

THE AMPHIBIANS AND REPTILES OF A MIDDLE TENNESSEE CEDAR GLADE

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INTRODUCTION

With the exception of Gentry's statewide check-list (1955, 1956), herpetological surveys in Tennessee have been restricted primarily to the eastern (Johnson 1958, 1964, King 1939, 1944) and the western portions (Blanchard 1922, Endsley 1954, Parker 1939, 1948, Sinclair 1950b) of the state. In Middle Tennessee, Ashton (1966) surveyed the salamanders of Davidson County, Harris (1967) described the herpetofauna of a DeKalb County hardwood forest (Davies Island) and Sinclair (1950a) reported 17 salamanders from various counties.

Preliminary collecting in Cedars of Lebanon State Forest indicated that certain species, uncommon in much of Middle Tennessee, were abundant there. It was also noted that some forms, common elsewhere in the mid-state area, were seldom or never encountered in the cedar glades. This survey was initiated in an attempt to determine the composition and relative abundance of the herpetofauna in a cedar glade habitat. It will also confirm range data for certain Tennessee amphibians and reptiles and furnish some insight into the utilization of the glade habitat by these vertebrates.

DESCRIPTION OF STUDY AREA

Cedars of Lebanon State Forest is located in the Nashville Basin (Wilson County) of Middle Tennessee, approximately 24 miles east of Nashville and 10 miles south of Lebanon on U. S. Highway 231. The forest contains over 8,000 acres while the state park, situated within this area, encompasses approximately 300 acres (Fig. 1). The flora and geology of the region are discussed by Braun (1964).

The "cedar glades" are tracts of sparse to dense stands of red cedar (*Juniperus virginiana*) growing in shallow soil underlain by limestone. While cedar is dominant, deciduous trees are scattered throughout some sections. Only two permanent bodies of water, a pond and a ditch, were present in the area sampled. The pond is approximately 15 ft. wide and 30 ft. long while the ditch, located behind the Cedars of Lebanon State Park Lodge, measured 4-6 ft. across and 40 ft. in length. The only other aquatic situations present are a wet weather creek and low places throughout the area, which retain temporary pools after heavy precipitation.

METHODS

This study was conducted during March, April and May, 1967 and consumed a total of 87 man-hours of collecting. Collecting was done by active searching in the field, primarily during daylight hours. Representatives of all species collected were deposited in the vertebrate collection of the Department of Biology, Tennessee Technological University (Cookeville). With the exception of the generic name *Notophthalmus*, currently in use for the red spotted newt (Mecham 1967), all scientific and common names used herein are after Conant (1958).

Except for certain amphibians, the total number of each species collected and observed was recorded. Additional collecting records were obtained from data of previous years and from other herpetologists familiar with the study area.

RESULTS AND DISCUSSION

Fifteen species of amphibians and 17 species of reptiles were found to occur in the cedar glades of Lebanon State Forest. During this study proper, 13 species of amphibians and 15 taxa of reptiles were recorded. Two species of amphibians and three species of reptiles reported by other collectors are included in the total number and are so denoted in the annotated account. All are listed in Tables I and II. The earliest collecting date was on March 4, when only amphibians were taken. On all other occasions, both vertebrate classes were recorded.

During the study, diurnal air temperatures ranged between 60-85 F and precipitation was below average. Since reptile and amphibian activity is highly regulated by weather conditions, the numbers recorded for some species not only reflect their abundance but also the weather conditions at the time of collecting. No doubt the abundance of certain species would be quite different if the area were sampled in the summer when higher temperatures prevailed.

