

# Terrestrial Small Mammals

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A variety of terrestrial small mammals with diverse size, form, geographic range, and ecological niche inhabit southern forests. Some are highly specialized for their environment, such as the semi-aquatic species or fossorial species, such as moles. Some, such as the cotton rat, are widely distributed throughout the region and others highly restrictive in their range and habitat. Because of their secretive and often nocturnal nature, most small mammals are not apparent to the casual observer, but they are prominent in southern forests.

Terrestrial small mammals are integral and important components of southern forest systems. They function as consumers of primary productivity. They consume, distribute, and disperse plant seed, including acorns. They consume large quantities of insects and other arthropods. Also, their subterranean activities aerate soils and they function in dispersing mycorrhizal fungi spores within forests (Maser et al. 1978).

Small mammals are primary prey for many mammals, birds, and reptiles and sustain many vertebrate

species on higher trophic levels. As such, small mammals play a substantial role in system energetics and nutrient cycling. Also, small mammals can be important vectors of diseases, such as tularemia, lyme disease, and hantavirus, which can infect humans, livestock, and other species of wildlife. A number of dif-

ferent species inhabit and function in southern forests. In this chapter I cover shrews and moles (Insectivores), and small terrestrial rodents.

## INSECTIVORES

Shrews are the smallest mammal, weighing less than an ounce. These Insectivores are very active with a high metabolism and voracious appetite. Their main diet is insects; other invertebrates such as earthworms, sowbugs, and snails; and larger vertebrates. They use burrows of other small mammals and construct burrows of their own. They have a long snout, poor sight and sense of smell, but keen hearing and tactile sense. Owls are among shrew

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Small rodents, such as this woodrat, are important components of southern forest systems. They consume primary productivity, and disperse plants and fungi (J. Dickson).

Small mammals are primary prey for many mammals, birds, and reptiles, and sustain many vertebrate species on a higher trophic level (OK Dept. Wildlife).



predators; shrew skulls show up regularly in owl pellets. Several species are found in southern forests.

The southeastern shrew is found throughout the South except the western extremity and along the southern coastal area (Hall 1981). Some specimens have been captured in dry woods, but most have been taken from marshy habitat to moist woods (Sealander and Heidt 1990). They have been documented in some young brushy stands (Table 2) and in some mature stands, particularly in hardwood stands on moist sites (Table 3).

The short-tailed shrew, originally recognized as 1 species (*Blarina brevicauda*), recently has been split into 3 species: *B. brevicauda* in the northeastern part of the region, *B. carolinensis* through the southern portion of the South, and *B. hylophaga* in the midwestern U.S. extending into eastern Oklahoma and northwestern Arkansas. *Blarina* spp. occur regularly throughout the region. Typical habitat of these species is moist woods (Sealander and Heidt 1990). They are very abundant species in the South, commonly inhabiting many different stand types at different stages of stand development from the young brushy stage to maturity (Tables 1,2,3).

The least shrew is distributed throughout the South. It is gregarious, often with several occupying the same nest during winter. It is not a woodland species, but is associated with dense herbaceous vegetation, particu-

larly grasses such as bluestem, bermudagrass, and Johnson grass (Schmidly 1983). It has been documented, apparently in appropriate habitat, in different stand types (Tables 1,2,3).

The water shrew occurs along the Appalachian Mountains from Virginia to northern Georgia (Hall 1981). Appropriately named (*S. palustris*), it occupies moist habitat along pond, stream, and marsh edges. Range of the long-tailed shrew is similar to that of the water shrew.

The smoky shrew occurs in the mountainous central part of the region from central Kentucky to western Virginia and southerly to northeastern Georgia and western South Carolina (Hall 1981). The pygmy shrew occurs along the eastern mountains from northern Virginia to northern Georgia. The swamp short-tailed shrew has been identified along coastal Virginia and North Carolina.

