

ARTICLES

LIZARDS AND SNAKES (ORDER SQUAMATA) OF HARVEY COUNTY, KANSAS

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Abstract—Harvey County is a small county on the western edge of the potential tallgrass prairie in southcentral Kansas containing four habitat regions for reptiles. This paper summarizes data on habitat distribution, population size and trends and individual size of adults for the six species of lizards and seventeen species of snakes that have been documented for the county. It is based on data collected in eighteen years of trapping studies on three sites, on less intensive observations in other parts of the county, on information on county reptiles from other competent Harvey County residents, and on Harvey County specimens in herpetological collections. Population changes are related to environmental changes in the county over the last forty years.

Introduction

Harvey County is on the western edge of the potential tallgrass prairie in southcentral Kansas (Küchler 1974). It is a small county containing only 15 townships, but it includes four habitat regions for reptiles: the McPherson Valley, Arkansas River Valley, Sandhills and Flint Hills regions (Figure 1).

Central Harvey County is part of the McPherson Valley in the Wellington-McPherson Lowlands, an old filled river valley. The soils are silt loams, silty clay loams and silty clays of the Crete-Ladysmith and Ladysmith-Goessel soil associations (Hoffman and Dowd 1974). This region is drained by the Little Arkansas River and its tributaries (Figure 1). Most of the land in this region is cultivated, mainly with annual grain crops - wheat, sorghum, soybeans and corn (before the mid-1980s small acreages of oats, barley and rye). Some perennial hay crops, especially alfalfa and brome grass, are also cultivated. Other habitats in this region important for lizards and snakes are uncultivated fencerows, riparian woodland, small pastures, and the residential land and parks of urban areas and farmyards.

The southwest corner of the county includes a part of the Arkansas River Valley (Figure 1). The soils are loams and sandy loams of the Farnum-Slickspots-Naron association (Hoffman and Dowd 1974). This region lacks a well-defined drainage system and has a number of wetlands. Like the McPherson Valley, this valley is mostly cultivated land. This region has been little searched for reptiles.

North of the town of Burrton and south and west of the Little Arkansas River are Sandhills. There is

another small area of Sandhills east of Halstead (Figure 1). The soils are fine sands and loamy fine sands of the Dillwyn-Tivoli and Carwile-Pratt associations (Hoffman and Dowd 1974). This region is almost entirely poorly drained hummocky native grassland with many ephemeral wetlands. Some of the mile roads are undeveloped. Most of this region is used for pasture although there is a small amount of unpastured grassland. The area mapped on Figure 1 includes only the land that is mostly grassland and does not include the cultivated and riparian areas on the edges of this region.

The eastern part of the county is in the western transitional edge of the Flint Hills (Figure 1). It is a mosaic of native grassland on rocky soil and cultivated land. The region demarcated on the map is that area with half or more of the land in native grass. However small native grasslands and shale breaks can be found west almost to Newton. The soils are silty clay loams and silty clays of the Irwin-Rosehill-Clime association (Hoffman and Dowd 1974). The southern part of the Flint Hills region in Harvey County has been less surveyed for reptiles. It has most of the limestone breaks in the county. These are small and isolated. The eastern part of the county is drained by tributaries of the Walnut River.

There are few records of reptiles from Harvey County before the 1930s. In 1932, Charles A. Smith, an amateur naturalist living in Halstead, sent a small collection of amphibians and reptiles from Harvey County to the U. S. National Museum. In 1937, Rufus Thompson, a botanist from the University of Kansas, made a small collection of lizards from "Burrton" in Harvey County. These specimens are now in the