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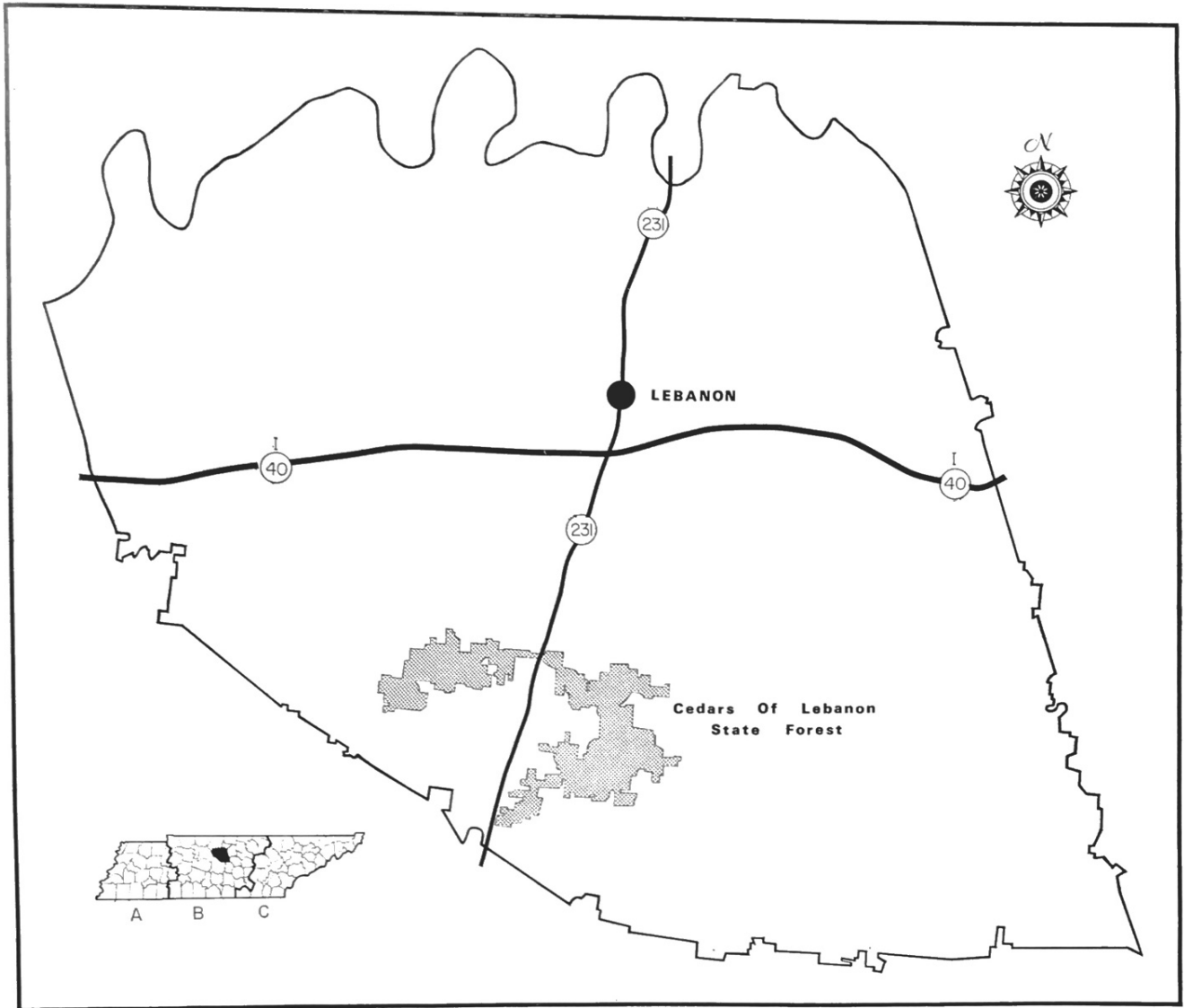


Fig. 1. Wilson Co., Tenn., showing the location of the study area. Insert (lower left) delineates the grand divisions of the state: A. West Tenn., B. Middle Tenn. (Wilson Co. shaded), and C. East Tennessee.

TABLE I

AMPHIBIANS KNOWN TO OCCUR IN THE CEDAR GLADES OF LEBANON STATE FOREST (WILSON CO., TENN.).