Moles, somewhat larger than shrews, are another insectivore. They construct extensive tunnels in which they live and are well adapted for their subterranean existence and for digging. Their legs are short and powerful and placement facilitates digging. Their eyes and ears are vestigial and they have a short almost hairless tail (Lowery 1974). Three moles occupy southern forests. The most common and found throughout is the

Table 1. Relative abundance of captures of terrestrial small mammals in 1 -year-old stands in the South

Stand <sup>b</sup>	Cotton Mouse	White-footed Mouse	Golden Mouse	Hispid Cotton Rat	Short-tailed shrew <sup>c</sup>	Least shrew	South-eastern shrew	Eastern Harvest Mouse	Marsh Rice Rat	House Mouse	Eastern Woodrat
1. Pine Plant.-GA		1		2				4		3	
2. Pine Plant.-MS		4		1	5				3	2	
3. Pine regen.-MS	1					2		3			
4. Bottomland hardwood-TX	1								2		3

<sup>a</sup>1=highest abundance, 2=2nd highest, etc.

<sup>b</sup>Citation: 1. Atkeson and Johnson 1979; 2. Perkins et al. 1989; 3. Wolfe and Lohofener 1963; 4. Dickson et al. unpubl. data

<sup>c</sup>Blarina spp.

Table 2. Relative abundance<sup>a</sup> of captures of terrestrial small mammals in young brushy stands (3-6 years old) in the South.

Stand <sup>b</sup>	Cotton Mouse	White-footed Mouse	Golden Mouse	Hispid Cotton Rat	Short-tailed Shrew <sup>c</sup>	Least shrew	South-eastern Shrew	Eastern Harvest Mouse	Marsh Rice Rat	House Mouse	Eastern Woodrat	Eastern Chipmunk	Other
1. Pine Stand-SC	3			1	4			2					
2. Pine Plant.-SC		3		1				2					
3. Pine Plant.-NC		9	3	1	6	3	8	2	7	5			
4. Pine Plant.-GA		2		1				3		4			
5. Pine Stand-MS	1			2	4	3	6	5					
6. Pine Plant.-MS		4		1	5				2	3			
7. Pine Plant.-TX			3	1				2 <sup>d</sup>			4		5 <sup>e</sup>
8. Bottoml. Hardw.-TX	2			1	5			3 <sup>d</sup>	4		6		
9. Right-of-way-TN		3			2			4				5	1'
10. Right-of-way-TN		2			1			4				5	3'

<sup>a</sup>1=highest abundance, 2=2nd highest, etc.

<sup>b</sup>Citation: 1,2. Mengak et al. 1989; 3. Mitchell et al. 1995; 4. Atkeson and Johnson 1979; 5. Wolf and Lohofener 1983; 6. Perkins et al. 1989; 7. Fleet and Dickson 1984; 8. Dickson et al. unpubl. data; 9,10. Johnson et al. 1979.

<sup>c</sup>Blarina spp.

<sup>d</sup>Fulvous harvest mouse

<sup>e</sup>Black Rat

<sup>f</sup>Pine vole

eastern mole. Of more limited range in the eastern mountains is the hairy-tailed mole and in the eastern mountains and along the eastern coast into Florida is the star-nosed mole. Moles feed on a variety of invertebrates in the soil and occasionally plants. They are found in a variety of open and forested habitats; usually in sandy to loamy soil in which they can tunnel easily; they usually do not occupy heavy clay or very rocky soils (Sealander and Heidt 1990).

## RODENTS

The eastern chipmunk occurs generally in the central and northwest portion of the region and is mostly absent from the coastal plain (Hall 1981). It is named and

noted for storing food in chambers in burrows which it constructs. It often frequents areas with some type of physical structure such as down logs, exposed tree roots, rock outcrops, rock piles, and log piles. Chipmunks are active during the day and seasonally undergo periods of torpor during winter. During winter they awake periodically to feed on their food cache or forage aboveground. Foods include buds, fruits and berries, grain, mushrooms, insects, and small vertebrates and their young or eggs. Acorns and hickory nuts are frequently stored items (Lowery 1974). Chipmunks are commonly captured in mature hardwood and pine stands in Tennessee (Table 3), and appear to be widespread and common in upland stands in the northern central portion of the South.

