

Scientific Report

Vertebrate animals on the Fitch Natural History Reservation (1948-2002)

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Preface

This report summarizes the status of vertebrate animals on the Fitch Natural History Reservation (FNHR) from 1948 until 2002. It was a collaborative effort of Galen L. Pittman (GLP) and W. Dean Kettle (WDK) with the late Henry S. Fitch (HSF). We had originally intended to publish this material (*ca* 2003) as a part of a larger treatise on the FNHR, including sections on environmental setting and land use history. However, due to lack of funding, no publication was produced at that time. Sadly, our colleague HSF died in 2009 before the project was complete. Recognizing the importance making available the synopsis of animals at FNHR, GLP and WDK decided to separate it from the planned FNHR monograph and publish it now (2016) within the Scientific Report Series of the Kansas Biological Survey. The reader should realize that populations of species described may have changed since 2002, but that date should be taken as a good indicator of trends and status. GLP and WDK have not edited the original section on vertebrates that the three authors agreed upon (i.e., it is in its original form). However, in some cases we have added footnotes, based on observations or events after 2002, where new information was available and deemed important to interpretations of statements about species in 2002. In all cases footnotes are the responsibility of GLP and WDK.

This report is based largely on the observations of HSF, resident naturalist at FNHR beginning in 1948 and resident there until the mid-2000s, and GLP, biologist and ornithologist beginning his observations at the KU Field Station about 1976. WDK, an ecologist beginning his work at the KU Field Station in 1976, provided miscellaneous observations and compilations. Mark Robbins, an ornithologist with the KU Biodiversity Institute, living adjacent to the FNHR since 1993, provided observational data for the original report 2002, and updates. George Pisani, who collaborated extensively with HSF on snake studies, also provided updates. D. Christopher Rogers, a biologist with the Kansas Biological Survey who has lived at the former residence of HSF at the FNHR since 2011, provided many recent observations.

HSF did not wish to be the senior author on the original monograph, but rather a co-author. Because the writing of the vertebrate section is unchanged from 2002, save the footnotes, we have included HSF posthumously as a co-author. WDK suggested that GLP serve as primary author because of his decades-long observations on the bird community, and general knowledge of vertebrate groups. GLP and WDK acknowledge the monumental contributions and insights of HSF in the production of this report. When we first discussed writing a section on vertebrates, HSF said something to the effect, "I think I could probably write a sentence or two about each species on the Reservation." Indeed he could! It was our honor and privilege to collaborate with Henry S. Fitch.

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Introduction

Each of the species that live on the area is unique in its ecological traits. Important differences exist in the size and permanence of an area occupied by an individual, and in the plant associates that it chooses for food or concealment. Many depend on particular prey species, which may change constantly in population density, or may at times move away from any given area. Special requirements may exist for hibernation, for breeding or for neonates, thus areas that are occupied by a species may not fulfill all of its requirements at different stages of its life history. Migratory species that spend part of each year far away from FNHR, including in foreign countries, may find their habitat there shrinking or disappearing, and may cease to thrive even though their needs are well satisfied on FNHR during the time that they spend there.

The species living on FNHR often undergo changes in their status as the constant environmental shifts that are occurring either favor or hamper them, often in ways that are not readily apparent. Successional change in vegetation at FNHR has had a major impact on the fauna. The main trend has been the reduction and loss of grassland species, especially those that require shortgrass habitat. This can produce cascading effects throughout the animal community as each of the thousands of animal species that are present on FNHR is involved in a complex of ecological relationships that involves all the other species. In the following sections we present information on the vertebrate community that occurs, or formerly occurred, on FNHR.^{1,2} We have also discussed some populations as they occur on adjacent tracts: the McColl Nature Preserve, the Rockefeller Experimental Tract, the Nelson Environmental Study Area (NESA),

¹ Please note that some discussions and tabular presentations in this report are very similar to, or in cases identical, to those presented in another report containing accounts for vertebrates at the University of Kansas Field Station (e.g., see Kettle and Whittemore [1991], and papers therein for discussions of mammals [Fitch and Kettle 1991], birds [Pittman 1991], and reptiles and amphibians [Fitch 1991]). The information here is strictly focused on FNHR, represents an update since 1991, and contains species accounts and anecdotal entries not found elsewhere. Likewise, we have not attempted to cite all publications supporting general summaries and species accounts, instead leaving it to the reader to explore the rich literature for FNHR and other ecological sources. Our goal here is to present an easily-assimilated compilation for understanding the vertebrate fauna of the FNHR.

