84°.42.419
167	36°.06.787	-84°.42.497
131	36°.04.461	-84°.58.665
131	36.°01.853	-84°.58.734
131	36°.01.797	-84°.55.500
131	36°.04.414	-84°.55.418
137	36°.04.105	-84°.39.364
137	36°.01.498	-84°.39.451
137	36°.01.439	-84°.36.228
137	36°.04.051	-84°.36.167
139	36°.03.986	-84°.32.929
139	36°.01.368	-84°.33.025
139	36°.01.307	-84°.29.810

Table 1. Continued.

Cell	Latitude	Longitude
139	36°.03.919	-84°.29.726
100	35°.59.183	-84°.55.577
100	35°.56.573	-84°.55.647
100	35°.56.516	-84°.52.438
100	35°.59.143	-84°.52.358
103	35°.59.019	-84°.45.934
103	35°.56.406	-84°.46.012
103	35°.56.349	-84°.42.804
103	35°.58.950	-84°.42.726
110	35°.58.558	-84°.23.476
110	35°.55.952	-84°.23.563
110	35°.55.886	-84°.20.352
110	35°.58.487	-84°.20.270
83	35°.56.636	-84°.58.854
83	35°.54.022	-84°.58.923
83	35°.53.971	-84°.55.711
83	35°.56.579	-84°.55.654
90	35°.56.221	-84°.36.399
90	35°.53.610	-84°.36.474
90	35°.53.541	-84°.33.250

Table 1. Continued.

Cell	Latitude	Longitude
90	35°.56.159	-84°.33.180
53	35°.51.304	-84°.52.572
53	35°.48.689	-84°.52.647
53	35°.48.633	-84°.49.443
53	35°.51.242	-84°.49.373

Table 2. Latitude and Longitude of sites trapped in either year 2002, 2003 and/or 2004 in the Emory/Obed watershed, located in Cumberland and Morgan Counties, Tennessee.

Cell	Year	Plot	Latitude	Longitude
167	2002	6	36°11.800	-84°49.984
167	2002	8	36°11.752	-84°50.171
167	2002	9	36°11.689	-84°49.961
167	2002	10	36°12.013	-84°49.761
167	2002	11	36°11.961	-84°49.579
167	2002	12	36°11.917	-84°49.641
167	2002	13	36°11.899	-84°49.758
167	2002	15	36°11.845	-84°49.611
167	2002	18	36°11.833	-84°49.489
172	2002	19	36°11.467	-84°35.724
172	2002	21	36°11.582	-84°35.759
172	2002	22	36°11.688	-84°35.827
172	2002/2004	28	36°11.738	-84°35.239
172	2002/2004	30	36°11.942	-84°35.200
172	2004	31	36°12.082	-84°35.316
172	2002/2004	32	36°12.169	-84°35.209
172	2002	33	36°12.250	-84°35.223
172	2004	34	36°12.489	-84°35.285

Table 2. Continued.

Cell	Year	Plot	Latitude	Longitude
172	2004	35	36°12.385	-84°35.252
172	2002/2004	36	36°12.766	-84°35.209
172	2004	59	36°11.048	-84°35.400
139	2002	37	36°06.143	-84°37.647
139	2002	39	36°06.031	-84°37.862
139	2002	41	36°06.273	-84°39.303
139	2002/2004	44	36°05.940	-84°38.973
139	2002/2004	45	36°05.866	-84°38.971
139	2002	47	36°05.832	-84°38.866
139	2002/2004	48	36°05.847	-84°38.666
139	2004	49	36°05.768	-84°38.719
139	2002	51	36°05.773	-84°38.562
139	2004	54	36°05.942	-84°38.457
139	2002/2004	55	36°05.870	-84°38.420
139	2004	56	36°06.217	-84°39.367
90	2004	66	35°58.485	-84°40.043
90	2002/2004	67	35°58.580	-84°40.029
90	2002/2004	68	35°58.612	-84°40.076
90	2002/2004	69	35°58.577	-84°40.117
90	2002/2004	70	35°56.239	-84°42.213

Table 2. Continued.

Cell	Year	Plot	Latitude	Longitude
90	2002/2004	71	35°56.340	-84°42.196
90	2002/2004	75	35°56.277	-84°42.255
90	2004	77	35°57.977	-84°39.437
90	2004	78	35°57.923	-84°39.525
90	2002	79	35°57.882	-84°39.429
90	2002	81	35°58.087	-84°39.363
90	2004	82	35°58.207	-84°39.446
90	2004	83	35°58.184	-84°39.528
137	2004	91	36°05.682	-84°45.442
137	2004	92	36°05.749	-84°45.494
137	2004	93	36°05.984	-84°47.098
137	2004	96	36°05.938	-84°47.217
137	2004	97	36°05.883	-84°47.257
137	2004	102	36°05.891	-84°46.889
137	2004	104	36°05.831	-84°46.926
137	2004	105	36°05.832	-84°46.848
110	2002/2004	109	35°59.736	-84°27.694
110	2002/2004	110	35°59.750	-84°27.735
110	2002	111	35°59.680	-84°27.785

Table 2. Continued.

Cell	Year	Plot	Latitude	Longitude
110	2004	112	35°59.733	-84°27.852
110	2004	113	35°59.658	-84°27.888
110	2004	114	35°59.603	-84°27.907
110	2004	115	35°59.601	-84°28.156
110	2002	117	35°59.764	-84°28.245
110	2002	118	35°59.680	-84°28.310
110	2002/2004	119	35°59.704	-84°27.673
110	2002	120	35°59.650	-84°27.712
110	2002	121	35°59.586	-84°27.747
110	2002	125	35°59.604	-84°27.939
53	2003	1	35°52.924	-84°58.369
53	2003	3	35°52.813	-84°58.124
53	2003	5	35°52.886	-84°57.905
53	2003	7	35°52.972	-84°57.664
53	2003	101	35°52.808	-84°58.294
53	2003	103	35°52.859	-84°58.031
53	2003	105	35°52.922	-84°57.783
53	2003	107	35°52.992	-84°57.537
103	2003	40	36°01.133	-84°51.658
103	2003	42	36°01.153	-84°51.405

Table 2. Continued.

Cell	Year	Plot	Latitude	Longitude
103	2003	44	36°01.188	-84°51.283
103	2003	46	36°01.314	-84°51.213
103	2003	150	36°01.042	-84°51.653
103	2003	152	36°01.065	-84°51.434
103	2003	154	36°01.137	-84°51.215
103	2003	156	36°01.312	-84°51.099
83	2003	19	35°37.635	-85°04.443
83	2003	22	35°59.752	-85°04.236
83	2003	24	35°59.591	-85°04.234
83	2003	121	35°57.650	-85°04.436
83	2003	123	35°57.679	-85°04.593
83	2003	124	35°59.992	-85°04.170
83	2003	126	35°59.975	-85°04.060
83	2003	129	36°00.014	-85°04.120
100	2003	11	36°01.303	-84°59.809
100	2003	13	36°01.342	-84°59.909
100	2003	16	36°01.512	-84°59.460
100	2003	18	36°01.375	-84°59.258
100	2003	110	36°01.315	-84°59.869
100	2003	113	36°01.244	-84°59.930

Table 2. Continued.

Cell	Year	Plot	Latitude	Longitude
100	2003	114	36°01.125	-84°59.935
100	2003	116	36°01.559	-84°59.597
131	2003	28	36°08.273	-85°04.729
131	2003	132	36°07.680	-85°04.515
131	2003	133	36°07.644	-85°04.561
131	2003	135	36°07.527	-85°04.523
131	2003	136	36°07.470	-85°04.432
131	2003	138	36°07.560	-85°04.361
131	2003	141	36.08.169	-85°04.657
131	2003	143	36°08.223	-85°04.905
139	2004	203	36°05.287	-84°39.127
139	2004	204	36°05.298	-84°39.234
139	2004	207	36°05.187	-84°38.960
139	2004	208	36°05.096	-84°38.990
139	2004	209	36°05.142	-84°38.849
139	2004	210	36°05.042	-84°38.890
139	2004	213	36°04.932	-84°38.597
139	2004	214	36°04.981	-84°38.719

Table 3. Species live-trapped in the Emory/Obed watershed, located in Cumberland and Morgan Counties, Tennessee between July 2002 and July 2004.

Date	Latitude	Longitude	Cell/Plot	Scientific Name	Number Collected (tag #given) R=recapture e=escape
7/2/2002	35°58.580	-84°40.029	90/67	*Peromyscus spp.*	1(4)
7/2/2002	35°58.612	-84°40.076	90/68	*Peromyscus spp.*	1(e)
7/2/2002	35°58.577	-84°40.117	90/69	*Peromyscus spp.*	3(1,2,3)
7/2/2002	35°56.277	-84°42.255	90/75	*Peromyscus spp.*	1(e)
7/2/2002	35°58.580	-84°40.029	90/67	*Terrapene carolina*	1
7/2/2002	35°58.087	-84°39.363	90/81	*Molothrus ater*	2
7/2/2002	35°58.087	-84°39.363	90/81	*Peromyscus spp.*	1(e)
7/2/2002	35°58.207	-84°39.446	90/82	*Peromyscus spp.*	2(6,7) 1(e)
7/3/2002	35°58.577	-84°40.117	90/69	*Tamias striatus*	1(31)
7/3/2002	35°56.340	-84°42.196	90/71	*Peromyscus spp.*	1(29)

Table 3. Continued.