Order CAUDATA

Family Ambystomidae

Ambystoma opacum

Ambystoma maculatum

Family Salamandridae

Notophthalmus viridescens viridescens x
louisianensis

Family Plethodontidae

Plethodon dorsalis dorsalis

Eurycea lucifuga

Order ANURA

Family Bufonidae

Bufo americanus americanus

Bufo woodhousei fowleri

Family Hylidae

Acris crepitans crepitans x *blanchardi*

Pseudacris triseriata feriarum

Hyla versicolor versicolor

Family Microhylidae

Gastrophryne carolinensis

Family Ranidae

Rana catesbeiana

Rana clamitans melanota

Rana pipiens sphenoccephala

Rana palustris

ANNOTATED ACCOUNT OF SPECIES

Class AMPHIBIA

Order CAUDATA (URODELA)

Family AMBYSTOMIDAE

Ambystoma opacum (Gravenhorst)

Marbled Salamander

Though we did not personally collect this species, one was taken on April 30 by another collector. This salamander is typically a fall breeder and is most active

at this time of year. Our findings, therefore, probably do not reflect the true abundance of these animals in the cedar glades. Sinclair (1950a) recorded marbled salamanders from upland swamps in Wilson County.

Ambystoma maculatum (Shaw)

Spotted Salamander

Two adult spotted salamanders are known from the glades. One was taken by a junior author in April, 1965 and a second by another investigator (Mary Dunlap, personal communication) during this survey. Two-inch larvae were found in August, 1967 (Glenn Gentry, personal communication).

Family SALAMANDRIDAE

Notopthalmus viridescens (Rafinesque)

Red Spotted Newt

This species was abundant in one of the two permanent bodies of water. Although courtship behavior was not observed at this site on April 4, hundreds of these animals were breeding on April 13. Their activity made an accurate count of their numbers impossible even though they were confined to a relatively small area. Four terrestrial immatures ("red eft") were also collected. We found evidence of intergradation between *N. v. viridescens* and *N. v. louisianensis* in the cedar glades population, as suggested by Sinclair (1950a) for other parts of Wilson County.

Family PLETHODONTIDAE

Plethodon dorsalis dorsalis Cope

Zigzag Salamander

Forty-five specimens of this species indicated it to be the most abundant and widely distributed *terrestrial* salamander in the glades during the spring. They were commonly found on moist substrate under rocks and logs. Sinclair (1950a) also noted their presence in some Wilson County caves. Their predominance may be due to a scarcity of permanent bodies of water. The hatchlings of the zigzag salamander are terrestrial whereas most other salamanders in the glades have aquatic larvae.

Eurycea lucifuga (Rafinesque)

Cave Salamander

One specimen was collected on May 9 under a piece of tin in an open field. Several have been taken in previous years by one of the junior authors. Sinks and limestone caves, a common habitat of this species, are found in the glades. Although our efforts in two such locations were negative, further searching in these situations will likely reveal a greater number of cave salamanders. Sinclair (1950a) found these in Wilson County but did not indicate their presence in the cedar glades.

Order ANURA (SALIENTIA)

Family BUFONIDAE

Bufo americanus americanus Holbrook

American Toad

Although collecting was done during the spring mating season, when this species is often encountered,

only one specimen was found (beneath a rock on March 28). Harris (1967) found these toads to be common inhabitants of a hardwood forest. They are apparently rare in the cedar glades.

Bufo woodhousei fowleri Hinckley

Fowler's Toad

Most of the 18 specimens recorded were found during the latter part of the study. They were commonly encountered under stones, boards or other debris, as well as moving about in open areas bordering the forest. Harris (1967) did not record this species in his survey.

Family HYLIDAE

Acris crepitans Baird

Cricket Frog

These tiny, active frogs were abundant around intermittent streams, temporary pools and other wet places. Actual numbers were not recorded. Some individuals bore characteristics of the northern cricket frog (*A. c. crepitans*) whereas others were more like Blanchard's cricket frog (*A. c. blanchardi*). The glade population appears to be one of the intergradation between these two subspecies.

Hyla versicolor versicolor Le Conte

Eastern Gray Tree Frog

On the night of May 4 one tree frog was captured on a mud flat bordering a temporary pool. Several individuals were heard calling from nearby trees at this time. Two other specimens were taken at this pool earlier (April 30) by another collector.