² The reader should note that in some cases a species is referred to as having “formerly occurred on” or as being “long gone from” the FNHR. This condition should be taken, in most cases, more appropriately to mean that successional trends in vegetation have drastically reduced or eliminated the population due to loss of suitable habitat. It is always possible that a species thus described might be found on FNHR if it dispersed from a population in suitable habitat surrounding FNHR, is a species having a larger home range that includes the FNHR, or is a species of small size that has found a microsite on FNHR where it can survive. Lastly, we have provided updates for some species, but these are miscellaneous observations and not based on quantitative sampling.

and a special large-scale study there known as the Biotic Succession-Habitat Fragmentation site (BSHF).

As a group vertebrates are ecologically important members of the ecosystem, and are often noticed by virtue of their larger size. However, invertebrate species comprise a no less ecologically important group. Difficulties with the taxonomy of many invertebrate groups, small body size and secretive nature for some, and the vast number of groups to study, mean comprehensive surveys are limited to those invertebrate groups for which scientific expertise, and interest is available. For example, extensive surveys of the spider fauna at FNHR and adjacent sites identified 249 species thus far (Guarisco and Fitch 1995). There are times when the presence of invertebrate groups is hard to overlook. One such occasion is the emergence year of the periodical cicada, *Magicicada* spp., which last emerged in 1998.³

The FNHR was established in 1947 and is the oldest part of the University of Kansas Field Station. Scores of publications describe establishment, successional changes in biota, and scientific research on FNHR (e.g., Fitch 1952; Fitch and McGregor 1956; Fitch 1965; Fitch 1999a; Fitch et al. 2001). Areas adjacent to the FNHR also are part of the KU Field Station, and have been used for studies in concert with the Reservation (e.g., Fitch and Hall 1978, Kettle et al. 2000; Kettle et al. 2001). The spatial relationship of these sites, and their differences in forest cover, are shown in the aerial photograph in Figure 1.

The following materials describe the status and changes in the community of vertebrate animals inhabiting the FNHR from 1948-2002.^{4,5}

³ Periodical cicadas again emerged in 2015.

⁴ Updates for the period 2003-2016 are provided as footnotes.

⁵ Standard common and scientific names are presented as of 2002 using the sources indicated (i.e., names have not been updated to reflect currently accepted changes).