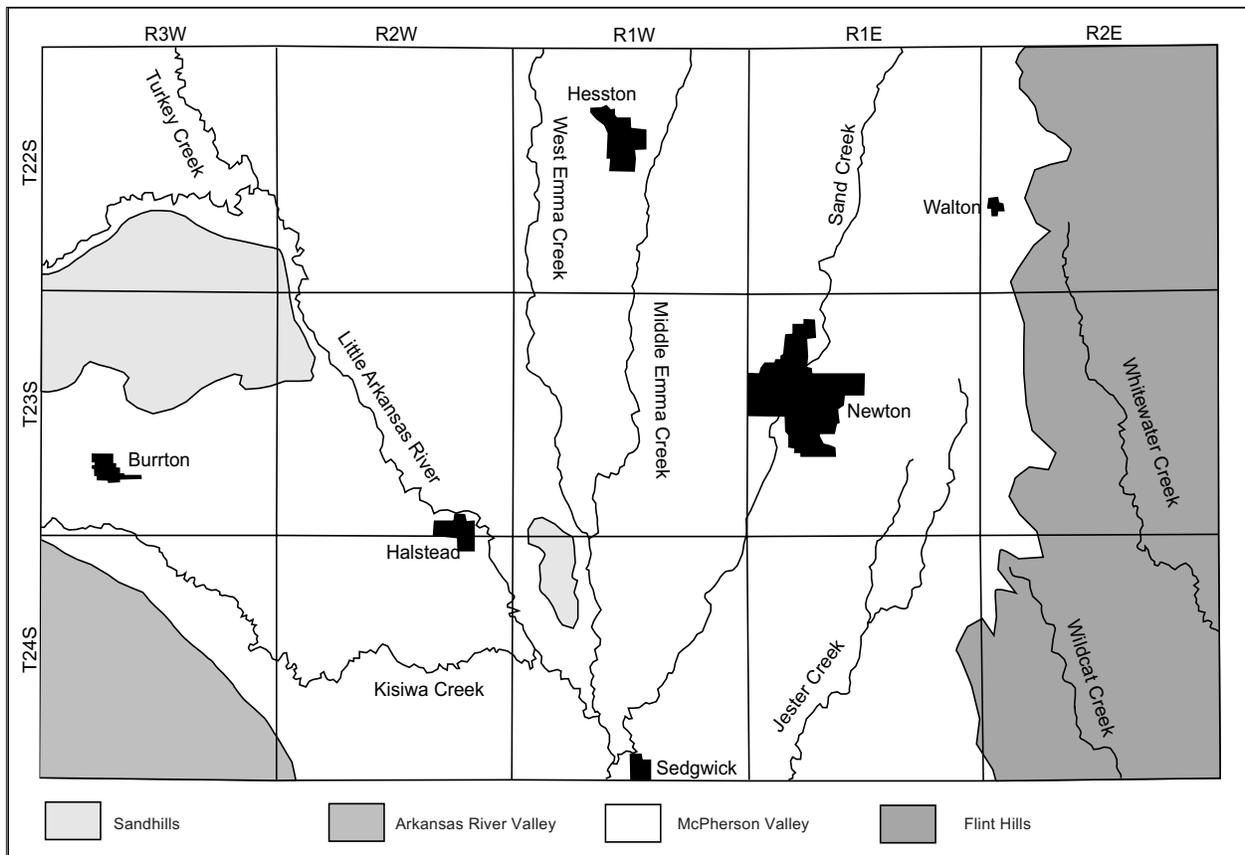


Figure 1. The habitat regions of Harvey County, Kansas.

Field Museum and the University of Illinois Museum. I made a collection of amphibians and reptiles in Harvey County in 1952 many of which are in a small collection at Bethel College in North Newton. Brad Anderson sent specimens of reptiles from Harvey County to the Kansas University Museum of Natural History in 1979.

From 1959 to 1963, 1966 to 1974, 1984 to 1985 and 1997 to 1998 inclusive, I conducted a population study of snakes and lizards by drift-fence trapping in Harvey County. These eighteen years of study resulted in data from more than 4,000 lizard captures and more than 10,000 snake captures. Most of the trapping was done on study sites in the Sandhills region of the county, but in 1984–85 and 1997–98 trapping was also done on study sites in the McPherson Valley near Sand Creek east of North Newton and in the Flint Hills region. This paper is based on data collected in these studies, on less intensive observations in other parts of the county, on information on county reptiles from other competent Harvey County residents, and on Harvey County specimens in herpetological collections. Some questions on the abundance and distribution of lizards and snakes in the county still

remain unanswered, not only because most of the data summarized in this paper is from a limited part of the county, but also because trapping methods were inefficient in sampling some populations, particularly those of Water Snakes and very small snakes.