Date	Latitude	Longitude	Cell/Plot	Scientific Name	Number Collected (tag #given) R=recapture e=escape
7/3/2002	35°58.577	-84°40.117	90/69	*Blarina brevicauda*	1
7/3/2002	35°56.239	-84°42.213	90/70	*Peromyscus spp.*	4(8,10,9,24)
7/3/2002	35°58.577	-84°40.117	90/69	*Peromyscus spp.*	R-3,2
7/3/2002	35°56.340	-84°42.196	90/71	*Didelphis virginia*	1
7/3/2002	35°58.087	-84°42.255	90/75	*Peromyscus spp.*	3(26,27,28)
7/3/2002	35°58.207	-84°39.446	90/82	*Peromyscus spp.*	1(20)R-6
7/3/2002	35°56.277	-84°42.255	90/75	*Sciurus carolinensis*	1(38)
7/3/2002	35°58.577	-84°40.117	90/69	*Peromyscus spp.*	1(30)
7/4/2002	35°58.612	-84°40.076	90/68	*Peromyscus spp.*	3(37,46,43)
7/4/2002	35°58.577	-84°40.117	90/69	*Didelphis virginia*	1
7/4/2002	35°58.577	-84°40.117	90/69	*Peromyscus spp.*	R-30,3
7/4/2002	35°56.340	-84°42.196	90/71	*Peromyscus spp.*	1(e)
7/4/2002	35°56.239	-84°42.213	90/70	*Peromyscus spp.*	R(e)

Table 3. Continued.

Date	Latitude	Longitude	Cell/Plot	Scientific Name	Number Collected (tag #given) R=recapture e=escape
7/4/2002	35°56.340	-84°42.196	90/71	*Peromyscus spp.*	2(33,32)
7/4/2002	35°56.277	-84°42.255	90/75	*Peromyscus spp.*	1(50)R-26
7/4/2002	35°58.087	-84°39.363	90/81	*Peromyscus spp.*	R-5
7/4/2002	35°58.580	-84°40.029	90/67	*Terrapene carolina*	1
7/4/2002	35°58.577	-84°40.117	90/69	*Molothrus ater*	1
7/4/2002	35°56.239	-84°42.213	90/70	*Peromyscus spp.*	R-24
7/5/2002	35°58.577	-84°40.117	90/69	*Tamias striatus*	2(35,36)
7/5/2002	35°58.612	-84°40.076	90/68	*Peromyscus spp.*	R-30,46
7/5/2002	35°56.340	-84°42.196	90/71	*Didelphis virginia*	1
7/5/2002	35°56.340	-84°42.196	90/71	*Sylvilagus floridanus*	1
7/5/2002	35°56.340	-84°42.196	90/71	*Peromyscus spp.*	2(42,44)R-32
7/5/2002	35°58.087	-84°39.363	90/81	*Peromyscus spp.*	1(39)
7/5/2002	35°58.087	-84°42.255	90/75	*Peromyscus spp.*	2(40,41)R-27

Table 3. Continued.

Date	Latitude	Longitude	Cell/Plot	Scientific Name	Number Collected (tag #given) R=recapture e=escape
7/5/2002	35°56.239	-84°42.213	90/70	*Peromyscus spp.*	R-24
7/9/2002	36°11.800	-84°49.984	167/6	*Peromyscus spp.*	1(45)
7/9/2002	36°11.689	-84°49.961	167/9	*Peromyscus spp.*	1(75)1(e)
7/9/2002	36°12.013	-84°49.761	167/10	*Peromyscus spp.*	3(17,23,82)
7/9/2002	36°11.961	-84°49.579	167/11	*Didelphis virginia*	1
7/9/2002	36°11.961	-84°49.579	167/11	*Peromyscus spp.*	1(58)
7/9/2002	36°11.917	-84°49.641	167/12	*Peromyscus spp.*	1(e)
7/9/2002	36°11.917	-84°49.641	167/12	*Sylvilagus floridanus*	1
7/9/2002	36°11.899	-84°49.758	167/13	*Peromyscus spp.*	1(e)
7/9/2002	36°11.845	-84°49.611	167/15	*Peromyscus spp.*	5(51,52,53,54,55)
7/9/2002	36°11.845	-84°49.611	167/15	*Peromyscus spp.*	1(e)
7/9/2002	36°11.845	-84°49.611	167/15	*Peromyscus spp.*	R-51
7/9/2002	36°11.833	-84°49.489	167/18	*Peromyscus spp.*	2(56,57)

Table 3. Continued.

Date	Latitude	Longitude	Cell/Plot	Scientific Name	Number Collected (tag #given) R=recapture e=escape
7/10/2002	36°12.013	-84°49.761	167/10	*Peromyscus spp.*	2(84,85)
7/10/2002	36°11.961	-84°49.579	167/11	*Peromyscus spp.*	4(59,60,61,62)
7/10/2002	36°11.917	-84°49.641	167/12	*Peromyscus spp.*	1(83)
7/10/2002	36°11.961	-84°49.579	167/11	*Didelphis virginia*	1
7/10/2002	36°11.833	-84°49.489	167/18	*Peromyscus spp.*	1(72)R-57
7/10/2002	36°11.845	-84°49.611	167/15	*Peromyscus spp.*	R-51,53
7/10/2002	36°11.752	-84°50.171	167/8	*Sylvilagus floridanus*	1
7/10/2002	36°11.752	-84°50.171	167/8	*Peromyscus spp.*	1(65)
7/10/2002	36°11.833	-84°49.489	167/18	*Sylvilagus floridanus*	1
7/11/2002	36°11.800	-84°49.984	167/6	*Peromyscus spp.*	2(64,71)
7/11/2002	36°11.752	-84°50.171	167/8	*Peromyscus spp.*	2(68,70)
7/11/2002	36°11.961	-84°49.579	167/11	*Peromyscus spp.*	2(67,73)R-59,60
7/11/2002	36°11.845	-84°49.611	167/15	*Peromyscus spp.*	1(66)R-51

Table 3. Continued.

Date	Latitude	Longitude	Cell/Plot	Scientific Name	Number Collected (tag #given) R=recapture e=escape
7/11/2002	36°11.917	-84°49.641	167/12	*Peromyscus spp.*	3(76,90,99)
7/11/2002	36°11.833	-84°49.489	167/18	*Peromyscus spp.*	1(34)
7/11/2002	36°11.899	-84°49.758	167/13	*Peromyscus spp.*	R
7/11/2002	36°11.689	-84°49.961	167/9	*Peromyscus spp.*	1(e)
7/12/2002	36°11.800	-84°49.984	167/6	*Peromyscus spp.*	2(63,69)
7/12/2002	36°11.800	-84°49.984	167/6	*Procyon lotor*	2
7/12/2002	36°11.917	-84°49.641	167/12	*Peromyscus spp.*	R
7/12/2002	36°11.917	-84°49.641	167/12	*Peromyscus spp.*	1(78)R-25
7/12/2002	36°11.899	-84°49.758	167/13	*Peromyscus spp.*	R
7/12/2002	36°11.845	-84°49.611	167/15	*Peromyscus spp.*	R-51,66,53,48
7/12/2002	36°11.961	-84°49.579	167/11	*Peromyscus spp.*	R-59,67,73
7/12/2002	36°11.833	-84°49.489	167/18	*Peromyscus spp.*	1(47)
7/12/2002	36°11.833	-84°49.489	167/18	*Peromyscus spp.*	1(e)R-72

Table 3. Continued.

Date	Latitude	Longitude	Cell/Plot	Scientific Name	Number Collected (tag #given) R=recapture e=escape
7/12/2002	36°11.833	-84°49.489	167/18	*Peromyscus spp.*	1(e)R-72
7/12/2002	36°11.833	-84°49.489	167/18	*Didelphis virginia*	1
7/12/2002	36°11.833	-84°49.489	167/18	*Sylvilagus floridanus*	1
7/16/2002	36°11.582	-84°35.759	172/21	*Peromyscus spp.*	2(77,109)
7/16/2002	36°11.688	-84°35.827	172/22	*Peromyscus spp.*	2(108,107)1(e)
7/16/2002	36°11.738	-84°35.239	172/28	*Peromyscus spp.*	2(106,105)
7/16/2002	36°11.738	-84°35.239	172/28	*Didelphis virginia*	1
7/16/2002	36°11.942	-84°35.200	172/30	*Peromyscus spp.*	1(92)
7/16/2002	36°11.942	-84°35.200	172/30	*Sylvilagus floridanus*	1
7/16/2002	36°12.766	-84°35.209	172/36	*Peromyscus spp.*	3(89,80,21)
7/16/2002	36°12.169	-84°35.209	172/32	*Peromyscus spp.*	2(101,102)
7/16/2002	36°11.467	-84°35.724	172/19	*Peromyscus spp.*	1(87)
7/16/2002	36°12.250	-84°35.223	172/33	*Peromyscus spp.*	2(103,104)

Table 3. Continued.

Date	Latitude	Longitude	Cell/Plot	Scientific Name	Number Collected (tag #given) R=recapture e=escape
7/16/2002	36°12.489	-84°35.285	172/34	*Peromyscus spp.*	4(86,98,11,14)
7/17/2002	36°12.766	-84°35.209	172/36	*Peromyscus spp.*	1(15)
7/17/2002	36°12.489	-84°35.285	172/34	*Peromyscus spp.*	1(81)R-11
7/17/2002	36°12.250	-84°35.223	172/33	*Peromyscus spp.*	3(114,115,113)
7/17/2002	36°12.250	-84°35.223	172/33	*Peromyscus spp.*	R-104,103
7/17/2002	36°11.942	-84°35.200	172/30	*Peromyscus spp.*	2(12,100)R-92
7/17/2002	36°11.738	-84°35.239	172/28	*Tamias striatus*	1(e)
7/17/2002	36°11.738	-84°35.239	172/28	*Peromyscus spp.*	1(112)
7/17/2002	36°11.688	-84°35.827	172/22	*Peromyscus spp.*	R-107,108
7/17/2002	36°11.688	-84°35.827	172/22	*Peromyscus spp*	2(110,111)
7/17/2002	36°11.582	-84°35.759	172/21	*Peromyscus spp.*	2(96,76)
7/17/2002	36°11.467	-84°35.724	172/19	*Peromyscus spp.*	1(88)
7/18/2002	36°11.467	-84°35.724	172/19	*Blarina brevicauda*	1

Table 3. Continued.