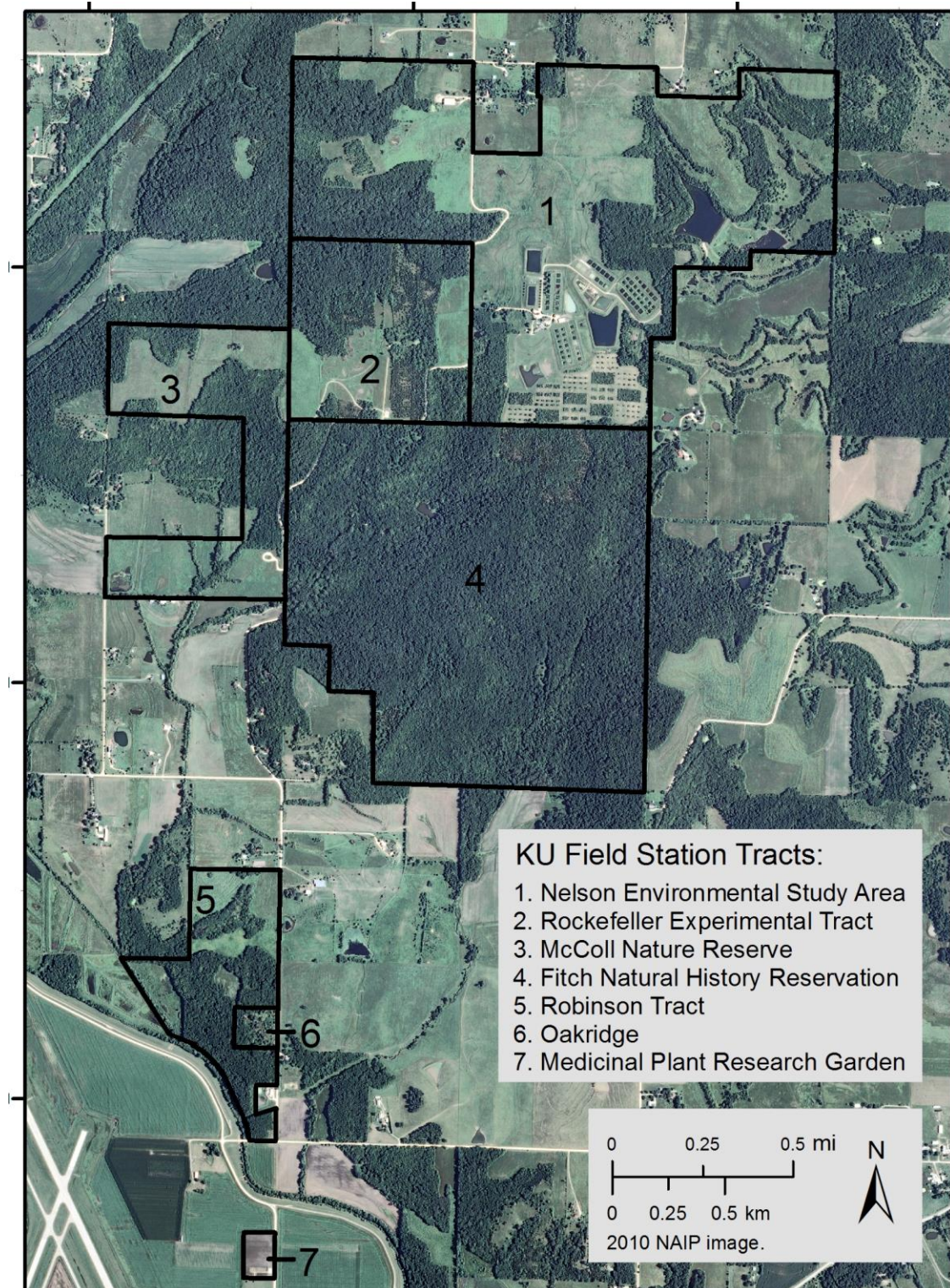


Figure 1. Location of the Fitch Natural History Reservation (FNHR) and nearby tracts of the KU Field Station. The Biotic Succession-Habitat Fragmentation (BSHF) facility is seen adjacent to the north boundary (eastern half) of FNHR.

Fish of the Fitch Natural History Reservation

Only five species of fish are documented from the FNHR, representing a small portion of the local fauna. Three species (Stoneroller, Black Bullhead, and Fathead Minnow) have been recorded in the stream draining the east side of FNHR. This is an ephemeral stream that frequently lacks surface flow during droughty times, however, during rainy periods the stream is connected by surface flow to larger streams and no doubt fish species migrate upstream onto FNHR. From the point where the creek leaves FNHR on the south boundary, it flows about 2.1 km (1.3 mile) south to Mud Creek, which in turn empties into the Kansas River 5.3 km (3.3 miles) downstream, and thus at times of adequate flow the east creek is in contact with a large pool of potentially colonizing fish species. The other two species recorded, Red Shiner and Golden Shiner, are found in the pond and are thought to have become established there as a result of downstream migration from a headwater pond on what is now known as NESAs.