Capture rates of snakes and lizards in drift-fence traps are a measure of activity of a species which is a rough measure of abundance. Capture rates are expressed in this paper as the numbers of individuals caught per 600 trap station days (600tsd) in the period mid-May through mid-July. (A trap station day is the operation of one trap station, consisting of one drift fence with a funnel trap on both ends, for a 24-hour period). Capture rates in 1997–98 are used as a measure of current abundance for those species with sufficient captures (Tables 1 and 2). Comparison of 1997–98 capture rates in the Sandhills region with those in other years of the study gives a measure of variability and trends in abundance. The median capture rate is used when summarizing the capture rates for more than two years. Lengths of snakes are expressed as snout–vent or body length (SVL) and total length (TL). Adults were identified by age (more than one year), color pattern (in some species) and/

or reproductive maturity (sperm production in males and enlarged ova in females).

The documented lizard fauna of Harvey County consists of six species, one of which is no longer present in the county. The snake fauna consists of seventeen species. Voucher specimens for the county are listed at the end of each species account. BC refers to a small collection at Bethel College in North Newton, Kansas.

Species Accounts

LIZARDS (SUBORDER LACERTILIA)

Western Slender Glass Lizard (*Ophisaurus a. attenuatus*). The glass lizard is an uncommon resident of the Sandhills region, but has not been found in other habitat regions of the county (Table 1). Capture rates have varied from 0.2 to 2.3/600tsd for the years of the study. The population of this species has remained rather stable and the highest capture rates were in 1997–98. The lizards captured (N = 48) varied in length from 143 to 230 mm SVL. The largest was a male (KU 182243), 230 mm SVL (685 mm TL).

Lesser Earless Lizard (*Holbrookia maculata*). The Lesser Earless Lizard is a resident of the Sandhills region, but is not found in other habitat regions. It was rarely caught in traps, but was seen uncommonly in open sandy areas. The population may be declining since one seen in 1985 was the only record during field work in 1984–85 and 1997–98 (USNM 88772–85; FMNH 106487–9; UIMNH 20367–8).

Texas Horned Lizard (*Phrynosoma cornutum*). Two specimens collected in 1937 in "Burrton," Harvey County, and one observed in Athletic Park in the City of Newton, are the only records of Horned Lizards for the county. I have never observed the Horned Lizard in Harvey County and neither have others who have collected and observed reptiles in the county. The lizard observed in Newton was almost certainly a released individual. The two specimens could also have been brought into the county. However, if these

specimens were collected in western Harvey County near Burrton (there is no evidence to suggest otherwise), there may have been a small population in the Sandhills until the late 1930s or 1940s, as the this area appears to be good habitat for the species. The Horned Lizard is not present in the county today (UIMNH 20422; FMNH 115799).

Fence Lizard (*Sceloporus undulatus*). The Fence Lizard is a common to uncommon resident of the Sandhills region, but has not been found in other habitat regions (Table 1). The capture rate varied from 13.8/600tsd in 1966 to 0 in 1998. It is probably declining in abundance. Eighty-seven per cent of the adult lizards captured (N = 236) were between 43 and 60 mm SVL. The largest was a female gravid with six eggs, 70 mm SVL (147 mm TL) (USNM 88787; UIMNH 21915; KU 21347).

Great Plains Skink (*Eumeces obsoletus*). The Great Plains Skink is locally common at some sites in the McPherson Valley and Flint Hills regions and was caught in both 1984–85 and 1997–98 (Table 1). The difference in capture rates in the two regions may be due to the localized nature of populations rather than to differences in the skink population in the two regions. The species was found in riparian woodland, grassland and fencerows between cultivated fields. It was caught twice in the Sandhills region in 1962, but was not found there before or since. Eighty-nine per cent of the lizards captured (N = 19) were between 74 and 112 mm SVL (KU 182242).