Table 3. Relative abundance<sup>a</sup> of captures of terrestrial small mammals in mature stands in the South.

Stand <sup>b</sup>	Cotton Mouse	White-footed Mouse	Golden Mouse	Hispid Cotton Rat	Short-tailed Shrew <sup>c</sup>	Least shrew	South-eastern Shrew	Eastern Harvest Mouse	Marsh Rice Rat	House Mouse	Eastern Woodrat	Eastern Chipmunk	Other
1. Pocosin-NC	2	6	1		4		3						5 <sup>h</sup>
2. Laurel oak floodplain-GA	1		2		3		7			5	4		6 <sup>e</sup>
3. Longleaf/slash-MS	1			3	4	2	4	4					
4. Bayhead-MS	1		3	6	4	4	2				6		
5. Pine-hardw.-MS		1											
6. Pine-hardw.-TX	2			4	3						1		
7. Streamside zone-TX	1		5	6	4			3 <sup>h</sup>			2		
8. Bottoml. Hardw.-TX	1		4		3			5 <sup>e</sup>			2		5 <sup>i</sup>
9. Oak-hickory-TN		3			2							1	
10. Pine-TN		3	5		1							2	4 <sup>g</sup>
11. Oak-hickory-TN		1			3							2	
12. Chestnut-oak-TN		1										2	
13. Pine-TN		1	3		4							2	

<sup>a</sup>1=highest abundance, 2=2nd highest, etc.

<sup>b</sup>Citation: 1. Mitchell et al. 1995; 2. Boyd 1976; 3.4. Wolfe and Lohofener 1983; 5. Perkins et al. 1989; 6. Fleet and Dickson 1984; 7. Dickson and Williamson 1988; 8. Dickson et al. unpubl. data; 9.10. Johnson et al. 1979; 11.12.13. Dueser and Shugart 1978;

<sup>c</sup>Blarina spp.      <sup>d</sup>Southern bog lemming      <sup>e</sup>Fulvous harvest mouse      <sup>f</sup>Marsh rice rat      <sup>g</sup>Pine vole

Range of the 13-lined ground squirrel, common throughout the central western U.S., extends only into the western edge of the region (NW Arkansas, NE Oklahoma, SE Texas)(Hall 1981). It is a diurnal, social animal that lives in colonies. They construct and use an extensive burrow system, and hibernate overwinter. Their diet is grass and forbs, insects, and some small vertebrates (Schmidly 1983). Ground squirrel habitat is grassland and they have extended their range easterly recently, apparently as a result of land clearing.

A fossorial rodent of southern forest soils is the pocket gopher. The species is noted for constructing an extensive subterranean burrow system which affords protection from predators and weather extremes. The animal spends most of its life underground and is well designed for that existence. It is a stocky rodent with stout front claws and small eyes. Pocket gophers are usually found in well- drained sandy soils in which they can burrow.

According to Hall (1981) several species of pocket gophers (*Geomys* spp.) occur in southern forests. The range of the plains pocket gopher, typically the mid-western plains? extends easterly into the South into Arkansas and Louisiana. The southeastern pocket gopher occurs from central Florida approximately mid-way into Georgia and Alabama. Hall (198 1) recognizes

3 species of pocket gophers (colonial, Sherman's, Cumberland Island) each with limited range along coastal Georgia.

Range of the hispid pocket mouse, a midwestern plains species, extends easterly into eastern Oklahoma and Texas, and western central Louisiana (Hall 1981). This pouched small mammal feeds mostly on seeds of forbs and grasses which it stores in its underground burrows constructed in soils loose enough for burrowing (Schmidly 1983).

The marsh rice rat occurs throughout the South except western Virginia and North Carolina (Hall 1981). The common and scientific name reflect its propensity to consume rice. It is found in damp, moist habitat such as pond and stream borders and marshy areas; hardly ever frequenting dry upland habitat (Lowery 1974). The species is commonly found in a variety of different stand types and stages of development (Tables 1,2,3), but moist/wet habitat is the key factor. In eastern Texas, none were captured in mesic streamside zones (Dickson and Williamson 1988) or in a young pine plantation or a mature upland hardwood pine stand (Fleet and Dickson 1984).