Limited sampling of the east stream at FNHR precludes conclusions about successional trends and distribution of fishes. In all probability other species of fish, migrating upstream from Mud Creek, have made temporary use of the east creek over the years; and presence of fish is known to have a tremendous impact on the ecology of small headwater streams. Likewise, limited sampling precludes any statements about population trends on fish inhabiting the pond.⁶

⁶ In 2010 a large pond, known as Arrowhead Lake, was constructed on NESAs about 200 meters north of the north boundary with FNHR. This pond is in the watershed of the FNHR pond, and is known to contain populations of Largemouth Bass (*Micropterus salmoides*), Bluegill Sunfish (*Lepomis macrochirus*), Green Sunfish (*Lepomis cyanellus*), Orange-spotted Sunfish (*Lepomis humilis*), Mosquitofish (*Gambusia affinis*), Black Bullhead (*Ameiurus melas*), and White Crappie (*Pomoxis annularis*). It is possible that at high flow in the future these species could leave Arrowhead Lake and disperse downstream and enter the FNHR pond.

Fish Species Accounts

Brief accounts of those fish confirmed from FNHR are presented here to describe population status and provide background on site-specific ecology (statements on general ecology are taken from Cross and Collins (1975)).

Black Bullhead (*Ameiurus melas*) - A member of the catfish family (Ictaluridae), this species has been observed in the east creek. It is omnivorous, generally lives in calm waters, and tolerates high turbidity.

Stoneroller (*Campostoma anomalum*) - A member of the minnow family (Cyprinidae), it has been noted in the east creek at FNHR. This fish feeds primarily on microorganisms that grow on the surface of stones and debris and is frequently abundant in small streams.

Red Shiner (*Cyprinella lutrensis*) - A member of the minnow family (Cyprinidae), it is known only from the pond and the stream draining from it. In general Red Shiners inhabit streams and ponds that are unfavorable to other fish species because of intermittent flow and high turbidity.

Golden Shiner (*Notemigonus crysoleucas*) - A member of the minnow family (Cyprinidae), it is known only from the pond and was not found there until the year 2000. It was able to invade the pond even though a population of Red Shiners was well established there. In general, Golden Shiners require deeper and clearer water than Red Shiners.

Fathead Minnow (*Pimephales promelas*) - A member of the minnow family (Cyprinidae), it has been noted in the east creek at FNHR. This omnivorous fish is one of the most widespread in Kansas and is among the first species to invade drainages after a rain. Of all the fish species potentially traveling upstream, this was the only species found in the east creek during 1957.

Amphibians of the Fitch Natural History Reservation

Ten species have been found on FNHR (see checklist in Appendix I), constituting 74% of the local fauna occurring in Douglas County. Missing are the Smallmouth Salamander (*Ambystoma texanum*): restricted to low wetlands such as the Baker Wetlands area; the Great Plains Toad (*Bufo cognatus*), at the eastern edge of its range restricted to the Kansas River floodplain; the Gray Treefrog (*Hyla versicolor*), here represented by its sibling species, Cope's Gray Treefrog; and the Boreal Chorus Frog (*Pseudacris maculata*), here represented by its sibling species, the Western Chorus Frog. Successional changes seem to have eliminated four of the ten species.

Geographical Characterization

Two of the ten species are transcontinental or nearly so in their distribution (Eastern Tiger Salamander and Woodhouse's Toad); five are mainly eastern with ranges that incorporate the deciduous forest biome, but extend far to the north (Eastern American Toad) or west (Northern Cricket Frog and Bullfrog) or east central (Cope's Gray Treefrog) or northwest (Western Chorus Frog). The remaining three have ranges that are centered in the Great Plains region (Plains Spadefoot, Plains Leopard Frog, and Great Plains Narrowmouth Toad).

Successional Trends

Water availability, which is of fundamental importance for breeding and larval development in amphibians, has not changed greatly at FNHR over the last 50 years despite major changes in vegetation with the shift from open grasslands and oldfield to woodlands. Although no species has noticeably increased with successional changes, most species have maintained more or less comparable numbers. However, three species are also dependent upon open habitats, Woodhouse's Toad, Great Plains Narrowmouth Toad, and Western Chorus Frog have undergone drastic reductions in population numbers as their preferred habitat was diminished with successional changes.

Methods

All of the anurans listed form breeding choruses and are thus readily detected where they might have otherwise been overlooked. Some kinds may be found by turning sheltering objects. Captures of most amphibians were made unintentionally when they found their way into wire funnel traps set for snakes.

