

Vertabrates of the Flint Hills

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The Flint Hills of Kansas constitute an ill-defined area with no prominences, deserts, extensive water, or other features that ordinarily are considered as barriers to the migrations of animals or in any way inimical to the well-being of animals that otherwise inhabit the midlands. This mass of ridges and breaks and valleys, however, constitutes the last major remnant of the formerly much more extensive tall grass prairie, with the tall grass species rapidly reduced westward. There is a definite gradient in rainfall from the east to west across the Flint Hills, and a gradient in temperature and rainfall from south to north. The major factors that determine the success of vertebrates, then, change rapidly enough in this 60×240 mile area to become submarginal for several species at one or the other extreme of the area.

Aquatic species, of course, are limited by the availability of water. The northern part of the Flint Hills is drained by the Kaw River and its tributaries and by the Marias des Cygnes River which connects to the Missouri River farther to the east. The southern two thirds, on the other hand, is drained by the Arkansas River, or its tributaries, namely the Neosho-Cottonwood, Verdigris and Elk Rivers and Caney and Walnut Creeks. Thus, the aquatic animals, fish in particular, in the northern part of the area are derived from the inhabitants of the Missouri River system, while those in the south are closely related to those of the Arkansas River system. Furthermore, the Kaw River and its broad flood plain constitute a natural passageway through the northern Flint Hills, allowing direct communication from east to west while the Arkansas River bypasses the area, and its tributaries run from north to south forming long, narrow passages into the heart of the region through which some interchange can be made with southern species. Of this system only the Cottonwood River provides a sort of east-west passage through the region.

Other than the fishes which are limited in distribution to continuous water or are dependent on man's intervention, distribution of amphibia, reptiles, and mammals is distinctly affected by the Flint Hills and the gradient of temperature and rainfall within their limits.

In the following discussion, I am considering the Flint Hills within the limit of Kansas. It may be assumed that that portion in Oklahoma will be found closely comparable to the area in Chautauqua and Cowley

counties in Kansas, and that portion in Nebraska comparable to Marshall county. No attempt will be made to tabulate all species of vertebrates—only representative types will be discussed, and some of the ranges as they are presently known will certainly be modified within the next few years. Many species of vertebrates are mobile and highly adaptable, so occupy wide areas, including the Flint Hills. Others apparently find conditions within the Flint Hills to be intolerable, so occupy only the extensions of their favorite habitats into one side or the other. Some of the species that occur in the Flint Hills but not on both sides are listed in Table II.

The Flint Hills of Kansas are almost devoid of salamanders. Only the tiger salamander, a southwestern form, occurs with any regularity. Six species of eastern salamanders occurs in the part of Kansas immediately adjoining the Flint Hills on the east of which only *Ambystoma texanum* locally penetrates the Flint Hills proper, Chase County.

Among the frogs and toads, nine species occupy the area immediately west of the Flint Hills of which six extend into, or through the Flint Hills (Fig. 1, and Table I). Eleven species of frogs and toads occur on the east edge of the hills, of which only seven have penetrated the Flint Hills more than a few miles. Seven species of turtles are present throughout the area, with one more to the west, and five limited to the east. Among the lizards, eastern species prairie skink (*Eumeces septentrionalis*) and five-lined skink (*Eumeces fasciatus*); and western species rough scaled lizard (*Sceloporus u. garmani*), earless lizard (*Holbrookia maculata*), and the Texas horned lizard (*Phrynosoma cornutum*) are found throughout most of the Flint Hills, but not beyond. The range

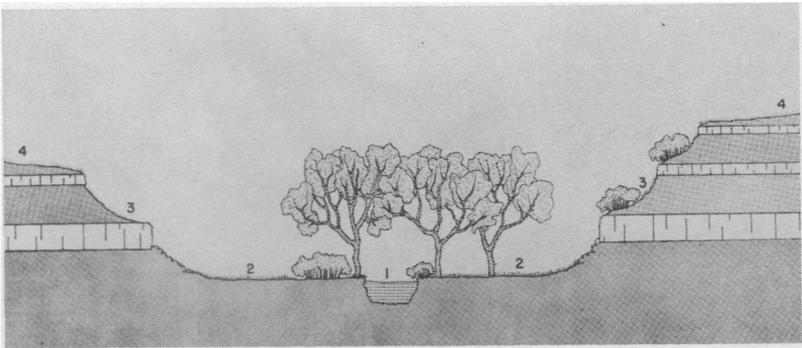


Fig. 1. Flint Hill habitats, illustrated by Kathy Smiley, in a section of a typical valley in the region. Habitat 1 is an intermittent stream with various pools. Habitat 2 is the flat valley floor, frequently flooded, with heavy grass, some brush, and sometimes trees. Habitat 3 is the steep slope with rock outcroppings and frequently brush above, on, or occasionally below the outcroppings. Habitat 4 is the flat or rolling upland above the break.

of one western species ends in the Flint Hills, as does those of four eastern species.