Prairie Racerunner (*Aspidoscelis sexlineata viridis*). The Racerunner is an abundant resident of the Sandhills region, but has not been found in other habitat regions in our study (Table 1). However, both Brad Anderson and John Torline (pers. comm.) reported having observed these lizards along the railroad track in Newton until the early 1960s. There may have been local populations in other parts of the county in open habitats at one time. The populations in the Sandhills may be declining since the capture rates in 1997 and 1998 were some of the lowest. The highest capture rate was 121.1/600tsd in 1966. Ninety

Table 1. Mean capture rates of lizards at the Sandhills, McPherson Valley, and Flint Hills study sites in Harvey County, Kansas from mid-May to mid-July in 1997 and 1998. Capture rates are expressed as the number of individual captures per 600 trap station days.

Species	Sandhills	McPherson Valley	Flint Hills
Western Slender Glass Lizard	1.9	0.0	0.0
Fence Lizard	0.1	0.0	0.0
Great Plains Skink	0.0	3.6	0.4
Prairie Racerunner	8.4	0.0	0.0

per cent of the adult lizards captured (N = 1614) were between 60 and 81 mm SVL. The largest was a male, 85 mm SVL (239 mm TL) (USNM 88786; FMNH 106821–2; AMNH).

SNAKES (SUBORDER SERPENTES)

Kansas Glossy Snake (*Arizona e. elegans*). The Glossy Snake is an uncommon to rare resident of the Sandhills region and has not been found in other regions of the county (Table 2). The capture rate in the Sandhills declined in 1970 and has remained low ever since. The median capture rate in the nine years prior to 1970 was 1.0/600tsd and the maximum was 1.5. In the nine years of the study since 1969 the median capture rate was 0.2 and the maximum was 0.4. Ninety-five per cent of the adult Glossy Snakes captured (N = 83) were between 550 and 950 mm SVL. The longest was 1000 mm SVL (1165 mm TL) (BC 36).

Yellowbelly Racer (*Coluber constrictor flaviventris*). The Racer is an abundant to common species in all habitat regions in Harvey County (Table 2). It was caught most commonly in grassland, especially pastures, and in fencerows between cultivated fields, and less commonly in riparian woodland. The population is subject to large fluctuations in size. In the Sandhills region in the seven years prior to 1968, the median capture rate was 10.0/600tsd and the maximum was 17.4. In the seven years from 1968 to 1974, the median capture rate was 3.4 and the maximum was 6.3. In 1984–85, the average capture rate was 33.4. Ninety-six per cent of the adult Racers captured (N = 1472) were between 550 and 950 mm SVL. The longest was a female, 1102 mm SVL (1395 mm TL) (USNM 88791; KU 21339–40, 192442, 216156; BC 59, 93).

Western Rat Snake (*Elaphe obsoleta*). The Western Rat Snake is a common species in the county. It is increasing in numbers and increasing its range, and is now found in all regions of the county (Table 2). It was uncommon in most of the county prior to 1970. Prior to 1997, it had not been trapped in the Sandhills region, although Smith had collected a specimen in 1932 from 10 miles northwest of Halstead, in the vicinity of the Sandhills, but possibly along the Little Arkansas River (specimen in the U. S. National Museum). The Western Rat Snake is particularly common in riparian woodland, but is also caught in grassland and in fencerows. It is also common in urban areas. The adult snakes captured (N = 14) were between 850 and 1500 mm SVL. The longest was a male, 1500 mm SVL (1795 mm TL) (USNM 88797; KU 216158).