**Harvest mice.**—Harvest mice are very small colorful cricetine rodents weighing less than an ounce and scientifically named for their grooved incisors. They

construct a baseball-sized nest of plant parts underneath or on the ground, or in grass or shrubs. They are mostly nocturnal and consume forb and grass seed, other plant parts, sometimes grain, and occasionally insects.

Three species of harvest mice are found in the South (Hail 1981). The plains harvest mouse, a species of the midwestern U. S., extends into eastern Oklahoma and the tip of northwestern Arkansas. The eastern harvest mouse occurs throughout the region except the tip of Florida, and predominates in the eastern portion of the region. The fulvous harvest mouse occurs from eastern Mississippi northwesterly through Arkansas and west through the region.

Harvest mice are associated with grass/forb and shrubby vegetation and are found in places such as abandoned fields, pastures, roadsides, and odd places vegetated by plants such as bluestem, Johnson grass, fescue, and honeysuckle (Sealander and Heidt 1990). The eastern harvest mouse predominates in the eastern portion of the region and the fulvous in the western portion. Harvest mice are common and widespread in appropriate habitat and populations often reach high densities. Harvest mice inhabit a wide variety of different stand types. They quickly invade young regeneration stands (Table 1), are very regular and abundant in young brushy stands (Table 2), and are sometimes found in mature stands (Table 3), probably near young stands or in openings where low vegetation has developed.

**Peromyscus**.—Widespread throughout southern forests are several species of **Peromyscus**. They feed on a variety of vegetative matter including seed and berries, and some insects and other invertebrates (Hall 1981). Several species have somewhat limited range in the South. The deer mouse, a transcontinental northern species, extends into the northern portion of the South,

from Virginia south into Georgia and westerly through Arkansas and Oklahoma. It is mostly associated with grass and forb vegetation in dry uplands (Choate et al. 1994). The range of *Attwateri's* mouse is from central Texas northeast through Oklahoma and easterly through most of northern Arkansas. General habitat of this species with a tufted tail tip is dry rocky outcrops and cedar glades of the Arkansas mountains. In Florida and parts of adjoining states is the old field mouse. Its range is mostly south of the white-footed mouse and apparently supplants it in that region. The old field mouse is usually associated with herbaceous vegetation in dry habitat, such as fallow fields and roadsides. In peninsular Florida is the Florida mouse whose range is mostly south of the old field mouse.

Other **Peromyscus** have wide distribution in the South. The white-footed mouse, a species of eastern U. S., occurs throughout the region except for southern Alabama, Georgia, and South Carolina, and all of Florida. The cotton mouse occupies all of the region, except for an area of eastern Tennessee, most of Virginia, and the northern portion of South Carolina (Hall 1981). These 2 species are probably the most abundant small mammal in southern forests. They are found in forested and sometimes somewhat open areas, often associated with woods' structure such as rocks, down logs, stumps, and logging slash. They are regular and very abundant in a wide variety of different stand types throughout the region from hardwoods of the eastern mountains, to coastal plain pine stands, to bottomland hardwoods. They inhabit stands of all ages including regeneration, young brushy, and mature (Tables 1,2,3). But white-footed and cotton mice are particularly prominent in mature stands. For example, one or the other was the most commonly captured species in 9 of the 13 mature stands comprising Table 3 and were the second most commonly captured species in 2 of the other 4 stands.

There is some question about the taxonomic integrity of the white-footed and cotton mouse where their ranges overlap. Conclusions from early studies were that hybridization did occur but isolation mechanisms were generally effective (McCarley 1954). The cotton mouse was slightly larger and inhabited moist habitat, whereas habitat of the white-footed mouse was dry uplands. But Lowery (1974) concluded that the inverse of the normal habitat relationship occurred in places in Louisiana. They are difficult to differentiate in the field and captures represent a continuum of sizes. Also, only 1 of the species is identified in almost all small mammal studies (Tables 1,2,3).