Date	Latitude	Longitude	Cell/Plot	Scientific Name	Number Collected (tag #given) R=recapture e=escape
7/18/2002	36°11.738	-84°35.239	172/28	*Peromyscus spp.*	2(117,119)
7/18/2002	36°11.942	-84°35.200	172/30	*Peromyscus spp.*	1(94)R-92,100
7/18/2002	36°12.169	-84°35.209	172/32	*Peromyscus spp.*	1(116)
7/18/2002	36°12.766	-84°35.209	172/36	*Peromyscus spp.*	1(13)R-15
7/18/2002	36°12.766	-84°35.209	172/36	*Neotoma magister*	1
7/18/2002	36°12.250	-84°35.223	172/33	*Peromyscus spp.*	R-104,113
7/19/2002	36°11.582	-84°35.759	172/21	*Peromyscus spp.*	R-77
7/19/2002	36°11.688	-84°35.827	172/22	*Peromyscus spp.*	R-111
7/19/2002	36°11.738	-84°35.239	172/28	*Peromyscus spp.*	1(120)R-119
7/19/2002	36°11.942	-84°35.200	172/30	*Sylvilagus floridanus*	1
7/19/2002	36°11.942	-84°35.200	172/30	*Peromyscus spp.*	R-94
7/19/2002	36°12.169	-84°35.209	172/32	*Peromyscus spp.*	1(118)1(e)
7/19/2002	36°12.169	-84°35.209	172/32	*Didelphis virginia*	1

Table 3. Continued.

Date	Latitude	Longitude	Cell/Plot	Scientific Name	Number Collected (tag #given) R=recapture e=escape
7/19/2002	36°12.250	-84°35.223	172/33	*Peromyscus spp.*	R-104,115
7/19/2002	36°12.766	-84°35.209	172/36	*Blarina brevicauda*	1
7/19/2002	36°12.766	-84°35.209	172/36	*Neotoma magister*	1
7/23/2003	36°06.143	-84°37.647	139/37	*Peromyscus spp.*	1(e)
7/23/2002	36°05.773	-84°38.562	139/51	*Peromyscus spp.*	1(123)
7/24/2002	36°06.143	-84°37.647	139/37	*Peromyscus spp.*	1(91)
7/24/2002	36°06.031	-84°37.862	139/39	*Peromyscus spp.*	2(126,127)
7/24/2002	36°06.217	-84°39.367	139/56	*Peromyscus spp.*	1(128)
7/25/2002	36°06.217	-84°39.367	139/56	*Peromyscus spp.*	R-128
7/26/2002	36°06.143	-84°37.647	139/37	*Peromyscus spp.*	R-91
7/30/2002	35°59.736	-84°27.694	110/109	*Sciurus carolinensis*	1(e)
7/30/2002	35°59.704	-84°27.673	110/119	*Peromyscus spp.*	1(193)
7/30/2002	35°59.704	-84°27.673	110/119	*Didelphis virginia*	1

Table 3. Continued.

Date	Latitude	Longitude	Cell/Plot	Scientific Name	Number Collected (tag #given) R=recapture e=escape
7/30/2002	35°59.680	-84°28.310	110/118	*Terrapene carolina*	1
7/31/2002	35°59.736	-84°27.694	110/109	*Peromyscus spp.*	1(133)
7/31/2002	35°59.704	-84°27.673	110/119	*Sciurus carolinensis*	1(e)
7/31/2002	35°59.704	-84°27.673	110/119	*Peromyscus spp.*	1(188)
8/2/2002	35°59.736	-84°27.694	110/109	*Sciurus carolinensis*	1(e)
8/2/2002	35°59.704	-84°27.673	110/119	*Peromyscus spp.*	R-193
8/2/2002	35°59.704	-84°27.673	110/119	*Terrapene carolina*	1
8/2/2002	35°59.604	-84.27.939	110/125	*Peromyscus spp.*	1(e)
6/3/2003	35°52.808	-84°58.294	53/101	*Peromyscus spp.*	3(197,178,192)
6/3/2003	35°52.859	-84°58.031	53/103	*Peromyscus spp.*	1(199)
6/3/2003	35°52.992	-84°57.537	53/107	*Peromyscus spp.*	1(176)
6/3/2003	35°52.972	-84°57.664	53/07	*Didelphis virginia*	1
6/3/2003	35°52.886	-84°57.905	53/05	*Peromyscus spp.*	1(149)

Table 3. Continued.

Date	Latitude	Longitude	Cell/Plot	Scientific Name	Number Collected (tag #given) R=recapture e=escape
6/3/2003	35°52.924	-84°58.369	53/01	*Peromyscus spp.*	1(e)
6/4/2003	35°52.808	-84°58.294	53/101	*Peromyscus spp.*	R-192,178
6/4/2003	35°52.859	-84°58.031	53/103	*Peromyscus spp.*	1(180)R-149
6/4/2003	35°52.922	-84°57.783	53/105	*Terrapene carolina*	1
6/4/2003	35°52.992	-84°57.537	53/107	*Peromyscus spp.*	R-176
6/4/2003	35°52.992	-84°57.537	53/107	*Didelphis virginia*	1
6/4/2003	35°52.924	-84°58.369	53/01	*Peromyscus spp.*	1(143)1(e)
6/4/2003	35°52.886	-84°57.905	53/05	*Peromyscus spp.*	1(132)
6/4/2003	35°52.813	-84°58.124	53/03	*Sciurus carolinensis*	1
6/4/2003	35°52.813	-84°58.124	53/03	*Peromyscus spp.*	1(e)
6/4/2003	35°52.813	-84°58.124	53/03	*Tamias striatus*	1(150)
6/5/2003	35°52.808	-84°58.294	53/101	*Peromyscus spp.*	1(e)
6/5/2003	35°52.808	-84°58.294	53/101	*Peromyscus spp.*	R-e

Table 3. Continued.

Date	Latitude	Longitude	Cell/Plot	Scientific Name	Number Collected (tag #given) R=recapture e=escape
6/5/2003	35°52.922	-84°57.783	53/105	*Tamias striatus*	1(74)
6/5/2003	35°52.992	-84°57.537	53/107	*Didelphis virginia*	R
6/5/2003	35°52.992	-84°57.537	53/107	*Peromyscus spp.*	R-176
6/10/2003	35°52.808	-84°58.294	53/101	*Peromyscus spp.*	R-178
6/10/2003	35°52.924	-84°58.369	53/01	*Peromyscus spp.*	1(121)R-143
6/10/2003	35°52.813	-84°58.124	53/03	*Sciurus carolinensis*	1(e)
6/10/2003	35°52.886	-84°57.905	53/05	*Sciurus carolinensis*	1(e)
6/10/2003	35°52.972	-84°57.664	53/07	*Sciurus carolinensis*	1(e)
6/10/2003	35°52.972	-84°57.664	53/07	*Peromyscus spp.*	2(145,136)
6/10/2003	35°52.859	-84°58.031	53/103	*Tamias striatus*	1(97)
6/10/2003	35°52.922	-84°57.783	53/105	*Tamias striatus*	1(189)
6/10/2003	35°52.992	-84°57.537	53/107	*Tamias striatus*	1(191)
6/10/2003	35°52.992	-84°57.537	53/107	*Peromyscus spp.*	R-176

Table 3. Continued.

Date	Latitude	Longitude	Cell/Plot	Scientific Name	Number Collected (tag #given) R=recapture e=escape
6/10/2003	35°52.992	-84°57.537	53/107	*Sciurus carolinensis*	1(194)
6/11/2003	35°52.808	-84°58.294	53/101	*Peromyscus spp.*	1(196)
6/11/2003	35°52.808	-84°58.294	53/101	*Didelphis virginia*	1
6/11/2003	35°52.859	-84°58.031	53/103	*Sciurus carolinensis*	1(184)
6/11/2003	35°52.922	-84°57.783	53/105	*Peromyscus spp.*	1(185)
6/11/2003	35°52.992	-84°57.537	53/107	*Tamias striatus*	1(182)
6/11/2003	35°52.924	-84°58.369	53/01	*Peromyscus spp.*	1(125)
6/11/2003	35°52.813	-84°58.124	53/03	*Peromyscus spp.*	1(131)1(e)
6/11/2003	35°52.813	-84°58.124	53/03	*Tamias striatus*	R-150
6/11/2003	35°52.886	-84°57.905	53/05	*Peromyscus spp.*	R-132
6/11/2003	35°52.886	-84°57.905	53/05	*Sciurus carolinensis*	1(140)
6/11/2003	35°52.972	-84°57.664	53/07	*Peromyscus spp.*	2(130,137)
6/11/2003	35°52.972	-84°57.664	53/07	*Tamias striatus*	2(129,144)

Table 3. Continued.

Date	Latitude	Longitude	Cell/Plot	Scientific Name	Number Collected (tag #given) R=recapture e=escape
6/12/2003	35°52.808	-84°58.294	53/101	*Tamias striatus*	1(195)
6/12/2003	35°52.808	-84°58.294	53/101	*Peromyscus spp.*	R-197
6/12/2003	35°52.859	-84°58.031	53/103	*Sciurus carolinensis*	1(177)
6/12/2003	35°52.922	-84°57.783	53/105	*Peromyscus spp.*	1(200)
6/12/2003	35°52.922	-84°57.783	53/105	*Tamias striatus*	R-189
6/12/2003	35°52.924	-84°58.369	53/01	*Tamias striatus*	1
6/12/2003	35°52.924	-84°58.369	53/01	*Blarina brevicauda*	1
6/12/2003	35°52.813	-84°58.124	53/03	*Tamias striatus*	1
6/12/2003	35°52.886	-84°57.905	53/05	*Sciurus carolinensis*	2(152,151)
6/12/2003	35°52.886	-84°57.905	53/05	*Sciurus carolinensis*	1
6/12/2003	35°52.972	-84°57.664	53/07	*Peromyscus spp.*	1(146)
6/17/2003	36.08.169	-85°04.657	131/141	*Didelphis virginia*	1
6/17/2003	36.08.169	-85°04.657	131/141	*Peromyscus spp.*	1(275)

Table 3. Continued.