Pseudacris triseriata feriarum (Baird)

Upland Chorus Frog

Though only a few were collected, these diminutive anurans are apparently abundant in the cedar glades. Numerous individuals were seen and heard calling from low, wet meadows during the early weeks of the study. Several were observed in amplexus on April 22.

Family MICROHYLIDAE

Gastrophryne carolinensis (Holbrook)

Eastern Narrow-Mouthed Toad

The three specimens recorded were all collected in May from beneath rocks and planks in an open field. This site was searched repeatedly during April. The occurrence of these animals in May was possibly related to the heavy rains at this time.

Family RANIDAE

Rana catesbeiana Shaw

Bullfrog

This species was most common around pools of intermittent streams and roadside puddles, where they were frequently sheltered beneath stones or other debris. The only larvae found were present in the two permanent bodies of water mentioned previously. Five adults were collected and several others observed. No large individuals were seen. The largest had a maximum

head-body length of 2.5 inches. The small size of these frogs is perhaps related to limited habitat.

Rana clamitans melanota (Rafinesque)
Green Frog

Three individuals were collected from pools of intermittent streams. Unlike *R. catesbeiana*, this species was not observed to frequent roadside puddles and did not appear to be as widely distributed or as abundant as the bullfrog, the animal which it most nearly resembles morphologically. Like the bullfrogs, all were relatively small in size.

Rana pipiens sphenoccephala Cope
Southern Leopard Frog

The two individuals collected, and others observed, bore definite characteristics of the southern subspecies, i.e. pointed snout and a pronounced, centrally located white spot on the tympanum. The glades are near the eastern boundary of the range for this subspecies in Tennessee (Conant, 1958). This was the only member of the family Ranidae recorded by Harris (1967) on Davies Island.

Rana palustris Le Conte
Pickerel Frog

The single specimen collected was taken on April 4 at the pond. Superficially, this frog resembles *R. pipiens* and the two are easily confused. The pickerel frog, however, may be distinguished by the rectangular dorsal markings and bright yellow coloration inside the thighs. It is reported to occur statewide but with a "spotty" distribution (Conant, 1958; Gentry, 1955).

TABLE II

REPTILES KNOWN TO OCCUR IN THE CEDAR GLADES OF
LEBANON STATE FOREST (WILSON CO., TENN.).

Order TESTUDINATA

Family Testudinidae

Terrapene carolina carolina
Pseudemys scripta elegans

Order SQUAMATA

Suborder LACERTILIA

Family Iguanidae

Sceloporus undulatus hyacinthinus

Family Teiidae

Cnemidophorus sexlineatus

Family Scincidae

Eumeces fasciatus
Eumeces inexpectatus
Eumeces laticeps

Suborder SERPENTES

Family Colubridae

Thamnophis sirtalis sirtalis
Heterodon platyrhinos platyrhinos
Diadophis punctatus edwardsi
Carphophis amoenus helenae
Coluber constrictor constrictor

Elaphe obsoleta obsoleta x *spiloides*

Lampropeltis getulus niger

Lampropeltis doliata triangulum

Lampropeltis doliata sypila

*Cemophora coccinea**

Tantilla coronata coronata

Family Crotalidae

Crotalus horridus

* See Addendum

Class REPTILIA

Order TESTUDINATA (CHELONIA)

Family TESTUDINIDAE

Terrapene carolina carolina (Linnaeus)

Eastern Box Turtle

One individual was captured in May, 1958 by a junior author. Another collector observed two specimens within the study area on April 30, 1967.

Pseudemys scripta elegans (Wied)

Red-Eared Turtle

One immature specimen was found dead in the water-filled ditch near the park lodge. This was the only aquatic turtle recorded during the study.

Order SQUAMATA

Suborder LACERTILIA (SAURIA)

Family IGUANIDAE

Sceloporus undulatus hyacinthinus (Green)

Northern Fence Lizard

The 103 recorded individuals indicated this to be the most abundant reptile in the cedar glades during the spring months. It was the most active lizard in the area and was frequently observed basking on large rocks and logs. This subspecies is common throughout Tennessee.