There are several species of *Peromyscus* spp., which are widespread throughout the South (H. Williamson).



The strikingly-colored golden mouse occurs throughout the South except the tip of Florida and coastal Louisiana and Texas (Hall 1981). It is somewhat arboreal, foraging and nesting in trees. Habitat of this species is generally described as forested uplands or lowlands, usually with substantial understory vegetation such as blackberry or cane thickets, or dense vines such as honeysuckle or grape (Sealander and Heidt 1990). The species is found in a variety of pine and hardwood stands and appears to first invade forest stands at the young brushy stage, becoming more prevalent as stands age (Tables 1,2,3). They were the most common species in a north Louisiana pine forest (Shadowen 1963).

The grizzled-appearing hispid cotton rat is found throughout the region except along the northern perimeter of Virginia and Kentucky, and the eastern mountains (Hall 1981). It is active diurnally. The species is associated with grass/forb and shrubby vegetation and usually is very abundant wherever that type of habitat occurs. Goertz (1973) sampled a number of different habitats in northern Louisiana. Cotton rats were captured in cultivated grasslands, broomsedge, broomsedge pond edge, and urban shrub and vines; all grass/forb or shrubby habitat. At high densities cotton rats can cause damage to cultivated crops.

The Hispid cotton rat quickly invades regeneration stands of seedlings and dense low vegetation (Table 1). It is consistently the most abundant of all species in young dense brushy stands throughout the South (Table 2). As stands develop and canopies shade out understory vegetation, cotton rat numbers dwindle in response to the changing habitat suitability (Table 3).

The eastern woodrat, commonly called pack rat because of its propensity to gather and cache natural and man-made objects, is distributed throughout the region, except for an area along the east coast covering most of Virginia, North Carolina, and central South Carolina; and also the tip of Florida (Hall 1981). It is a nocturnal forager which constructs a large nest or den in trees or on the ground. Nests often are constructed around some kind of physical structure such as an uprooted tree, stump, rocky outcrop, abandoned barn, or human refuse. It feeds mostly on vegetative matter, including mushrooms, twigs, and seeds and berries. Oak acorns are a conspicuous part of their diet. It is found in a variety of different stand types and ages (Tables 1,2,3), but ideal habitat seems to be riparian forests. In the Coastal Plain of eastern Texas, woodrats inhabit a variety of different habitats, including an upland mature pine-hardwood and a young pine plan-

tation, particularly where there were windrows of logging debris (Fleet and Dickson 1984). Also they inhabit mesic streamside zones (Dickson and Williamson 1988), and quickly invade harvested bottomland hardwood sites (Dickson et al. unpublished data). In Mississippi, woodrats were captured only in bayheads, not in upland pine stands (Wolfe and Lohofener 1983).

Several small microtine rodents occupy southern forests, mostly in the northern portion of the region. These species feed mostly on vegetation, including bark and roots. They develop an extensive runway system above ground in vegetation thick enough to conceal them from predators and also an underground burrow system. Population densities often fluctuate widely.

Gapper's red-backed mouse, found throughout Canada and the northern U.S., extends into the South along the eastern mountains (Hall 1981). The meadow vole is found in the northeast portion of the region into central Georgia. The rock vole occurs throughout northeastern Canada and its range extends southwestwardly into the South along the eastern mountains. A species normally associated with midwestern prairies, the prairie vole, extends into the region as far south as central Arkansas and northern Alabama (Hall 1981). In the early part of this century several were captured in the prairies in the vicinity of the Texas/Louisiana border (Lowery 1974), but none have been found in recent decades. The pine vole occurs throughout the eastern U.S. except along the southern coast, most of Florida, and coastal North Carolina (Hall 1981). The southern bog lemming, a species of northeastern North America, extends into the South along the eastern mountains (Hall 1981).