Amphibian Species Accounts

Brief accounts of amphibian species are presented here to describe population dynamics, convey information on recent population status, and provide background on site-specific ecology. The reader should refer to the published literature for details on species biology and ecology.

Eastern Tiger Salamander (*Ambystoma tigrinum*) - Only two records were obtained: on 24 October 1951 and 7 October 1955 they were caught in wire funnel traps set for snakes at hilltop rock outcrops on FNHR near its southern edge. Both individuals were immature and they were thought to have traveled to the area from sloughs in the Kansas River floodplain about two miles farther south. FNHR probably lacks a resident population, but in some years may receive autumn wanderers in search of hibernacula.

Plains Spadefoot (*Spea bombifrons*) - Locally this is a species of the Kansas River floodplain and it only occasionally finds its way to the upland habitats of FNHR. Breeding occurs in temporary pools after heavy rains, and larval development is exceptionally rapid. Several adults and young were caught in wire funnel traps on the western part of the FNHR in 1955, 1956 and 1957, but none has been recorded on the area for more than 40 years.

American Toad (*Bufo americanus*) - A woodland species, this toad is fairly common on FNHR and breeds regularly in the FNHR pond. Alternative breeding sites are shallow pools in the diversion ditch north of the headquarters, or pools along the creek that flow from the pond. The first male to find a suitable pool for spawning attracts others; often a dozen or more congregate forming a chorus and the site changes from year to year. After breeding the toads disperse to various types of woodland, seeking shelter by day under flat rocks or in mammal burrows, and foraging mainly at night.

Woodhouse's Toad (*Bufo woodhousii*) - This common toad prefers open habitat and has steadily lost ground on FNHR, and probably now has no resident population on the area. In earlier decades it bred at the FNHR pond in some years, and persisted in open areas around buildings with roads and lawns, but the encroachment of trees has resulted in habitat deterioration.

Northern Cricket Frog (*Acris crepitans*) - Habitat of the cricket frog, wet mud at the edge of the FNHR pond and along intermittent streams, has changed remarkably little over several decades, and the frogs themselves remain abundant. They are heavily preyed upon by bullfrogs, raccoons and opossums and sometimes by transient herons.

Cope's Gray Treefrog (*Hyla chrysoscelis*) - Treefrogs continue to breed at the FNHR pond. From the choruses of breeding males, and occasional sightings, it can be concluded that numbers have changed little over several decades. In summer one or more adults can nearly always be found hiding beneath the lid of the propane tank at headquarters.

Western Chorus Frog (*Pseudacris triseriata*) - Chorus frogs prefer relatively open areas such as oldfields and are to a large extent subterranean, using soil cracks as well as the burrows of certain mammals. They have persisted on

FNHR despite habitat deterioration that has resulted from the expansion of forest. Every year there is a small chorus of breeding males in the diversion ditch just to the north of headquarters but numbers continue to shrink. Immediately south of the ditch is the area stripped of sod in the 1940s, and still not fully recovered, but retaining some features of the frogs' habitat whereas nearby areas that were not disturbed are less attractive.

Plains Leopard Frog (*Rana blairi*) - The Leopard Frog has been a perennial resident of the FNHR pond and its numbers have fluctuated drastically. Being smaller, the Leopard Frog is often eaten by the Bullfrog, and to a large extent its numbers are controlled by the Bullfrog population.

Bullfrog (*Rana catesbiana*) - Like the Leopard Frog, the Bullfrog has been a perennial resident of the FNHR pond. Only a few of the hundreds or thousands of frogs usually present are fully adult. Choruses of breeding males can be heard through the summer, and usually consist of fewer than six. After every heavy summer rain there is a mass migration of juveniles, which may be of several different sizes. They disperse into all habitats and relatively few of them survive when the weather becomes dry. Because of the availability of Bullfrogs, the pond is a favorite place for raccoons, opossums, herons, and hawks to forage; but perhaps the species greatest predator is the cannibalistic adult. It may even eat half-grown frogs that are themselves preying on newly metamorphosed individuals. There are dozens of ponds on nearby land, some of it privately owned, that provide breeding places for Bullfrogs that could serve for natural restocking, if the resident population at FNHR should ever be depleted.