Prairie Kingsnake (*Lampropeltis c. calligaster*). The Prairie Kingsnake is a common to uncommon resident of all the habitat regions in the county (see Table 2). In the 18 years of study in the Sandhills region, capture rates varied from 0 to 2.6/600tsd. The highest capture rate (3.2) occurred in the two eastern study sites in 1984–85. In the Sandhills region, it was caught more commonly in unpastured grassland than in pastures. In the McPherson Valley and Flint Hills regions, it was caught commonly in riparian woodland, fencerows, and grassland, especially unpastured grassland. Ninety per cent of the adult Prairie Kingsnakes captured (N = 138) were between 550 and 900 mm SVL. The longest was a male, 1105 mm SVL (1277 mm TL) (BC 26).

Speckled Kingsnake (*Lampropeltis getula holbrooki*). The Speckled Kingsnake is rare in Harvey County and may be no longer present. There are three records, two in the Sandhills region and one in the McPherson Valley region. The last record was in 1979 (KU182245).

Table 2. Mean capture rates of snakes at the Sandhills, McPherson Valley and Flint Hills study sites in Harvey County, Kansas from mid-May to mid-July in 1997 and 1998. Capture rates are expressed as the number of individual captures per 600 trap station days.

Species	Sandhills	McPherson Valley	Flint Hills
Kansas Glossy Snake	0.2	0.0	0.0
Yellowbelly Racer	15.3	3.5	6.2
Western Rat Snake	0.6	2.5	2.7
Prairie Kingsnake	1.2	1.0	1.0
Bullsnake	2.8	0.0	0.0
Plains Garter Snake	6.8	0.0	0.0
Red-sided Garter Snake	10.5	6.0	14.2
Plains Hognose Snake	0.8	0.0	0.0
Eastern Hognose Snake	0.5	0.0	0.0

Bullsnake (*Pituophis catenifer sayi*). The Bullsnake is common in the Sandhills region (Table 2). The population has been relatively stable. The median capture rate for the 18 years of study was 2.7/600tsd. Capture rates were unusually high in 1967 and 1968, 7.3 and 6.7 respectively, when small mammal populations were high. The lowest capture rate was 1.1 in 1962. No Bullsnares were trapped in the McPherson Valley region. However, I have seven records from this region, mostly DORs, the last one being in 1962. Brad Anderson (pers. comm.) had two records in the 1990s within the Newton city limits. Although never common in this region, the species has declined in numbers in the last forty years. No Bullsnares were trapped in the Flint Hills region, but one was found 0.5 miles south of our trapping site in 1997. John Torline (pers. comm.), who lives in this region, reports that he sees one or two every year. Eighty-two per cent of the adult Bullsnares captured (N = 274) were between 850 and 1250 mm SVL. The longest was a female, 1565 mm SVL (1696 mm TL). The shortest one-year old snake was 660 mm SVL (753 mm TL) (USNM 88790; BC 105).

Yellowbelly Water Snake (*Nerodia erythrogaster flavigaster*). I have 31 records of this Water Snake from both the Sandhills and McPherson Valley regions (KU182383).

Diamondback Water Snake (*Nerodia rhombifer*). I have 24 records of this species from the Sandhills, McPherson Valley and Flint Hills regions of the county (BC 39).

Northern Water Snake (*Nerodia sipedon sipedon*). I have 25 records of the Northern Water Snake from both the Sandhills and McPherson Valley regions. Both Brad Anderson and John Torline (pers. comm.) have observed them in the Flint Hills region (BC 8, 58).

Graham's Crayfish Snake (*Regina grahamii*). I have six records of the Crayfish Snake from the Sandhills and McPherson Valley regions. The last record was in 1963, and they may no longer be present (USNM 88792).