Date	Latitude	Longitude	Cell/Plot	Scientific Name	Number Collected (tag #given) R=recapture e=escape
6/17/2003	36°07.470	-85°04.432	131/136	*Peromyscus spp.*	2(252,268)
6/17/2003	36°07.560	-85°04.361	131/138	*Sciurus carolinensis*	1(251)
6/17/2003	36°07.680	-85°04.515	131/132	*Cyanocitta cristata*	1
6/17/2003	36°07.680	-85°04.515	131/132	*Peromyscus spp.*	2(154,153)
6/17/2003	36°07.680	-85°04.515	131/132	*Peromyscus spp.*	2(e)
6/17/2003	36°07.644	-85°04.561	131/133	*Peromyscus spp.*	2(156,155)
6/17/2003	36°08.273	-85°04.729	131/28	*Peromyscus spp.*	1(e)1(203)
6/18/2003	36°07.644	-85°04.561	131/133	*Didelphis virginia*	1
6/18/2003	36°07.644	-85°04.561	131/133	*Peromyscus spp.*	1(160)R-155
6/18/2003	36°07.680	-85°04.515	131/132	*Peromyscus spp.*	2(159,157)
6/18/2003	36°07.680	-85°04.515	131/132	*Peromyscus spp.*	R-153,158,154
6/18/2003	36°08.273	-85°04.729	131/28	*Peromyscus spp.*	2(205,206)1(e)
6/18/2003	36°07.527	-85°04.523	131/135	*Peromyscus spp.*	1(263)

Table 3. Continued.

Date	Latitude	Longitude	Cell/Plot	Scientific Name	Number Collected (tag #given) R=recapture e=escape
6/18/2003	36°07.470	-85°04.432	131/136	*Didelphis virginia*	1
6/18/2003	36°07.560	-85°04.361	131/138	*Didelphis virginia*	2
6/18/2003	36°07.560	-85°04.361	131/138	*Tamias striatus*	1(265)
6/18/2003	36°08.223	-85°04.905	131/143	*Peromyscus spp.*	2(267,273)
6/18/2003	36°08.223	-85°04.905	131/143	*Sciurus carolinensis*	1(274)
6/19/2003	36°08.223	-85°04.905	131/143	*Sciurus carolinensis*	1(e)
6/19/2003	36.08.169	-85°04.657	131/141	*Sciurus carolinensis*	1(271)
6/19/2003	36°07.527	-85°04.523	131/135	*Tamias striatus*	1(e)
6/19/2003	36°07.560	-85°04.361	131/138	*Tamias striatus*	1(257)1(e)
6/19/2003	36°07.644	-85°04.561	131/133	*Peromyscus spp.*	1(174)
6/19/2003	36°07.644	-85°04.561	131/133	*Cyanocitta cristata*	1
6/19/2003	36°07.680	-85°04.515	131/132	*Peromyscus spp.*	R-159
6/19/2003	36°07.680	-85°04.515	131/132	*Peromyscus spp.*	1(e)1(201)

Table 3. Continued.

Date	Latitude	Longitude	Cell/Plot	Scientific Name	Number Collected (tag #given) R=recapture e=escape
6/19/2003	36°07.680	-85°04.515	131/132	*Didelphis virginia*	1
6/24/2003	36°07.527	-85°04.523	131/135	*Peromyscus spp.*	R-263
6/24/2003	36°07.470	-85°04.432	131/136	*Peromyscus spp.*	2(259,256)1(e)
6/24/2003	36°07.560	-85°04.361	131/138	*Tamias striatus*	1(270)R-257
6/24/2003	36°07.560	-85°04.361	131/138	*Didelphis virginia*	1
6/24/2003	36.08.169	-85°04.657	131/141	*Blarina brevicauda*	2
6/24/2003	36°08.223	-85°04.905	131/143	*Sciurus carolinensis*	1(264)1(e)
6/24/2003	36°08.223	-85°04.905	131/143	*Peromyscus spp.*	1(e)
6/24/2003	36°08.273	-85°04.729	131/28	*Peromyscus spp.*	1(224)R-206
6/24/2003	36°07.680	-85°04.515	131/132	*Peromyscus spp.*	R-159
6/25/2003	36°08.273	-85°04.729	131/28	*Peromyscus spp.*	1(163)
6/25/2003	36°08.273	-85°04.729	131/28	*Peromyscus spp.*	R-224
6/25/2003	36°07.680	-85°04.515	131/132	*Peromyscus spp.*	1(225)R-158

Table 3. Continued.

Date	Latitude	Longitude	Cell/Plot	Scientific Name	Number Collected (tag #given) R=recapture e=escape
6/25/2003	36°07.680	-85°04.515	131/132	*Sciurus carolinensis*	1
6/25/2003	36°07.644	-85°04.561	131/133	*Didelphis virginia*	1
6/25/2003	36°07.644	-85°04.561	131/133	*Peromyscus spp.*	R-156
6/25/2003	36°08.223	-85°04.905	131/143	*Peromyscus spp.*	1(258)
6/25/2003	36°08.223	-85°04.905	131/143	*Sciurus carolinensis*	1(e)
6/25/2003	36.08.169	-85°04.657	131/141	*Peromyscus spp.*	1(253)
6/25/2003	36°07.527	-85°04.523	131/135	*Peromyscus spp.*	1
6/25/2003	36°07.470	-85°04.432	131/136	*Peromyscus spp.*	R-259
6/25/2003	36°07.470	-85°04.432	131/136	*Blarina brevicauda*	1
6/25/2003	36°07.560	-85°04.361	131/138	*Peromyscus spp.*	2(255,269)
6/25/2003	36°07.560	-85°04.361	131/138	*Didelphis virginia*	R
6/26/2003	36°08.223	-85°04.905	131/143	*Sciurus carolinensis*	R-264
6/26/2003	36°07.560	-85°04.361	131/138	*Tamias striatus*	1(425)

Table 3. Continued.

Date	Latitude	Longitude	Cell/Plot	Scientific Name	Number Collected (tag #given) R=recapture e=escape
6/26/2003	36°07.527	-85°04.523	131/135	*Peromyscus spp.*	1(424)
6/26/2003	36°08.273	-85°04.729	131/28	*Peromyscus spp.*	R-203
6/26/2003	36°07.680	-85°04.515	131/132	*Sciurus carolinensis*	1(injured)
7/1/2003	36°01.375	-84°59.258	100/18	*Tamias striatus*	1(e)
7/1/2003	36°01.512	-84°59.460	100/16	*Didelphis virginia*	1
7/1/2003	36°01.512	-84°59.460	100/16	*Peromyscus spp.*	1(223)
7/1/2003	36°01.244	-84°59.930	100/113	*Tamias striatus*	1(423)
7/2/2003	36°01.125	-84°59.935	100/114	*Didelphis virginia*	1
7/2/2003	36°01.125	-84°59.935	100/114	*Colinus virginianus*	1
7/2/2003	36°01.244	-84°59.930	100/113	*Didelphis virginia*	1
7/2/2003	36°01.303	-84°59.809	100/11	*Peromyscus spp.*	1(216)
7/2/2003	36°01.512	-84°59.460	100/16	*Peromyscus spp.*	1(207)R-223
7/3/2003	36°01.244	-84°59.930	100/113	*Sciurus carolinensis*	2(422,421)

Table 3. Continued.

Date	Latitude	Longitude	Cell/Plot	Scientific Name	Number Collected (tag #given) R=recapture e=escape
7/3/2003	36°01.559	-84°59.597	100/116	*Peromyscus spp.*	1(420)
7/3/2003	36°01.342	-84°59.909	100/13	*Sciurus carolinensis*	1(214)
7/3/2003	36°01.375	-84°59.258	100/18	*Sciurus carolinensis*	1(167)
7/3/2003	36°01.375	-84°59.258	100/18	*Mephitis mephitis*	1
7/3/2003	36°01.512	-84°59.460	100/16	*Peromyscus spp.*	R-223
7/8/2003	36°01.375	-84°59.258	100/18	*Sciurus carolinensis*	1(167)
7/8/2003	36°01.342	-84°59.909	100/13	*Sciurus carolinensis*	1(166)
7/8/2003	36°01.559	-84°59.597	100/116	*Peromyscus spp.*	1(119)
7/9/2003	36°01.512	-84°59.460	100/16	*Peromyscus spp.*	R-223,207
7/9/2003	36°01.375	-84°59.258	100/18	*Sciurus carolinensis*	R-167
7/9/2003	36°01.244	-84°59.930	100/113	*Sciurus carolinensis*	1(401)R-421
7/9/2003	36°01.125	-84°59.935	100/114	*Tamias striatus*	1(402)
7/9/2003	36°01.559	-84°59.597	100/116	*Peromyscus spp.*	1(403)R-119

Table 3. Continued.

Date	Latitude	Longitude	Cell/Plot	Scientific Name	Number Collected (tag #given) R=recapture e=escape
7/9/2003	36°01.559	-84°59.597	100/116	*Peromyscus spp.*	R-420
7/9/2003	36°01.559	-84°59.597	100/116	*Sciurus carolinensis*	1(404)
7/10/2003	36°01.559	-84°59.597	100/116	*Procyon lotor*	2
7/10/2003	36°01.559	-84°59.597	100/116	*Peromyscus spp.*	R-119
7/10/2003	36°01.125	-84°59.935	100/114	*Tamias striatus*	R(e)
7/10/2003	36°01.244	-84°59.930	100/113	*Sciurus carolinensis*	1(418)
7/10/2003	36°01.315	-84°59.869	100/110	*Sciurus niger*	1(417)
7/10/2003	36°01.512	-84°59.460	100/16	*Mephitis mephitis*	1
7/10/2003	36°01.342	-84°59.909	100/13	*Sciurus carolinensis*	3
7/15/2003	36°01.042	-84°51.653	103/150	*Mephitis mephitis*	1
7/15/2003	36°01.065	-84°51.434	103/152	*Neotoma magister*	1
7/15/2003	36°01.137	-84°51.215	103/154	*Terrapene carolina*	1
7/16/2003	36°01.065	-84°51.434	103/152	*Tamias striatus*	1(416)

Table 3. Continued.