Three subspecies of snakes are limited to the east, and two species are limited to the west (Table 1). Four eastern species of snakes do not occur west of the Flint Hill (Table II). *Lampropeltis doliata gentilis*

Table I. Species of vertebrates limited by the Flint Hills of Kansas.

A. Species limited to the West	B. Species limited to the East
<i>Spea bombifrons</i>	<i>Ambystoma maculatum</i>
<i>Bufo cognatus</i>	<i>Necturus maculosus</i>
	<i>Bufo terrestris</i>
	<i>Bufo w. fowleri</i>
	<i>Hyla versicolor</i>
	<i>Rana areolata</i>
	<i>Rana clamitans</i>
	<i>Rana pipiens berlandieri</i>
<i>Kinosternon flavescens</i>	<i>Macroclemys temminckii</i>
	<i>Terrapene carolina</i>
	<i>Graptemys geographica</i>
	<i>Graptemys pseudogeographica</i>
	<i>Pseudemys floridana</i>
<i>Sceloporus undulatus garmani</i>	<i>Sceloporus u. undulatus</i>
<i>Masticophis flagellum</i>	<i>Ophoedrys aestivus</i>
	<i>Natrix erythrogaster transversum</i>
<i>Ancistrodon c. laticinctus</i>	<i>Natrix rombifera</i>
<i>Crotalus viridis</i>	<i>Crotalus horridus</i>
<i>Dipodomys ordii</i>	<i>Sciurus carolinensis</i>
<i>Onychomys leucogaster</i>	<i>Marmota monax</i>
<i>Vulpes velox</i>	<i>Tamias striatus</i>
<i>Mustela nigripes</i>	<i>Glaucomys volans</i>

Table II. Species of quadripeds (and snakes) in the Flint Hills of Kansas that are shared only with the west (A) or with the east (B).

A. Shared with the West	B. Shared with the East
<i>Ambystoma tigrinum mavortium</i>	<i>Ambystoma texanum</i>
<i>Pseudacris clarkii</i>	<i>Pseudacris nigrita</i>
	<i>Microhyla olivacea</i>
	<i>Sternotherus odoratus</i>
<i>Holbrookia maculata</i>	<i>Scincella laterale</i>
<i>Sceloprus undulatus garmani</i>	<i>Eumeces fasciatus</i>
	<i>Eumeces septentrionalis</i>
	<i>Carpophis amoenus</i>
	<i>Masticophis f. flagellum</i>
<i>Lampropeltis doliata gentilis</i>	<i>Lampropeltis doliata sypila</i>
<i>Tantilla nigriceps</i>	<i>Tantilla gracilis</i>
	<i>Ancistrodon contortrix mokeson</i>
	<i>Synaptomys cooperi</i>
	<i>Microtus pinetorum</i>
	<i>Urocyon cinereoargenteus</i>

and *Lampropeltis d. sypila* ranges overlap throughout the Flint Hills (Fig. 1).

Ranges of five eastern species of mammals essentially end at the eastern edge of the Flint Hills, while those of eight western species end within a few miles of the west edge (Table 1). Thirty species of mammals occur in the Flint Hills at the present time, all of which range both east and west. Seven species have become extinct in the past century (timber wolf, black bear, mountain lion, river otter, wapiti, antelope, and bison). The prairie vole (*Microtus o. ochrogaster*) and a peculiar brush-dwelling strain of *Peromyscus maniculatus* have their ranges basically radiating from the Flint Hills.

The Flint Hills do not constitute a barrier to birds, except for availability of specific habitats, although the ranges of several species terminate in the area of the Flint Hills.

Within the Flint Hills, I consider the existence of four rather distinct habitats that sustain distinct, although overlapping, animal communities. The invertebrate animals probably follow much the same patterns of distribution as the vertebrates do.