Great Plains Narrowmouth Toad (*Gastrophryne olivacea*) - During the 1950s narrowmouthed toads were much in evidence, especially in the open, rocky woodland of Skink Woods, and a half a mile farther north at the Quarry, and they were studied in both places. None has been seen at either site for several decades, and evidently the species has been eliminated. Habitat change has been most striking at the Quarry, where both invading trees and herbaceous ground vegetation have affected bare rock surfaces. In Skink Woods changes have been far more subtle, but equally effective in bringing about reduction and disappearance. It is doubtful whether there is now a resident population on any part of FNHR. However, these toads still breed on the BSHF at NESAs, in puddles that collect where there were terraces. Individuals must occasionally cross the boundary line onto FNHR.

Reptiles of the Fitch Natural History Reservation

For convenience, we have followed the traditional systematic presentation and retained the turtles within the Class Reptilia under the order Testudines. We are aware that some would recognize this group as a separate class (Chelonia) under the order Cryptodira (Potts et al. 1999). Twenty-five species of reptiles (turtles, lizards, and snakes) have been found on FNHR (see checklist in Appendix I). This represents nearly 62% of the 39 species of local (Douglas County) reptiles. Missing from FNHR are seven aquatic (mainly fluviatile) species: Painted Turtle (*Chrysemys picta*), False Map Turtle (*Graptemys pseudogeographica*), Slider (*Trachemys scripta*), Smooth Softshell (*Apalone mutica*), Spiny Softshell (*Apalone spinifera*), Plainbelly Watersnake (*Nerodia erythrogaster*), Diamondback Water Snake (*Nerodia rhombifer*); four floodplain or wetland species: Graham's Crayfish Snake (*Regina grahamii*), Western Ribbon Snake (*Thamnophis proximus*), Plains Garter Snake (*Thamnophis radix*), and Massasauga (*Sistrurus catenatus*); three forest species: Coal Skink (*Eumeces anthracinus*), Rough Green Snake (*Opheodryx aestivus*), and Redbelly Snake (*Storeria occipitomaculata*); and one arenicolous species, Eastern Hognose Snake (*Heterodon platirhinos*). Two species not included in our list, because they were each seen only once on FNHR and were probably released captives, are the Painted Turtle (*Chrysemys picta*) and the Eastern Box Turtle (*Terrapene carolina*).

Geographical Characterization

The reptile community of FNHR is representative of the ecotonal (transitional) area between the forest to the east and the Great Plains grasslands that dominate to the west. Of the 25 species occurring on FNHR, three are transcontinental in distribution (Ringneck Snake, Speckled Kingsnake, and Common Garter Snake); six are characteristic of the Great Plains (Ornate Box Turtle, Eastern Collared Lizard, Great Plains Skink, Northern Prairie Skink, Flathead Snake, and Great Plains Rat Snake); one is mainly western (Gopher Snake); and the remaining 15 species are most characteristic of the Eastern Deciduous Forest Biome. Of those 15; seven (Five-lined Skink, Ground Skink, Western Worm Snake, Eastern Rat Snake, Smooth Earth Snake, Copperhead, and Timber Rattlesnake) have overall ranges corresponding well with the Forest Biome; five (Six-lined Racerunner, Slender Glass Lizard, Prairie Kingsnake, Eastern Racer, and Northern Water Snake) have ranges extending west far into the Great Plains grasslands, and three (Common Snapping Turtle, Milk Snake, and Brown Snake) range southward into the tropics.

Successional Trends

The herpetofauna of FNHR has changed during the last 50 years due to successional changes in vegetation from open grassland and oldfield to woodland, with the majority of species declining in population numbers. Populations of species requiring open habitats, formerly common on FNHR, have declined or

have been eliminated as a result of successional changes (e.g., Ornate Box Turtle, Great Plains Skink, Six-lined Racerunner, Gopher Snake, and Timber Rattlesnake). Successional change to woodland may have favored the Western Worm Snake, and Common Garter Snake. Two species tightly associated with the aquatic environment of the pond, Common Snapping Turtle and Northern Water Snake, have maintained fairly constant numbers despite changes in the terrestrial habitat.