Family TEIIDAE

Cnemidophorus sexlineatus (Linnaeus)

Six-Lined Racerunner

Sixteen of the 18 specimens were found under rocks. None were encountered beneath logs. This lizard is commonly found in rocky, open areas of the glades. Many individuals found under rocks were coiled in the entrances of underground burrows, which were of varying lengths. When pursued, these agile lizards frequently sought this type of cover. The digging and use of such burrows is discussed by Fitch (1958).

A 1958 collecting trip into the glades, when temperatures were well above 90 F. revealed *Cnemidophorus* to be the most common reptile. This may reflect an ability of these lizards to remain active at temperatures which limit the activity of other reptiles in the area. Harris (1967) did not collect any racerunners in his deciduous forest sample and Gentry (1956) did not record its occurrence in Wilson County.

Family SCINCIDAE

Eumeces fasciatus (Linnaeus)

Five-Lined Skink

Nineteen specimens were collected under stones, logs and loose bark. Individuals were often seen basking on rock walls and logs. When pursued, they ran to surface cover or ascended trees. An occasional specimen escaped into burrows apparently dug by racerunners. The first male observed in breeding color was on April 13.

Eumeces inexpectatus Taylor

Southeastern Five-Lined Skink

Apparently the distribution of this species in Tennessee is not well known. Although Smith's (1946) range map indicates the presence of *E. inexpectatus* in extreme eastern Tennessee, Gentry (1956) did not personally identify any in compiling his state checklist. Ash (1945) noted the absence of this species in Monroe and Polk Counties. One specimen from Blount County (Smoky Mountain National Park Collection) was reported by King (1939). Johnson (1964), however, did not collect this species in Oak Ridge, some 40 miles northwest of Blount County, nor did Harris (1967) record it in his Middle Tennessee work. Thus, unlike other lizards present in the cedar glades, this skink's occurrence in other mid-state areas has not been confirmed.

Twenty-two of these lizards were collected in this study. Numerous specimens have also been taken in the glades in previous years. This area is on the edge of the range for *E. inexpectatus* according to Conant (1958).

E. inexpectatus and *E. fasciatus* appear to differ with regard to behavior and habitat preference. Unlike *E. fasciatus*, no *E. inexpectatus* were observed basking and none ascended trees when pursued. Whereas *E. fasciatus* was often found under the loose bark of logs, *E. inexpectatus* was always in contact with the ground, usually in burrows beneath large stones. Males were first observed in breeding color on April 20. An ecological study of *E. inexpectatus* in the cedar glades is now in progress.

Eumeces laticeps (Schneider)

Broad-Headed Skink

Although this lizard is reported to occur statewide (Conant, 1958; Gentry, 1956), it is apparently not as common as other members of the genus. Only one adult, measuring 9.0 inches (total length), was taken in the glades. This animal was captured near the base of a large tree in August, 1967. Johnson (1964) recorded one specimen from Oak Ridge and Harris (1967) found 7 on Davies Island in DeKalb County.

Order SQUAMATA

Suborder SERPENTES (OPHIDIA)

Family COLUBRIDAE

Thamnophis sirtalis sirtalis (Linnaeus)

Eastern Garter Snake

Two specimens were collected. In previous years this snake was most commonly found under rocks near temporary streams in the glades. However, only one specimen taken in the present study was found in this situation.

Heterodon platyrhinos platyrhinos Latreille

Eastern Hognose Snake

A freshly killed animal was found on a gravel road on April 2 and a second individual was taken in August, after completion of the survey. Both were brightly colored, spotted phase adults.

Diadophis punctatus edwardsi (Merrem)

Northern Ringneck Snake

Five of the six snakes collected bore the interrupted row of ventral black spots characteristic of the northern subspecies. While one specimen had a complete row of spots on the venter, a characteristic of *D. p. stictogenys*, it lacked the chin spots ascribed to this subspecies. The glades are near the range junction for these subspecies (Conant, 1958) and a larger sample may well reveal intergradation between the two. All were found on moist ground under rocks.