Throughout the Flint Hills, the topographic limitations of plant, and animal, communities, follow a rather uniform pattern, varying in proportions and in degrees of development. These habitats may be illustrated (Fig. 1) as: (1) the stream in the lowest part of the valley, (2) the flat "flood plain," frequently wooded, along the stream, (3) the "breaks" or steep slopes above the flood plain, and (4) the flat or gently rolling uplands that constitute the true prairie and make up as much as 80% of the total area. I will discuss the animals that characterize each of these habitats, with not attempt to give complete lists or analyze populations.

The streams, and particularly the larger pools in the streams constitute a suitable habitat for several interesting animals. Black bullheads

Table III. Number of species bordering the Flint Hills on the west and on the east, and those shared with the Flint Hills.

Group	Bordering west	Shared with Flint Hills	In Flint Hills	Shared with Flint Hills	Bordering east
Caudata	1	1	1	0	6
Anura	9	7	8	6	11
Chelydra	8	7	7	7	12
Lacertila	7	6	7	5	9
Serpentes	24	21	28	23	28
Mammals	39	30	30	30	37
Total	90	73	90	82	107

that live on crayfish, insect larvae, and carrion and certain types of aquatic vegetation, can be found in nearly every pool in the Flint Hills. Large mouth black bass and channel cats occur in the larger streams, and in recently established reservoirs. Several species of sunfish, predominately the green sunfish, as well as suckers and various minnows are constant inhabitants of these pools.

Several amphibia of particular interest are regularly found in these pools. The cricket frogs, chrous frogs, grass frogs and bull frogs are known to many inhabitants of the area.

This area regularly supports only one salamander—the western tiger salamander. This beast when adult is 7–8 in. long, shiny black with bright yellow spots. It lays its eggs in pools and ponds in February and March. Its larvae, with external gills and broad tail, live usually two years in the water, then metamorphose after reaching a length of 8–10 inches. It is probable, although not yet proved, that many of the larvae in this region reproduce as larvae and never emerge from the water.

Reptiles in the pools are mostly limited to the snapping turtle (*Chelydra serpentina*) and the common water snake (*Natrix sipedon*). The snapper is primarily a mud-dwelling animal, and never gets far from the water. The water snake, quite commonly but mistakenly called a “water moccasin” is a short, heavy-bodied, nonpoisonous but ill-tempered critter that eats fish and frogs.

The flood plains support a few mammals, particularly gophers (*Geomys bursarius*) and moles (*Scalopus aquaticus*) underground; cotton rats (*Sigmodon hispidus*) in the heavy grass, the deer mouse (*Peromyscus leucopus*) under the trees, and the fox squirrel (*Sciurus niger*) in the trees. Muskrats live in the stream banks, and beavers formerly lived in the banks of the larger streams and have made a favorable come back in the past 15 years.

The pools provide temporary resting places for many migratory waterfowl, and the trees along the streams provide nesting and feeding places for many of the common birds, including red-tailed hawks, crows, great horned owls, and a number of woodpeckers, none of which is peculiar to the Flint Hills. Warblers, except in migration, are almost totally absent, with only the yellow warbler nesting throughout the area, Kentucky warbler and oven bird in more heavily wooded areas, and the yellow-breasted chat in brushy habitats in the southern half of the area.

The breaks constitute a peculiar set of conditions characterized by steep slopes, rock outcroppings and brush (aromatic sumac, wild plum, panicked dogwood). Here we find a variety of lizards, principally the mountain boomer, or collared lizard, the Sonoran skink and the horned

lizard. This is the regular denning area of blacksnake, copperhead, and pigmy rattler. Among mammals, the wood rat, the coyote, the striped skunk, and the spotted skunk most frequently den on the breaks.

The brush on the breaks provides good nesting places for loggerhead shrikes, catbirds, field sparrows, and in some localities, painted buntings and towhees. As a result of continuous overgrazing and repeated burning, the brush on the breaks has increased to dense thicket conditions in many spots, expanding the habitat of thicket species, and decreasing the open ledge habitat required by lizards and snakes.

The upland areas of the Flint Hills are still covered primarily by native prairie grasses—the last extensive remnant of the tall grass prairie of a century ago. Domestic cattle have replaced the buffalo, and the better ground has been plowed, providing a more varied habitat than was originally here. These extensive upland prairies maintain enormous native animal populations in addition to domestic mammals. This is the peculiar habitat in which the prairie vole (*Microtus ochrogaster*) thrives, and with it the tiny harvest mouse (*Reithrodontomys montanus*), the prairie deer mouse (*Peromyscus maniculatus bairdii*) and the larger pocket mouse (*Perognathus hispidus*).