Date	Latitude	Longitude	Cell/Plot	Scientific Name	Number Collected (tag #given) R=recapture e=escape
7/16/2003	36°01.137	-84°51.215	103/154	*Terrapene carolina*	1
7/17/2003	36°01.065	-84°51.434	103/152	*Peromyscus spp.*	1(415)
7/22/2003	36°01.065	-84°51.434	103/152	*Tamias striatus*	R-416
7/22/2003	36°01.312	-84°51.099	103/156	*Peromyscus spp.*	1(409)
7/22/2003	36°01.133	-84°51.658	103/40	*Mephitis mephitis*	1
7/22/2003	36°01.188	-84°51.283	103/44	*Terrapene carolina*	1
7/22/2003	36°01.188	-84°51.283	103/44	*Tamias striatus*	1(211)
7/22/2003	36°01.314	-84°51.213	103/46	*Peromyscus spp.*	1(148)
7/23/2003	36°01.188	-84°51.283	103/44	*Blarina brevicauda*	1
7/23/2003	36°01.314	-84°51.213	103/46	*Peromyscus spp.*	1(168)
7/24/2003	36°01.042	-84°51.653	103/150	*Sciurus carolinensis*	1
7/24/2003	36°01.042	-84°51.653	103/150	*Procyon lotor*	1
7/24/2003	36°01.042	-84°51.653	103/150	*Peromyscus spp.*	1

Table 3. Continued.

Date	Latitude	Longitude	Cell/Plot	Scientific Name	Number Collected (tag #given) R=recapture e=escape
7/24/2003	36°01.065	-84°51.434	103/152	*Neotoma magister*	1
7/24/2003	36°01.312	-84°51.099	103/156	*Peromyscus spp.*	1
7/24/2003	36°01.133	-84°51.658	103/40	*Peromyscus spp.*	1
7/24/2003	36°01.188	-84°51.283	103/44	*Tamias striatus*	1
7/24/2003	36°01.314	-84°51.213	103/46	*Blarina brevicauda*	1
7/24/2003	36°01.314	-84°51.213	103/46	*Peromyscus spp.*	R-168
7/29/2003	35°59.992	-85°04.170	83/124	*Sciurus carolinensis*	1(407)
7/29/2003	35°59.992	-85°04.170	83/124	*Peromyscus spp.*	1(408)
7/29/2003	36°00.014	-85°04.120	83/129	*Sciurus carolinensis*	1(e)
7/29/2003	36°00.014	-85°04.120	83/129	*Tamias striatus*	1(412)
7/29/2003	35°57.650	-85°04.436	83/121	*Sciurus carolinensis*	2(413,410)
7/29/2003	35°57.679	-85°04.593	83/123	*Sciurus carolinensis*	1(411)
7/29/2003	35°57.679	-85°04.593	83/123	*Didelphis virginia*	1

Table 3. Continued.

Date	Latitude	Longitude	Cell/Plot	Scientific Name	Number Collected (tag #given) R=recapture e=escape
7/29/2003	35°59.591	-85°04.234	83/24	*Procyon lotor*	1
7/29/2003	35°37.635	-85°04.443	83/19	*Sciurus carolinensis*	2(212,173)
7/29/2003	35°37.635	-85°04.443	83/19	*Tamias striatus*	1(e)
7/30/2003	35°57.650	-85°04.436	83/121	*Sciurus carolinensis*	1(208)
7/30/2003	35°57.650	-85°04.436	83/121	*Sciurus carolinensis*	1
7/30/2003	35°57.650	-85°04.436	83/121	*Mephitis mephitis*	1
7/30/2003	35°57.650	-85°04.436	83/121	*Peromyscus spp.*	1(414)
7/30/2003	35°57.679	-85°04.593	83/123	*Mephitis mephitis*	1
7/30/2003	35°57.679	-85°04.593	83/123	*Tamias striatus*	1(210)
7/30/2003	35°57.679	-85°04.593	83/123	*Peromyscus spp.*	1(222)
7/30/2003	35°57.679	-85°04.593	83/123	*Sciurus carolinensis*	1(e)
7/30/2003	35°59.975	-85°04.060	83/126	*Tamias striatus*	2(451,405)
7/30/2003	36°00.014	-85°04.120	83/129	*Sciurus carolinensis*	R-407

Table 3. Continued.

Date	Latitude	Longitude	Cell/Plot	Scientific Name	Number Collected (tag #given) R=recapture e=escape
7/30/2003	35°59.752	-85°04.236	83/22	*Mephitis mephitis*	1
7/31/2003	35°59.992	-85°04.170	83/124	*Peromyscus spp.*	R(e)
7/31/2003	35°57.650	-85°04.436	83/121	*Sciurus carolinensis*	2(475,452)R-413
7/31/2003	35°59.752	-85°04.236	83/22	*Sciurus carolinensis*	1(220)
7/31/2003	35°59.591	-85°04.234	83/24	*Mephitis mephitis*	2
7/31/2003	35°37.635	-85°04.443	83/19	*Sciurus carolinensis*	2
7/31/2003	35°59.992	-85°04.170	83/124	*Tamias striatus*	1(458)
7/31/2003	35°59.992	-85°04.170	83/124	*Sciurus carolinensis*	1
8/5/2003	35°57.650	-85°04.436	83/121	*Blarina brevicauda*	1
8/5/2003	35°57.679	-85°04.593	83/123	*Sciurus carolinensis*	1(454)R-411
8/5/2003	35°57.679	-85°04.593	83/123	*Blarina brevicauda*	1
8/5/2003	36°00.014	-85°04.120	83/129	*Didelphis virginia*	1
8/5/2003	36°00.014	-85°04.120	83/129	*Tamias striatus*	1

Table 3. Continued.

Date	Latitude	Longitude	Cell/Plot	Scientific Name	Number Collected (tag #given) R=recapture e=escape
8/5/2003	36°00.014	-85°04.120	83/129	*Sciurus carolinensis*	R(e)
8/5/2003	35°59.975	-85°04.060	83/126	*Tamias striatus*	R-451
8/5/2003	35°59.752	-85°04.236	83/22	*Blarina brevicauda*	1
8/5/2003	35°59.752	-85°04.236	83/22	*Sciurus carolinensis*	1(e)
8/5/2003	35°59.752	-85°04.236	83/22	*Sciurus carolinensis*	1
8/5/2003	35°59.591	-85°04.234	83/24	*Mephitis mephitis*	1
8/5/2003	35°59.591	-85°04.234	83/24	*Didelphis virginia*	1
8/5/2003	35°59.591	-85°04.234	83/24	*Peromyscus spp.*	1(e)
8/5/2003	35°59.591	-85°04.234	83/24	*Sciurus carolinensis*	1(e)
8/6/2003	35°57.679	-85°04.593	83/123	*Sciurus carolinensis*	3(457,456,473)
8/6/2003	35°57.679	-85°04.593	83/123	*Sciurus carolinensis*	R(208,219)
8/6/2003	35°57.679	-85°04.593	83/123	*Tamias striatus*	3(474,459,461)
8/6/2003	35°57.679	-85°04.593	83/123	*Tamias striatus*	R-210

Table 3. Continued.

Date	Latitude	Longitude	Cell/Plot	Scientific Name	Number Collected (tag #given) R=recapture e=escape
8/6/2003	35°59.992	-85°04.170	83/124	*Blarina brevicauda*	1
8/6/2003	35°59.992	-85°04.170	83/124	*Sciurus carolinensis*	R-407
8/6/2003	35°59.975	-85°04.060	83/126	*Tamias striatus*	1(e)
8/6/2003	35°59.975	-85°04.060	83/126	*Tamias striatus*	1(462)R-451
8/6/2003	36°00.014	-85°04.120	83/129	*Didelphis virginia*	1
8/6/2003	36°00.014	-85°04.120	83/129	*Tamias striatus*	3(467,463,464)
8/6/2003	35°59.752	-85°04.236	83/22	*Sciurus carolinensis*	2(e)
8/6/2003	35°59.752	-85°04.236	83/22	*Sciurus carolinensis*	R-212
8/6/2003	35°59.752	-85°04.236	83/22	*Didelphis virginia*	1
8/6/2003	35°59.591	-85°04.234	83/24	*Sciurus carolinensis*	1(e)
8/7/2003	36°00.014	-85°04.120	83/129	*Tamias striatus*	1(465,470)R-467
8/7/2003	35°59.975	-85°04.060	83/126	*Didelphis virginia*	1
8/7/2003	35°59.992	-85°04.170	83/124	*Sciurus carolinensis*	1(468)

Table 3. Continued.

Date	Latitude	Longitude	Cell/Plot	Scientific Name	Number Collected (tag #given) R=recapture e=escape
8/7/2003	35°59.992	-85°04.170	83/124	*Sciurus carolinensis*	R-407
8/7/2003	35°57.650	-85°04.436	83/121	*Sciurus carolinensis*	R
8/7/2003	35°57.650	-85°04.436	83/121	*Sciurus carolinensis*	2(466,453)
8/7/2003	35°57.650	-85°04.436	83/121	*Peromyscus spp.*	1(460)
8/7/2003	35°57.650	-85°04.436	83/121	*Peromyscus spp.*	1
8/7/2003	35°57.679	-85°04.593	83/123	*Tamias striatus*	3(455,471,209)
8/7/2003	35°57.679	-85°04.593	83/123	*Tamias striatus*	R-210
8/7/2003	35°57.679	-85°04.593	83/123	*Tamias striatus*	1
8/7/2003	35°57.679	-85°04.593	83/123	*Sciurus carolinensis*	1
8/7/2003	35°57.679	-85°04.593	83/123	*Sciurus carolinensis*	2(469,472)
8/7/2003	35°37.635	-85°04.443	83/19	*Procyon lotor*	R
8/7/2003	35°37.635	-85°04.443	83/19	*Mephitis mephitis*	1
8/7/2003	35°59.752	-85°04.236	83/22	*Sciurus carolinensis*	3

Table 3. Continued.