Plains Garter Snake (*Thamnophis radix*). The Plains Garter Snake is an abundant resident of the Sandhills region (Table 2). However, the capture rate fluctuated greatly from year to year depending upon the amount of water and therefore the amount of frog activity on the study sites. The highest capture rate was 28.7/600tsd in 1973 and the lowest was 1.5 in 1968. No Plains Garter Snakes were trapped in the McPherson Valley or Flint Hills regions. I have observed them in the McPherson Valley region within two miles of the Sandhills in years when the population in the Sandhills region was large. A specimen was collected near Halstead in 1922, but this is also near a Sandhills area. An individual observed by John Torline (pers. comm.) six miles east of North Newton in the late 1990s is the only record away from the Sandhills. Brad Anderson (pers. comm.) has not seen this species outside the Sandhills region in Harvey County, although he has seen it further east in the Flint Hills in Butler County. The species may be rare in regions with a high proportion of cultivated ground. Ninety-eight per cent of the adult Plains Garter Snakes captured (N = 2161) were between 400 and 700 mm SVL. The longest was a female, 841 mm SVL (947 mm TL but it had an incomplete tail). Another female was 835 mm SVL (1045 mm TL). The smallest reproductively mature male was 402 mm SVL and the smallest mature female was 497 mm SVL (KU 2041, 216160; BC 28, 29, 60).

Red-sided Garter Snake (*Thamnophis sirtalis parietalis*). This Garter Snake is an abundant species in most habitats throughout the county (Table 2). Population fluctuations on the Sand Prairie study sites were similar to those of the Plains Garter Snake with low capture rates of 1.7/600tsd in 1967 and 1968 and highest capture rates in 1960 and 1973 of 22.1 and 21.9 respectively. Although this snake was trapped most commonly near wetlands, it was caught in all habitats sampled. It was also commonly observed in residential areas. Ninety per cent of the adults captured in the Sandhills (N = 1838) were between 400 and 700

Table 3. Median number of acres of annual grain crops planted each year and percentage of acreage in cool season grain crops, of hay fields harvested each year and of pasture for each decade from 1960 to 1999 in Harvey County, Kansas. Total land area in Harvey County is approximately 345,600 acres.

Decade	Grain Planted	% Cool Season	Hay Harvested	Pasture
1960s	203,650	64%	23,550	78,838
1970s	225,900	57%	18,540	67,500
1980s	222,050	60%	16,950	45,900
1990s	249,850	52%	19,230	44,267

Data from USDA National Agricultural Statistics Service, 1961–2000 and Kansas State Board of Agriculture, 1961–1998.

mm SVL. The longest was a female, 991 mm SVL (1240 mm TL). The smallest reproductively mature male was 339 mm SVL, but all others were more than 400 mm SVL. The smallest reproductively mature female was 470 mm SVL, but all others were more than 520 mm SVL. Snakes in the Flint Hills region may grow more slowly. The sample of Red-sided Garter Snakes from the Flint Hills (N = 85) included 33 reproductively mature females with 11 less than 500 mm SVL. The sample from the McPherson Valley was smaller (N = 43) and only included five reproductively active females, all more than 500 mm SVL (KU 216161; BC 54–7, 70, 94).

Lined Snake (*Tropidoclonion lineatum*). The Lined Snake was not trapped in any of our studies and it has not been observed in the Sandhills region. It is locally common in the McPherson Valley and Flint Hills regions. It is often found in urban areas (KU 182248).

Western Massasauga (*Sistrurus catenatus tergeminus*). The Massasauga is a rare snake in Harvey County. It was caught in the Sandhills region five times in the 18 years of trapping, the last capture in 1971. Brad Anderson (pers. comm.) can usually find at least one per year in the Sandhills region. In the McPherson Valley region, a Western Massasauga was killed in the fall of 1993 two miles west of Newton and Brad Anderson (pers. comm.) received one that had been caught in a native grassland four miles east of Newton. Wedel (1954) described two experiences with “rattlesnakes” in the 1890s on the Bethel College campus in North Newton, and suggested that such experiences were not uncommon at that time. Massasaugas may have been more common then. However the identification of the snakes mentioned by Wedel is uncertain. There is no record as yet for this species in the Flint Hills region (KU 216164).

Prairie Ringneck Snake (*Diadophis punctatus arnyi*). The Prairie Ringneck Snake was not trapped in any of our studies and it has not been observed in the Sandhills region. In the McPherson Valley region, one was collected from under concrete at the old Newton city dump in 1979 and one was collected from under grass mulch in a residential yard near North Newton in 1999. Brad Anderson (pers. comm.) found one in a rocky area in the Flint Hills region. John Torline (pers. comm.) has seen a few DOR in this region (KU 182244).