This is the home of our largest remaining predator, the plains coyote (*Canis nebrascensis*) which commonly dens near the upper limit of the breaks and lives primarily in the open uplands. The Flint Hills region at present has the highest concentration of coyotes ever recorded anywhere, an overall population of nearly two breeding pairs per square mile. Coyotes are dependent upon the productivity of the land for their survival: rabbits and mice eat the vegetation, coyotes eat the rabbits and mice. Until the food demand of coyotes exceeds the available food supply, we can expect further increases in their numbers. Under normal conditions, there may be at any one time, as many as 12,000 mice, 160 rabbits, and 5 coyotes in a typical square mile of Flint Hills upland. Each coyote requires the equivalent of 15 mice or 1/2 rabbit per day for normal activity. If the number of mice drops below 2,000 per square mile, or rabbits below 20 per square mile, coyote numbers will be reduced—by reduced reproduction.

The upland prairies are as rich in bird life as in mammals. Meadowlarks, prairie horned larks, dickcissels, lark sparrows, and grasshopper sparrows are everywhere. Quail do well in the open prairies, but with prairie interspersed with farmland, bobwhite populations are probably as high in the Flint Hills now as they are anywhere in the nation. The greater prairie chicken once occupied all the tall grass prairie from Central Kansas to Illinois. Now there are only remnants of prairie, and relic

populations of prairie chicken, except in the Flint Hills, where we can again afford the luxury of an open season on chickens, even if only for two birds per hunter. The prairie chicken is a majestic bird, weighs over a kilogram, and lives for several years. These birds congregate on the same booming grounds each spring for courtship and mating. The hen lays 10 to 16 eggs in a nest on the ground and incubates them for 4 weeks. The young are able to run within a few minutes after hatching. Destruction of habitat by cultivation and close grazing has been more to blame for reduction of prairie chicken numbers than all the shooting that has ever been done.

My favorite bird on the prairie is the upland plover. This bird arrives in mid-April, each male takes up a territory and defends it by strutting, threatening, or flight song. I have never seen actual combat between males of this species, but suspect it could happen if two dominant males chose overlapping territories. Eggs are laid on bare spots on the ground, much as killdeer eggs are, or in shallow, grass-lined depressions. Young are hatched in late May, and are full grown in about a month. Upland plovers frequently revert to sandpiper habits in July and August, feeding in mud flats and along the waters edge.

Nighthawks, although common over much of the eastern half of the United States, find the rocky spots of the Flint Hills particularly suitable for nesting. A close relative of the nighthawk, the poor-will, occupies a special niche in the prairie. The poor-will looks and flies like a night-hawk except for the lack of white wing spots. They nest in open grass land, a few meters down on the upper slope, just below the flat upland table. Their presence was not observed until a few years ago, but now they are known to occur in several parts of the Flint Hills, and probably do occur, and have for centuries, throughout the area.

Change of animal populations is of considerable interest. In 1803, Pike crossed this area and considered it uninhabitable wasteland, but we have numerous records indicating enormous numbers of buffalo, and some elk, deer, and antelope from 1820 to 1850. These large herbivores, as well as timber wolves and cougar had been greatly reduced by 1860 and essentially eliminated by 1870. White tailed deer repopulated the area within the past 25 years until now there is an official hunting season for deer. Bobcats have returned in moderate numbers, and we hear repeated rumors of cougar, both in the north and south ends of the Flint Hills. Our present economy cannot tolerate return of buffalo, elk, and timber wolf to the area. In 1936, cotton rats invaded from Oklahoma. By 1950 they had extended their range into Nebraska, and now have become established mostly in the flood plains throughout the Flint Hills. In

years of high population density, as in 1958, cotton rats occupy all grass areas available.

Population fluctuations occur continuously with weather changes, as well as with major habitat changes. I mentioned earlier the dependence of coyotes on rabbits and rodents, and my work indicates that coyote reproduction is directly linked to the *Microtus* cycle. The *Microtus* populations, in turn, are affected adversely by prolonged heat, extreme cold, too little moisture, too much moisture, and of course, secondarily by the changes in vegetation resultant from unusual weather conditions. I have found *Microtus* population density to be greatly reduced by the drought of 1953-57, by the cold winter and excessive snow of 1960, and by disease conditions, apparently independent of general weather conditions in 1963. Barring epidemics of the 1963 type, animal production in this area, as any other, reflects an interaction between climatic conditions and fertility of the soil.

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