The meadow jumping mouse is a species of northern North America; but its range extends into the southeast as far south as lower Alabama (Hall 1981). The woodland jumping mouse, a species of northeastern Canada and the U.S., occurs along the eastern mountains into the South. Both species hibernate during winter. Main foods are grass seed, fruits, insects, and fungi. The meadow jumping mouse is associated with herbaceous cover and seems to be especially abundant in dense grass/forb fields in moist habitat such as pond edges and marshes (Choate et al. 1994). The woodland jumping mouse appears to be associated more with forest and forest-field edge than the meadow jumping mouse.

Exotics.-Three species of old world rats and mice; the black rat, Norway rat, and house mouse, have

been introduced into the region and occur throughout, usually in association with humans and their habitations, but also elsewhere. All 3 species originated in Asia, and came to North America on ships with early European settlers (Choate et al. 1994). All have naked tails with prominent annulations (Lowery 1974). They have caused immense economic loss from their consumption and damage to human foods.

The house mouse, about the size of a *Peromyscus*, is widespread throughout. They are common in human habitations but feral populations exist also, and populations can reach very high densities (Lowery 1974). They are captured fairly regularly in a variety of young open and brushy forest stands in early developmental stages (Tables 1,2) but not in mature stands (Table 3).

The Norway rat, about the size of a woodrat, is widespread in the South around human habitations and elsewhere, such as rice and cane fields. In Louisiana, Goertz and Long (1973) found them in 5 habitats, most frequently in a zoological park and in occupied urban buildings. The black rat is similar in size and appearance to the Norway rat and is found throughout the South except the northern central portion. It usually inhabits upper parts of buildings, hence its name, roof rat. In northern Louisiana they were found in 6 habitats, most commonly in rural barns with livestock and in areas overgrown with vines (Goertz and Long 1973). Both of these larger species are often associated with human refuse and have been vectors in the transmission of diseases responsible for substantial human mortality in the past in Europe and in places in the United States.

## SMALL MAMMALS AND FOREST STANDS

Some small mammal species, such as *Peromyscus*, are widespread throughout the region, occurring in a wide variety of stand habitat types and stages of development. Others, such as the pocket gophers on the islands of Georgia, are restrictive in range. And many of the uncommon species in the South are northern and western species that have only limited range extensions into the South.

Generally, small mammals of southern forests are associated with and respond positively to physical structure such as down logs, debris, and stumps; and to productivity of vegetation close to the ground. Several studies have analyzed relationships of small mammal communities and stand development (Tables 1,2,3). There is a general succession of species in developing forest stands, particularly in stands that are changing

rapidly, such as recently regenerated stands. Small mammals quickly invade recently harvested pine and hardwood stands and usually are at their highest abundance in young, rapidly developing stands. In a bottomland hardwood forest in eastern Texas, more than 500 individual animals were captured the first winter after harvesting, even before vegetative growth developed (Dickson et al. unpublished data). And other studies have documented abundant small mammals in very young pine plantations (Atkeson and Johnson 1979), and young northern hardwood stands (Healy and Brooks 1988). Total captures generally were negatively correlated with indicators of mature forest such as tree basal area, and positively correlated with density of low vegetation. *Peromyscus* spp. usually are the earliest invader. *P. gossypinus* or *P. leucopus* were the most abundant small mammal in 3 of 4 very young stands (Table 1). In eastern Texas, harvested bottomland sites were quickly invaded by cotton mice, marsh rice rats, and eastern woodrats.

Relative abundance of small mammals remains very high in young developing stands with dense grass, forbs, and shrubs, and their seeds and fruit. Abundant small mammals have been documented in pine plantations in North Carolina (Mitchell 1995), Georgia (Atkeson and Johnson 1979), and eastern Texas (Fleet and Dickson 1984); and in bottomland hardwoods (Dickson et al. unpublished data).