Plains Hognose Snake (*Heterodon n. nasicus*). The Plains Hognose Snake is a common to uncommon resident of the Sandhills region, but is not found in the other habitat regions of the county (Table 2). Capture rates were higher on pastures than on ungrazed grassland. Capture rates declined in 1968 and have been low since. The median capture rate in the seven

years of study prior to 1968 was 8.5/600tsd with a maximum of 12.3 and a minimum of 4.5. In the eleven years after 1967, the median capture rate was 1.3 with a maximum of 1.9 and a minimum of 0.6. Ninety-three per cent of the adult Plains Hognose Snakes captured (N = 592) were between 300 and 550 mm SVL. The largest snake was a female, 707 mm SVL (800 mm TL). The smallest reproductively mature male was 246 mm SVL (293 mm TL) (BC 67, 92, 104, 110–2, 114).

Eastern Hognose Snake (*Heterodon platirhinos*). The Eastern Hognose Snake is an uncommon to rare species in the Sandhills region and has not been found in other habitat regions (Table 2). Capture rates were higher on pastures. Capture rates of this species declined in 1967 and have been low since. The median capture rate in the six years of the study prior to 1967 was 2.8/600tsd with a maximum of 5.7 and a minimum of 1.6. In the twelve years after 1966, the median capture rate was 0.4 with a maximum of 0.8 and a minimum of 0. Eighty per cent of the adult Eastern Hognose Snakes captured (N = 92) were between 450 and 650 mm SVL. The largest was a female, 750 mm SVL (870 mm TL) (USNM 88794–6; BC 68–9).

Species of Questionable Occurrence

Eastern Collared Lizard (*Crotaphytus collaris*). Brad Anderson (pers. comm.) observed an Eastern Collared Lizard twenty years ago in a rocky area which he remembers as being in southeastern Harvey County. Eastern Collared Lizards possibly exist in a few of the small rocky areas in the southern part of the Flint Hills region, but there is no specimen from Harvey County and no recent observation.

Rough Green Snake (*Opheodrys aestivus*). Robert Dester (pers. comm.) reported seeing a green snake in a tree on his property in the Flint Hills region in the early 1990s. There are no other records of this species in Harvey County.

Discussion

The Sandhills of Harvey County have a much greater diversity and abundance of snakes and lizards than the other regions of the county. In the Sandhills region, five species of lizards (four today) and fifteen species of snakes (possibly reduced to thirteen today) have been found. In the McPherson Valley region, only two species of lizard (one today) and thirteen species of snakes (possibly reduced to eight today) and in the Flint Hills region one species of lizard and nine species of snakes have been found. This is only

partly due to the more intensive study in the Sandhills. In the 1980s and 1990s, we caught snakes in traps on the Sandhills site at an average rate of 55.0/600 tsd while on the Flint Hills site they were caught at an average rate of 23.0 and on the McPherson Valley site at 14.0. Soil type and prey abundance are important factors in these differences in reptile abundance and diversity. They are especially important for those species, like the Kansas Glossy Snake, Hognose Snakes, and Lesser Earless Lizard, that are only found in the Sandhills. The sandy soil may be more favorable for burrowing species. The large number of wetlands in the Sandhills, with high populations of amphibians in many years, may be important for maintaining the abundance of those serpents, like Hognose Snakes and Garter Snakes, that feed on amphibians.

Degradation of reptile habitat is also a very important factor in limiting the abundance of snakes and lizards, and has occurred to a much greater degree outside the Sandhills, especially in the McPherson Valley region where most of the land is in annually cultivated grain crops. Approximately 60% of the acreage of grain is in cool season grains (Table 3), mainly winter wheat, which is fallow and therefore provides poor habitat for reptiles during much of their active season. Fencerows may be important avenues for travel and important escape cover in these degraded habitats, but few snakes use these narrow habitats continuously. There may be small populations of Great Plains Skinks that occupy fencerows and adjacent fields.