Carphophis amoenus helenae (Kennicott)

Midwest Worm Snake

This snake, usually concealed beneath stones, was the most abundant serpent recorded during the study. Two forms of this polytypic species occur in Tennessee: the eastern worm snake (*C. a. amoenus*) and the midwest worm snake (*C. a. helenae*). Most of the Middle Tennessee worm snakes have characteristics of *C. a. helenae*, which include the fusion of each prefrontal scale to its adjacent internasal scale. These scales are separate in *C. a. amoenus*. Based on these criteria, two of the 17 individuals recorded resembled *C. a. amoenus* and the rest were identified as *C. a. helenae*. Since a majority of the specimens were identified as *C. a. helenae*, it seems justifiable to designate the cedar glades population as such. This is in accord with the findings of Blanchard (1924) regarding the consistency of the above characters.

Coluber constrictor constrictor Linnaeus

Northern Black Racer

Four specimens (two adults, two juveniles) were collected. Though identification was not made to subspecies, this area is within the range of *C. c. constrictor* according to Wright and Wright (1957) and Conant (1958). This species did not appear to be as abundant as in previous years when, on several occasions, 3-4 individuals were taken in one day. The stomach of an adult racer contained one *E. inexpectatus* and a juvenile had consumed the tail of an unidentified skink. The comparatively large size of this ingested appendage

indicated the lizard to be much too large for the young snake to swallow.

Elaphe obsoleta (Say)

Rat Snake

One specimen was obtained in April, 1967 by another collector (Mary Dunlap, personal communication). Though we did not see this animal, typically in Middle Tennessee the rat snakes have chocolate colored dorsal blotches on a ground color that may vary from light to dark brown. Solid black individuals are rare. The rat snakes throughout Middle Tennessee show a pattern of intergradation between the black rat snake (*E. o. obsoleta*) and the gray rat snake (*E. o. spiloides*) and subspecific determination is often difficult.

Lampropeltis getulus niger (Yarrow)

Black King Snake

Eleven individuals were recorded. It seems this species is more readily collected in the glades than in many parts of Middle Tennessee. Harris (1967), for example, captured only 7 specimens over a 1½ year period. We found it to be present in clearings as well as near the edge of wooded areas. The disgorged stomach contents of one individual indicate that they feed on fence lizards, at least in part.

Lampropeltis doliata triangulum (Lacépède)

Eastern Milk Snake

Lampropeltis doliata sypila (Cope)

Red Milk Snake

Both of the above forms of this polytypic species were collected. Five *L. d. triangulum* were taken during the study and several have been captured here in previous years. In addition, one *L. d. sypila* was collected in September, 1957 and two others were taken during this survey. All were located under stones in open areas. Though neither of these snakes were reported by Harris (1967), he did collect 1 specimen of the related scarlet kingsnake (*L. d. doliata*). Gentry (1956) did not report any of the above from Middle Tennessee while both Conant (1958) and Sinclair (1965b) show only *L. d. triangulum* in the Wilson County area.

Most of the milk snakes taken were small (under 2 ft.). Their occurrence in the glades may be due to the availability of small lizards and snakes as food. Two captive individuals fed readily on fence lizards and worm snakes. Conant (1938) found a relationship between the presence of milk snakes and dense small snake populations in Ohio.

Tantilla coronata coronata Baird and Girard

Although this mildly poisonous snake is uncommon in many parts of the mid-state region, it is abundant in the cedar glades. Sinclair (1965a) states that *Tantilla* occurs in association with the six-lined racerunner (*C. sexlineatus*) in parts of Alabama as well as in the cedar glades of Middle Tennessee. Harris (1967) did not list this species from Davies Island. The 13 individuals

recorded were found on moist ground under rocks, usually in wooded areas.