Date	Latitude	Longitude	Cell/Plot	Scientific Name	Number Collected (tag #given) R=recapture e=escape
8/7/2003	35°59.591	-85°04.234	83/24	*Tamias striatus*	1
6/2/2004	35°56.277	-84°42.255	90/75	*Didelphis virginia*	1
6/2/2004	35°56.277	-84°42.255	90/75	*Peromyscus spp.*	1(e)
6/2/2004	35°57.923	-84°39.525	90/78	*Didelphis virginia*	1
6/2/2004	35°57.882	-84°39.429	90/79	*Peromyscus spp.*	1(302) 1(e)
6/2/2004	35°57.882	-84°39.429	90/79	*Blarina brevicauda*	1
6/2/2004	35°58.184	-84°39.528	90/83	*Peromyscus spp.*	2(303,304)
6/2/2004	35°58.184	-84°39.528	90/83	*Tamias striatus*	1(305)
6/3/2004	35°58.485	-84°40.043	90/66	*Tamias striatus*	1(319)
6/3/2004	35°58.485	-84°40.043	90/66	*Peromyscus spp.*	1(e)
6/3/2004	35°58.612	-84°40.076	90/68	*Peromyscus spp.*	1(318)
6/3/2004	35°58.612	-84°40.076	90/68	*Didelphis virginia*	1
6/3/2004	35°56.239	-84°42.213	90/70	*Procyon lotor*	1

Table 3. Continued.

Date	Latitude	Longitude	Cell/Plot	Scientific Name	Number Collected (tag #given) R=recapture e=escape
6/3/2004	35°56.239	-84°42.213	90/70	*Sciurus carolinensis*	1(307)R-38
6/3/2004	35°56.239	-84°42.213	90/70	*Peromyscus spp.*	1(306)
6/3/2004	35°56.277	-84°42.255	90/75	*Peromyscus spp.*	1(308)
6/3/2004	35°56.277	-84°42.255	90/75	*Blarina brevicauda*	1
6/3/2004	35°57.923	-84°39.525	90/78	*Sciurus carolinensis*	1(311)
6/3/2004	35°57.923	-84°39.525	90/78	*Peromyscus spp.*	1(313)
6/3/2004	35°57.923	-84°39.525	90/78	*Tamias striatus*	1(312)
6/3/2004	35°57.882	-84°39.429	90/79	*Didelphis virginia*	1
6/3/2004	35°57.882	-84°39.429	90/79	*Blarina brevicauda*	1
6/3/2004	35°57.882	-84°39.429	90/79	*Sciurus carolinensis*	1(309)
6/3/2004	35°58.184	-84°39.528	90/83	*Tamias striatus*	R-305
6/3/2004	35°58.184	-84°39.528	90/83	*Peromyscus spp.*	2(316,315)
6/3/2004	35°58.184	-84°39.528	90/83	*Peromyscus spp.*	2(317,314)

Table 3. Continued.

Date	Latitude	Longitude	Cell/Plot	Scientific Name	Number Collected (tag #given) R=recapture e=escape
6/4/2004	35°58.485	-84°40.043	90/66	*Peromyscus spp.*	2(330,329)
6/4/2004	35°58.485	-84°40.043	90/66	*Microtus pinetorum*	1
6/4/2004	35°58.485	-84°40.043	90/66	*Tamias striatus*	R-319
6/4/2004	35°58.485	-84°40.043	90/66	*Peromyscus spp.*	1(327)
6/4/2004	35°58.612	-84°40.076	90/68	*Peromyscus spp.*	R-318
6/4/2004	35°58.612	-84°40.076	90/68	*Sciurus carolinensis*	1(331)
6/4/2004	35°56.239	-84°42.213	90/70	*Tamias striatus*	1(321)
6/4/2004	35°56.239	-84°42.213	90/70	*Sciurus carolinensis*	1(320)
6/4/2004	35°56.239	-84°42.213	90/70	*Peromyscus spp.*	R-306
6/4/2004	35°56.277	-84°42.255	90/75	*Sciurus carolinensis*	2(322,324)
6/4/2004	35°56.277	-84°42.255	90/75	*Sciurus carolinensis*	1(323)
6/4/2004	35°56.277	-84°42.255	90/75	*Peromyscus spp.*	1(325)
6/4/2004	35°57.923	-84°39.525	90/78	*Peromyscus spp.*	1(333)

Table 3. Continued.

Date	Latitude	Longitude	Cell/Plot	Scientific Name	Number Collected (tag #given) R=recapture e=escape
6/4/2004	35°57.923	-84°39.525	90/78	*Tamias striatus*	R-312
6/4/2004	35°57.882	-84°39.429	90/79	*Sciurus carolinensis*	1(e)
6/4/2004	35°57.882	-84°39.429	90/79	*Tamias striatus*	1(332)
6/4/2004	35°57.882	-84°39.429	90/79	*Sylvilagus floridanus*	1
6/4/2004	35°57.882	-84°39.429	90/79	*Blarina brevicauda*	1
6/4/2004	35°58.184	-84°39.528	90/83	*Tamias striatus*	R-305
6/4/2004	35°58.184	-84°39.528	90/83	*Mephitis mephitis*	2
6/15/2004	36°04.932	-84°38.597	139/213	*Didelphis virginia*	1
6/16/2004	36°05.187	-84°38.960	139/207	*Peromyscus spp.*	1(376)
6/16/2004	36°05.096	-84°38.990	139/208	*Peromyscus spp.*	1(377)
6/17/2004	36°05.187	-84°38.960	139/207	*Procyon lotor*	1
6/17/2004	36°05.142	-84°38.849	139/209	*Didelphis virginia*	1
6/22/2004	36°05.940	-84°38.973	139/44	*Didelphis virginia*	1

Table 3. Continued.

Date	Latitude	Longitude	Cell/Plot	Scientific Name	Number Collected (tag #given) R=recapture e=escape
6/22/2004	36°05.866	-84°38.971	139/45	*Peromyscus spp.*	1(379)
6/22/2004	36°06.217	-84°39.367	139/56	*Peromyscus spp.*	1(378)
6/23/2004	36°05.942	-84°38.457	139/54	*Peromyscus spp.*	1(365)
6/23/2004	36°05.942	-84°38.457	139/54	*Didelphis virginia*	1
6/24/2004	36°05.942	-84°38457	139/54	*Peromyscus spp.*	1(396)
6/25/2004	36°05.942	-84°38.457	139/54	*Peromyscus spp.*	R-365
6/25/2004	36°05.768	-84°38.719	139/49	*Procyon lotor*	1
6/30/2004	35°59.680	-84°27.785	110/111	*Peromyscus spp.*	1(370)
6/30/2004	35°59.733	-84°27.852	110/112	*Peromyscus spp.*	1(380)
7/1/2004	35°59.733	-84°27.852	110/112	*Peromyscus spp.*	R-380
7/1/2004	35°59.658	-84°27.888	110/113	*Tamias striatus*	1(381)
7/1/2004	35°59.601	-84°28.156	110/115	*Peromyscus spp.*	1(382)
7/2/2004	35°59.658	-84°27.888	110/113	*Tamias striatus*	R-381

Table 3. Continued.

Date	Latitude	Longitude	Cell/Plot	Scientific Name	Number Collected (tag #given) R=recapture e=escape
7/2/2004	35°59.601	-84°28.156	110/115	*Peromyscus spp.*	1(383)
7/12/2004	36°05.891	-84°46.889	137/102	*Peromyscus spp.*	2(385,386)
7/13/2004	36°05.832	-84°46.848	137/105	*Peromyscus spp.*	R-386
7/13/2004	36°05.749	-84°45.494	137/92	*Peromyscus spp.*	1(384)
7/13/2004	36°05.883	-84°47.257	137/97	*Didelphis virginia*	1
7/13/2004	36°05.891	-84°46.889	137/102	*Blarina brevicauda*	1
7/21/2004	36°12.766	-84°35.209	172/36	*Peromyscus spp.*	1(387)
7/21/2004	36°12.489	-84°35.285	172/34	*Peromyscus spp.*	1(388)
7/21/2004	36°12.169	-84°35.209	172/32	*Peromyscus spp.*	1(389)
7/21/2004	36°11.942	-84°35.200	172/30	*Peromyscus spp.*	1(390)
7/22/2004	36°12.766	-84°35.209	172/36	*Tamias striatus*	1(391)
7/22/2004	36°12.489	-84°35.285	172/34	*Peromyscus spp.*	2(392,397)
7/22/2004	36°12.082	-84°35.316	172/31	*Blarina brevicauda*	1

Table 3. Continued.

Date	Latitude	Longitude	Cell/Plot	Scientific Name	Number Collected (tag #given) R=recapture e=escape
7/22/2004	36°11.048	-84°35.400	172/59	*Peromyscus spp.*	1(369)
7/23/2004	36°12.385	-84°35.252	172/35	*Peromyscus spp.*	1(367)
7/23/2004	36°12.385	-84°35.252	172/35	*Peromyscus spp.*	1(e)
7/23/2004	36°11.738	-84°35.239	172/28	*Peromyscus spp.*	1(373)
7/23/2004	36°12.082	-84°35.316	172/31	*Blarina brevicauda*	1
7/24/2004	36°12.385	-84°35.252	172/35	*Peromyscus spp.*	R-367
7/24/2004	36°11.942	-84°35.200	172/30	*Peromyscus spp.*	1(368)
7/24/2004	36°11.738	-84°35.239	172/28	*Peromyscus spp.*	1(366)

Table 4. Model selection results for Program MARK models of white-footed mice detection probability (p) and occupancy (Ψ) on site level in the Emory/Obed watershed, located in Cumberland and Morgan Counties, Tennessee.