Snakes and lizards may be injured and killed by operations involved in crop production and by the greater road traffic outside the Sandhills. Some agricultural chemicals applied to crops in the McPherson Valley and Flint Hills regions may affect reptile reproduction and/or mortality. Only 2% of the Red-sided Garter Snakes caught in the Sandhills showed obvious injury or scarring while there was 10% injury or scarring at the other sites. For Racers, the injury rate was 10% in the Sandhills and 19% at the other sites.

Changes in abundance of snakes and lizards over the last 45 years are best documented in the Sandhills, where we have a long history of study. However, lesser amounts of evidence document changes in the other two regions as well. Three species, the two Garter Snakes and the Yellow-bellied Racer, have had very large fluctuations in population size on the study sites in the Sandhills, the Garter Snakes often making large changes from year to year in response to changes in amphibian availability. The Racers have undergone longer term fluctuations with no obvious cause. The Red-sided Garter Snake and

Yellow-bellied Racer populations also seem to behave similarly in the other regions, although they never become as abundant.

Three species, Western Slender Glass Lizard, Bullsnake and Prairie Kingsnake, have had more stable populations in the Sandhills with smaller fluctuations. The Bullsnake has been greatly reduced, if not extirpated, in the McPherson Valley region and probably reduced in the Flint Hills region. The Prairie Kingsnake has remained uncommon in all three regions. The earlier status of the Western Slender Glass Lizard in the two eastern regions is unknown, but it is probably not present today.

Six species, Prairie Racerunner, Fence Lizard, Lesser Earless Lizard, Eastern and Plains Hognose Snakes and Kansas Glossy Snake, have had substantial declines in the Sandhills. All of these species are now found only in the Sandhills region and most of them were probably never common outside the Sandhills region.

One species, the Western Rat Snake, has increased in abundance and distribution in the county. In the 1950s it was uncommon to rare, but now it is common in the Flint Hills and McPherson Valley regions and has recently moved into the Sandhills.

Habitat changes have occurred in Harvey County in the last 50 years that have probably been important in these changes in reptile populations. In the 1940s and 1950s, there was much open sand and many sand blowouts in the Sandhills region. Better pasture management and wetter years have increased vegetative cover and stabilization of the dunes. This is probably one factor in the population declines of the Prairie Racerunner, Fence Lizard, Lesser Earless Lizard, Kansas Glossy Snake, Plains Hognose Snake and Eastern Hognose Snake, as they depend upon burrowing for foraging and cover and some are heliophilic and need open areas to maintain the high temperatures necessary for activity. Prior to European settlement, these species populations may have been most common in open areas created by grazing, fire, and drought.

In the last 40 years, there has been a decrease in the acreage of pastures in Harvey County and an increase in the acreage of annual grain crops. The acreage of perennial hay crops has not changed substantially (Table 3), and there has been relatively little acreage (3,567 acres currently) devoted to CRP grassland. Pasture and perennial hay and grassland would provide more cover for reptiles. Most of the decreases in pasture acreage have been in the McPherson Valley region. This decrease in perennial cover was probably a factor in the decline of many snake populations in this region, especially the Bullsnake.

In the McPherson Valley region there has been a consolidation of smaller crop fields into larger fields with the loss of many miles of fencerows. This results in a further degradation of habitat for lizards and snakes, and is probably an additional factor causing continued decline in reptiles in this region.

There has been an increase in tree growth in the county, due to the maturation of riparian woodland along streams that were grassland streams before settlement, the spread of trees into pastures in some parts of the Flint Hills and Sandhills regions, the spread of trees and tall shrubs into fencerows and other uncultivated areas, and the development of new residential areas with planted trees. This is an important factor responsible for the increase in abundance and range of the Western Rat Snake. Increase in woodland and competition from Western Rat Snakes may also be factors in the decrease of Bullsnake populations in the McPherson Valley and Flint Hills regions, as both are predators on small mammals and birds. These changes could also result in a decrease in numbers of Bullsnares in the Sandhills region in the future.

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