But small mammal community composition changes quickly in rapidly developing regeneration stands. In the bottomland hardwood study, after the first vegetative growing season (year 2) cotton mice and rice rats, the most abundant species the first year, decreased in captures (Dickson et al. unpublished data). But cotton rats and fulvous harvest mice invaded the clearcuts in response to the development of low, dense vegetation. A somewhat similar situation occurred with small mammal communities in young pine plantations in Georgia (Atkeson and Johnson 1979). White-footed mice quickly invaded pine plantations and were the most abundant small mammal the first year, but by the second year they were mostly supplanted by cotton rats. The small mammal community had shifted from domination by granivores/omnivores to a predominance of herbivores.

As young stands age, their canopies close, and herbaceous and shrubby vegetation is shaded out at about age 7 to 10, habitat suitability for small mammals decreases and small mammal populations decrease. In a series of pine plantations in Georgia (Atkeson and Johnson 1979), captures declined somewhat by planta-



Small mammals, such as this marsh rice rat (above left), are quickly attracted to debris from harvesting (above right), and small mammal populations flourish in the dense vegetative growth which follows (below) (*H. Williamson*).



tion age 5, but decreased further by age 7 as the pine canopies closed despite increased captures of woodland species. By year fifteen, plantations supported very few small mammals. A similar overview is concluded from trapping in pine plantations in North Carolina (Mitchell et al. 1995). There were more than 3 times the number of small mammals and significantly more species captured in open young pine plantations as were captured in middle-aged closed canopied stands.

Mature forest stands with closed canopies and little herbaceous vegetation usually support a relatively low density of small mammals. In eastern Texas there were about 3 times the number of captures of small mammals in a young clearcut as an adjacent second growth pine-hardwood stand and a similar relationship in Mississippi, where there were abundant small mammals in bedded and herbicided young pine plantations, but virtually none in a mature pine-hardwood forest (Perkins et al. 1989). But openings created by tree fall in mature stands probably attract and benefit small mammals.

Other studies have documented and contrasted small mammal communities in different habitat types. In the Coastal Plain of North Carolina (Mitchell et al. 1995), small mammal abundance and diversity was higher in tall pocosins than in closed-canopy pine plantations, but lower than that in young open pine-plantations. In the Coastal Plain of Mississippi more small mammals were captured in hardwood bayheads than in upland longleaf-slash pine stands which were grazed and burned (Wolfe and Lohofener 1983). In an upland hardwood region of eastern Tennessee, small mammal abundance was higher in pine plantations than rights-of-way (ROW), but lower in a mature oak-hickory forest than ROW's (Johnson et al. 1979).

In a comparison of 3 second-growth forest types in Tennessee, by far the most small mammals were captured in oak-hickory stands, followed by pine stands and chestnut oak stands (Dueser and Shugart 1978).

The white-footed mouse was the most frequently captured small mammal, followed by the eastern chipmunk, short-tailed shrew, and golden mouse. In another study in eastern Tennessee (Johnson et al. 1979), small mammal diversity was higher in a pine plantation with a honeysuckle understory than in an oak-hickory forest.

In laurel oak floodplain stands in the Georgia Piedmont, the cotton mouse, golden mouse, short-tailed shrew, woodrat, house mouse, rice rat, and southeastern shrew were found in decreasing order of abundance (Boyd 1976).

## MANAGEMENT

Generally, silvicultural activities in which trees are harvested or natural events which create forest openings, which increase ground debris, grass and forbs, and brushy vegetation favor small mammal populations. Small mammals are attracted quickly to recently harvested stands of different types; attracted to the cover and food produced by logging debris and the lush vegetation growth that rapidly follows. In eastern Texas, capture rates were negatively associated with variables reflective of mature forest habitat (leaf ground cover, and basal area of shrubs and trees) and were positively correlated with down woody material and measures of low vegetation. The importance of herbaceous cover to small mammal communities also has been demonstrated elsewhere (for example, Dueser and Shugart 1978, Mitchell et al. 1995). Also, thinning of dense forest stands and the resulting flush of low vegetation growth should benefit small mammals. In North Carolina, more small mammals and a more diverse community was found in thinned pine plantations than in unthinned plantations (Mitchell et al. 1995).

In addition, particular measures may be required for species of concern. Special habitat may need to be protected or managed, and specific species management measures may be necessary.