Model[a]	AIC_c	ΔAIC_c	AIC_c weight	Deviance	# Par
P(YEAR/SITE) ψ(SEASON)	672.4	0.00	0.98	664.0	4
P(YEAR/SITE) ψ(DWD)	682.3	10.0	0.01	674.0	4
p(YEAR/SITE) ψ(.)	685.3	12.9	0.00	679.1	3
p(YEAR/SITE) ψ(OAK)	685.4	13.1	0.00	677.1	4
p(YEAR/SITE) ψ(SNAG)	685.8	13.4	0.00	677.5	4
p(YEAR/SITE) ψ(HICKORY)	685.8	13.5	0.00	677.5	4
p(YEAR/SITE) ψ(EFFORT)	685.9	13.5	0.00	677.6	4
p(YEAR/SITE) ψ(HICKORY + OAK)	685.9	13.6	0.00	675.4	5
p(YEAR/SITE) ψ(OVERHGT)	686.4	14.0	0.00	678.1	4
p(YEAR/SITE) ψ(SUCCESSION)	686.5	14.1	0.00	678.2	4
p(YEAR/SITE) ψ(DISTAGE)	687.0	14.6	0.00	678.7	4
p(YEAR/SITE) ψ(STEMS)	687.2	14.8	0.00	678.9	4
p(YEAR/SITE) ψ(DIST)	687.2	14.8	0.00	678.9	4
p(YEAR/SITE) ψ(BATOTAL)	687.3	15.0	0.00	679.0	4
p(YEAR/SITE) ψ(YEAR/SITE)	687.4	15.0	0.00	679.0	4
p(EFFORT) ψ(.)	699.0	26.7	0.00	692.8	3
p(SEASON) ψ(.)	700.2	27.9	0.00	694.0	3
p(.) ψ(.)	706.4	34.0	0.00	702.3	2
p(t) ψ(.)	711.9	39.5	0.00	697.0	7

[a] BATOTAL = total basal area
DIST = severity of any disturbances
DISTAGE = time since disturbance
DWD = downed woody debris volume
EFFORT = effort of trapping
HICKORY = basal area of only hickory species
HICKORY + OAK = basal area of only hickory and oak species
OAK = basal area of only oak species
OVERHGT = top height of canopy overstory
SEASON = trapping weeks divided into two week intervals
SNAG = basal area of snags
STEMS = number of stems
SUCCESSION = succession of the forest (stand development)
YEAR/SITE = year of trapping/corresponding sites trapped
t = trap occasion
. = constant occupancy rate
AIC= -2 ln(model likelihood) + 2(number of parameters)

Table 5. Model selection results for Program MARK models of eastern chipmunk detection probability (p) and occupancy (Ψ) on site level in the Emory/Obed watershed, located in Cumberland and Morgan Counties, Tennessee.

Model[a]	AIC_c	ΔAIC_c	AIC_c weight	Deviance	# Par
p(YEAR/SITE) ψ(BATOTAL)	338.4	0.0	0.50	330.1	4
p(YEAR/SITE) ψ(YEAR/SITE)	340.6	2.2	0.17	332.3	4
p(YEAR/SITE) ψ(EFFORT)	341.1	2.7	0.13	332.8	4
p(YEAR/SITE) ψ(SEASON)	342.4	4.0	0.07	334.1	4
p(YEAR/SITE) ψ(HICKORY)	344.4	6.0	0.03	336.1	4
p(YEAR/SITE) ψ(.)	344.9	6.4	0.02	338.7	3
p(YEAR/SITE) ψ(DIST)	345.1	6.7	0.02	336.8	4
p(YEAR/SITE) ψ(DWD)	345.2	6.8	0.02	336.9	4
p(YEAR/SITE) ψ(HICKORY + OAK)	346.2	7.8	0.01	335.7	5
p(YEAR/SITE) ψ(SNAG)	346.7	8.3	0.01	338.4	4
p(YEAR/SITE) ψ(OAK)	346.7	8.3	0.01	338.4	4
p(YEAR/SITE) ψ(DISTAGE)	346.8	8.4	0.01	338.5	4
p(YEAR/SITE) ψ(OVERHGT)	346.9	8.5	0.01	338.6	4
p(YEAR/SITE) ψ(SUCCESSION)	347.0	8.5	0.01	338.6	4
p(YEAR/SITE) ψ(STEM)	347.0	8.6	0.01	338.7	4
p(t) ψ(.)	348.4	10.0	0.00	333.5	7
p(SEASON) ψ(.)	349.1	10.7	0.00	342.9	3
p(EFFORT) ψ(.)	350.5	12.1	0.00	344.3	3

[a] BATOTAL = total basal area
DIST = severity of any disturbances
DISTAGE = time since disturbance
DWD = downed woody debris volume
EFFORT = effort of trapping
HICKORY = basal area of only hickory species
HICKORY + OAK = basal area of only hickory and oak species
OAK = basal area of only oak species
OVERHGT = top height of canopy overstory
SEASON = trapping weeks divided into two week intervals
SNAG = basal area of snags
STEMS = number of stems
SUCCESSION = succession of the forest (stand development)
YEAR/SITE = year of trapping/corresponding sites trapped
t = trap occasion
. = constant occupancy rate
AIC= -2 ln(model likelihood) + 2(number of parameters)

Table 6. Model selection results for Program MARK models of eastern gray squirrel detection probability (p) and occupancy (Ψ) on site level in the Emory/Obed watershed, located in Cumberland and Morgan Counties, Tennessee.

Model[a]	AIC_c	ΔAIC_c	AIC_c weight	Deviance	# Par
p(EFFORT) ψ(STEMS)	346.7	0.0	0.26	338.4	4
p(EFFORT) ψ(EFFORT)	347.4	0.7	0.18	339.1	4
p(EFFORT) ψ(SNAG)	348.8	2.1	0.09	340.5	4
p(EFFORT) ψ(SEASON)	349.1	2.4	0.08	340.8	4
p(EFFORT) ψ(SUCCESSION)	349.6	2.8	0.06	341.2	4
p(EFFORT) ψ(OAK)	349.9	3.2	0.05	341.6	4
p(EFFORT) ψ(.)	350.2	3.5	0.05	344.0	3
p(EFFORT) ψ(HICKORY)	350.3	3.6	0.04	342.0	4
p(EFFORT) ψ(HICKORY + OAK)	350.5	3.8	0.04	340.0	5
p(EFFORT) ψ(YEAR/SITE)	350.7	4.0	0.04	342.4	4
p(EFFORT) ψ(BATOTAL)	351.0	4.3	0.03	342.7	4
p(EFFORT) ψ(OVERHGT)	351.7	5.0	0.02	343.4	4
p(EFFORT) ψ(DWD)	351.7	5.0	0.02	343.4	4
p(EFFORT) ψ(DISTAGE)	352.2	5.5	0.02	343.9	4
p(EFFORT) ψ(DIST)	352.3	5.6	0.02	344.0	4
p(t) ψ(.)	353.5	6.8	0.01	338.6	7
p(YEAR/SITE) ψ(.)	355.3	8.6	0.00	349.1	3
p(.) ψ(.)	355.8	9.1	0.00	351.7	2
p(SEASON) ψ(.)	355.8	9.1	0.00	349.6	3

[a] BATOTAL = total basal area
DIST = severity of any disturbances
DISTAGE = time since disturbance
DWD = downed woody debris volume
EFFORT = effort of trapping
HICKORY = basal area of only hickory species
HICKORY + OAK = basal area of only hickory and oak species
OAK = basal area of only oak species
OVERHGT = top height of canopy overstory
SEASON = trapping weeks divided into two week intervals
SNAG = basal area of snags
STEMS = number of stems
SUCCESSION = succession of the forest (stand development)
YEAR/SITE = year of trapping/corresponding sites trapped
t = trap occasion
. = constant occupancy rate
AIC= -2 ln(model likelihood) + 2(number of parameter

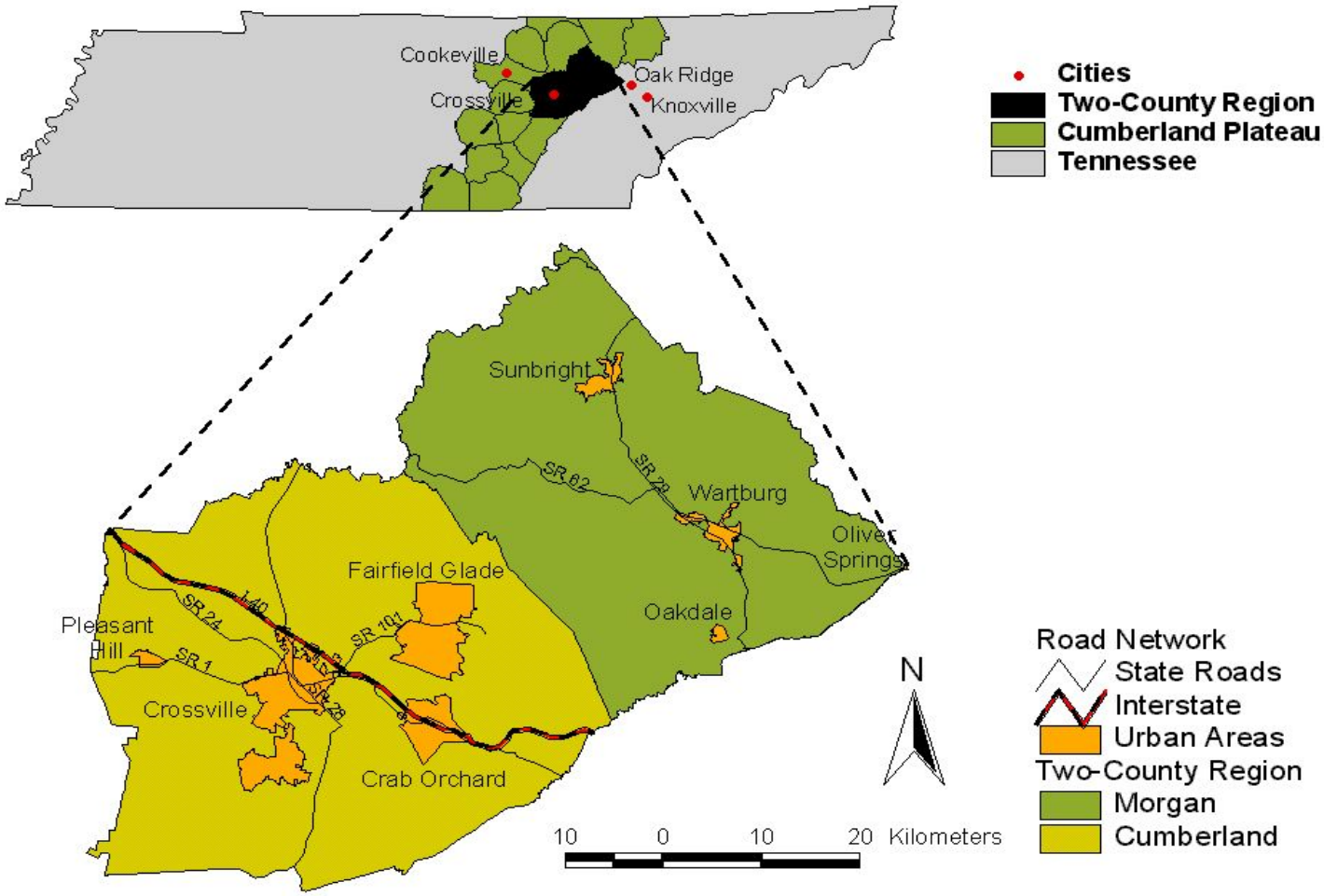


Figure 1. Emory/Obed watershed, located in Cumberland and Morgan Counties, Tennessee (From Strickland 2003).