Family CROTALIDAE

Crotalus horridus Linnaeus

Timber Rattlesnake

Our findings indicate this to be the only dangerous reptile in the glades. Though this species was not taken in the present study, it is included due to the information provided by Mr. Eldon C. Payne, Superintendent, Cedars of Lebanon State Park. He and other park employees related that an occasional rattler is killed on roads within the study area. Since we were unable to obtain study specimens, subspecific designation cannot be made.

SUMMARY AND CONCLUSIONS

The Cedars of Lebanon State Park and Forest (Wilson Co., Tennessee) is inhabited by 13 families of amphibians and reptiles, represented by 33 taxa. The 15 species of amphibians recorded include 8 frogs, 5 salamanders, and 2 toads. Eighteen reptiles were found, including 11 snakes, 5 lizards, and 2 turtles.

The herpetofauna of the cedar glades appears directly related to the dry, open conditions of this area. Many species common to Middle Tennessee are rare or absent in the glades. The scarcity of permanent bodies of water likely accounts for the absence of water snakes (*Natrix spp.*), dusky salamanders (*Desmognathus fuscus*) and most aquatic turtles. Relatively few species of salamanders were recorded. The unseasonably dry conditions during the early part of the study possibly influenced these results. Salamander genera (e.g., *Ambystoma*, *Eurycea* and *Plethodon*) normally associated with moist forests are poorly represented in the glades. Some snakes (*Elaphe obsoleta*, *Agkistrodon contortrix* and *Crotalus horridus*), which commonly inhabit hardwood forests, are rare in the area. This is perhaps due to a lack of suitable habitat for prey species.

The environmental conditions in the glades provide excellent habitat for other species, however. From a comparison of collecting data in other parts of Middle Tennessee, the following appear to be more abundant in the glades than elsewhere: *Sceloporus undulatus*, *Cnemidophorus sexlineatus*, *Tantilla coronata*, *Lampropeltis getulus*, and *L. doliata*. *Eumeces inexpectatus*, which is unknown from other Middle Tennessee locations, is quite abundant in this cedar glade. The open, xeric conditions apparently provide a unique and favorable habitat for lizards. The abundance of *L. getulus* and *L. doliata* may be partially due to the availability of lizards, which are known food items of these snakes.

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ADDENDUM

Cemophora coccinea (Blumenbach)—
Family Colubridae
Scarlet Snake

While this paper was in press, it was learned that a single, 10 inch scarlet snake was taken in Cedars of Lebanon State Forest on May 4, 1968 by M. T. Finley, a graduate student at Mississippi State University. This brilliantly marked animal was located beneath a stone in a clearing at approximately 1:00 P.M. The above specimen is to be deposited in the Tennessee Technological University collection with others taken during this study.

The Cedar Glades of Lebanon approach the northern range boundary in Tennessee for this monotypic species according to Conant's (1958) map. Gentry (1956) relates its occurrence, although sparse, in East, Middle and West Tennessee but does not list mid-state county records.

Inclusion of *Cemophora* increases the total number of reptiles known from Cedars of Lebanon State Park and Forest to 19 and the number of snakes to 12.

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Pathology as co-investigators. The survey is being conducted in cooperation with City of Memphis Hospitals, the Shelby County Health Department, and UTMU's Department of Obstetrics-Gynecology. Under the mass-testing program initiated in 1952, the frequency of uterine cancer in Memphis has been reduced by 50 per cent.

Vanderbilt University—Chancellor Alexander Heard has announced the construction of eight new buildings or additions in the area of science and medicine. The construction of these facilities costing in excess of \$10 million will be financed through a NSF 'Center of

Excellence' grant, the Health Sciences Advancement Award to Vanderbilt in 1967, loans, gifts from alumni, campaign funds, and other monies including the Ford Foundation grant. Included in the construction plans are a new Science Library, buildings for Molecular Biology and Mathematics, five new floors for the Physics Building, completion of three shell floors in the Chemistry Building, and expansion of the off-campus Dyer Observatory. The buildings, designed by Shepley, Bulfinch, Richardson, and Abbott of Boston will feature flexible laboratory facilities, classrooms and faculty offices, a teaching observatory, and a greenhouse.

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