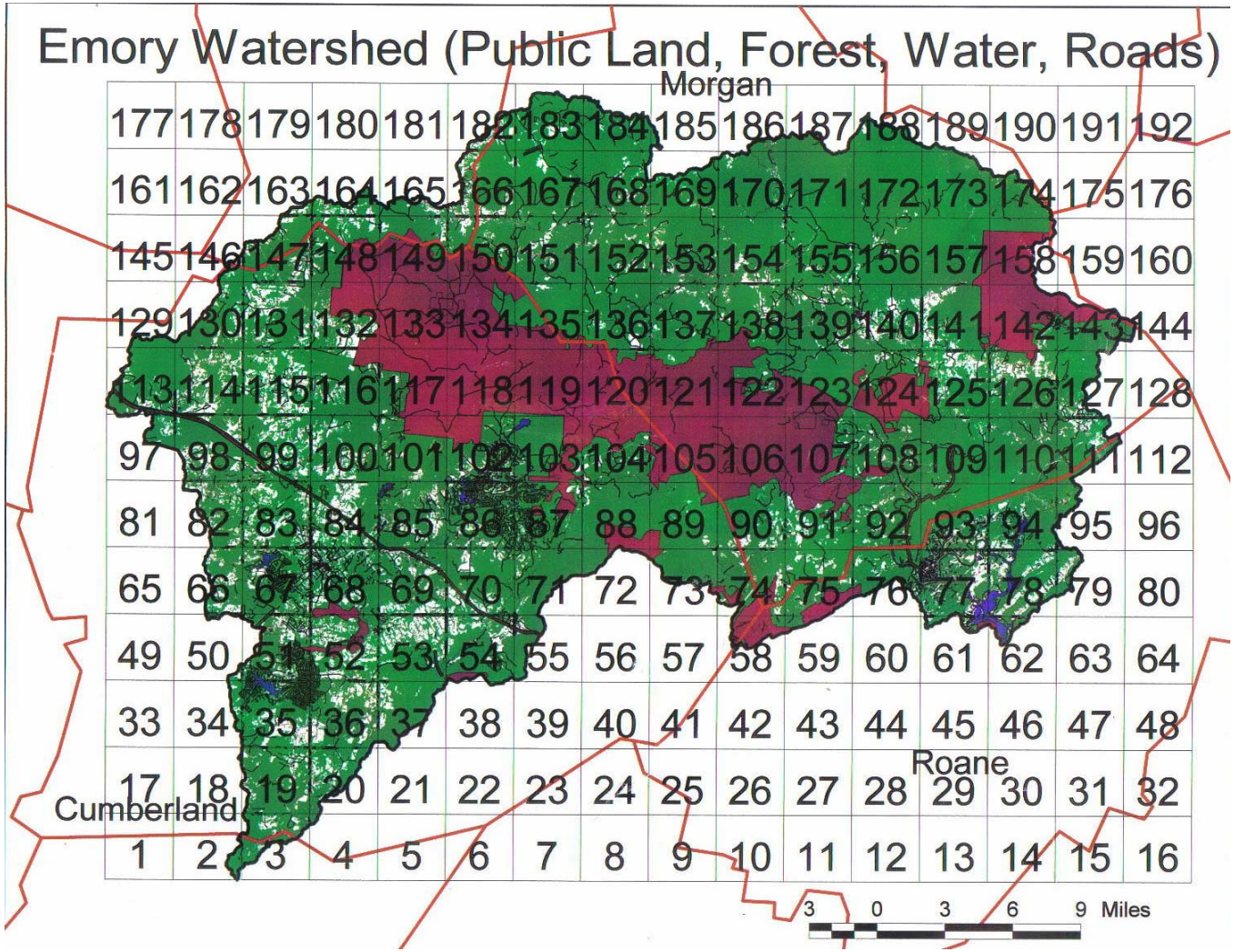


Figure 2. Division of landscapes (2,331 ha-square) sampled in the Emory/Obed watershed Tennessee, between the years of 2002-2004.

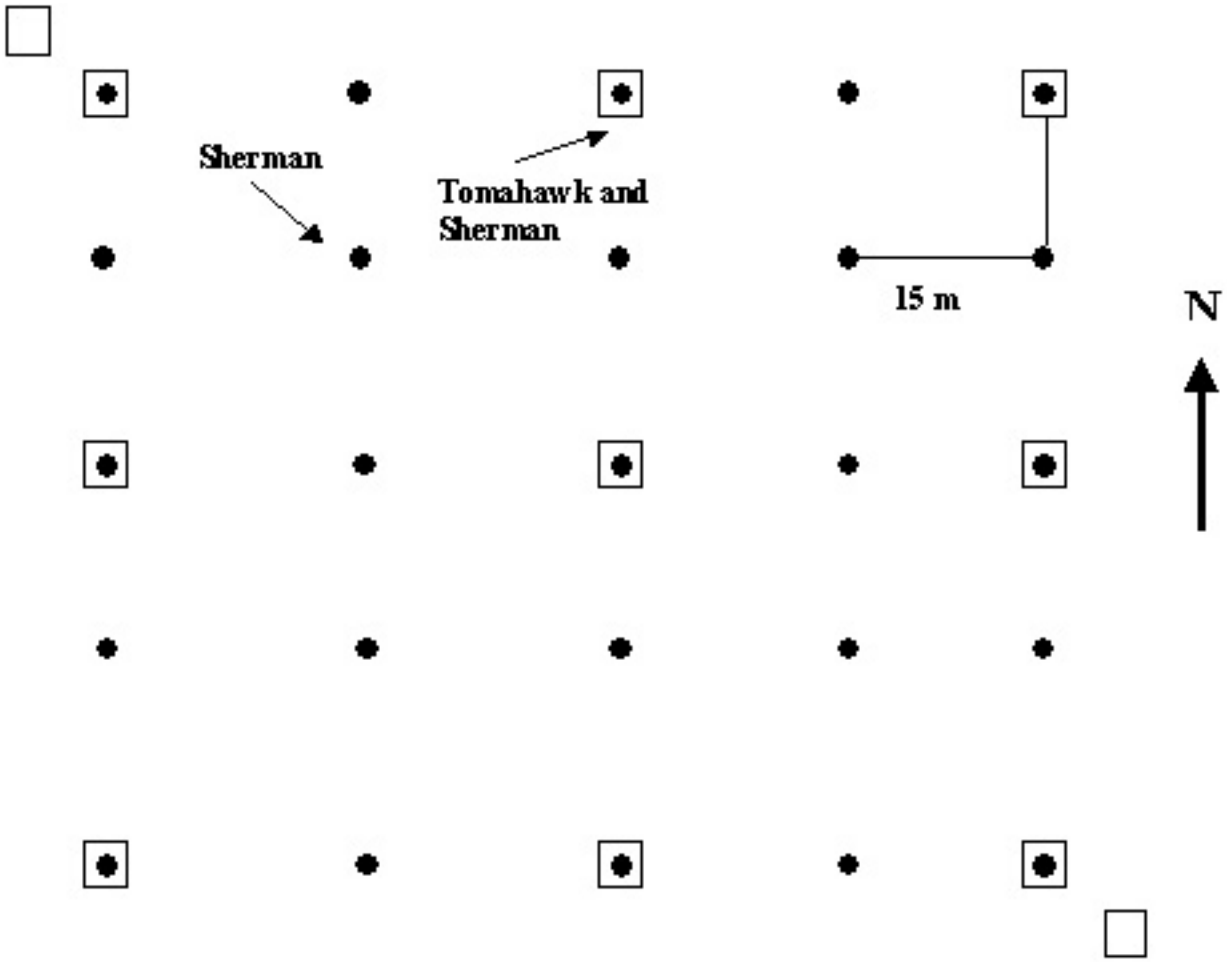


Figure 3. 5x5 trapping grid for small mammals in the Emory/Obed watershed, located in Cumberland and Morgan Counties, Tennessee from 2002-2004.

VITA

Carrie Hedio Salyers was born in Chagrin Falls, OH on April 24, 1977. She lived in Ohio until the age of 8, when her family moved to Newport News, VA. She graduated from Menchville High School in 1995. From there, she attended Old Dominion for two years before transferring to the University of Tennessee, Knoxville to finish her degree. She received her Bachelor of Science degree in Wildlife and Fisheries Science in December of 2001. Finishing her internship with TVA's terrestrial zoologist, Hill Henry, Carrie was accepted into graduate school at the University of Tennessee, Knoxville to complete her Master of Science degree in Wildlife and Fisheries Science in the Fall of 2002. She married Brac Salyers in October of 2005.