Methods

Characterization of the reptile populations at FNHR is based on thousands of records from almost continuous live-trapping over a 54-year period (see Fitch 1999a for extensive analysis of the snake community at FNHR). Artificial shelters of boards, sheet metal or corrugated metal, many of them of standardized size, 2 feet x 4 feet, have supplemented live traps as a method for sampling reptile populations. Ratios of previously captured (and individually marked) to new individuals after periods of sampling on selected areas have been the basis for Petersen Index censusing in some cases.

Reptile Species Accounts

Brief accounts of those reptile species confirmed from FNHR are presented here to describe population dynamics, convey information on recent population status, and provide background on site-specific ecology. The reader should refer to the published literature for details on species biology and ecology.

Common Snapping Turtle (*Chelydra serpentina*) - Several live in the FNHR pond, a relatively isolated population. In recent years, several nests near the pond and mowed headquarters area were found to have been robbed by raccoons.

Ornate Box Turtle (*Terrapene ornata*) - Disappeared from FNHR in 1960s as its short, grassland habitat was eliminated. A few are still found on adjacent NESAs (BSHF site) that has areas of closely mown turf.

Eastern Collared Lizard (*Crotaphytus collaris*) - In 1949 several of these lizards captured in the northern Flint Hills near Manhattan were introduced at the Quarry and they thrived in the barren rocky habitat there, but did not disperse to other habitats. As trees and brush invaded, their habitat deteriorated, and in 1956 the last one disappeared after several generations in this small area.

Five-lined Skink (*Eumeces fasciatus*) - A colony persists in headquarters area and a few other places. It is much reduced from its former abundance because of habitat change. It prefers an open type of forest and forest edge.

Great Plains Skink (*Eumeces obsoletus*) - A few were present, mainly at the Quarry and Rat Ledge during the early years. This species is long gone from FNHR, but persists nearby on BSHF.

Northern Prairie Skink (*Eumeces septentrionalis*) - Found from time to time in headquarters area throughout the 1950s and early 1960s. It is thought that the mowed lawn area helped it persist, precariously. It has not been seen for more than 30 years.

Ground Skink (*Scincella lateralis*) - Usually a leaf litter species in woodland, but found in grass of formerly grazed pastures at FNHR. It has persisted in moderate numbers.

Six-lined Racerunner (*Cnemidophorus sexlineatus*) - Former areas of activity included the driveway, the ditch bank on the north boundary of House Field, the Quarry, and the Road Field/High Field area on eroded and barren gully banks. By about the 1970s, it had disappeared as barren areas shrank.

- Slender Glass Lizard (*Ophisarus attenuatus*) - A tallgrass species; it increased gradually for about 18 years after 1948, but then declined as trees and shrubs shaded out the grass. It is now rare but still present on FNHR, where patches of grass remain.
- Western Worm Snake (*Carphophis vermis*) - As a forest and edge species it has maintained its numbers.
- Ringneck Snake (*Diadophis punctatus*) - Still found in moderate numbers in former pastures (House Field and Quarry Field) but reduced to a small percentage of its former abundance.
- Flathead Snake (*Tantilla gracilis*) - Long gone from the open rocky areas where it formerly occurred (e.g., the Quarry and Rat Woods).
- Eastern Racer (*Coluber constrictor*) - As a tallgrass species, the racer did not thrive on the heavily grazed pastures before FNHR was dedicated. However, it increased rapidly in the early years after grazing was discontinued. Since the early 1950s the trend has been reversed. Invading woody vegetation has tended to shade out the grass. Formerly high populations of small mammals have declined which reduced its food supply, thus the racer's numbers are much reduced.
- Great Plains Rat Snake (*Elaphe emoryi*) - In the late 1980s there was a thriving colony half a mile west of the FNHR entrance on private land, but the population has been nearly eliminated there by successional changes. A gravid female was collected in 1999, her eggs hatched, and the young released on the BSHF site at NESAs.
- Eastern Rat Snake (*Elaphe obsoleta*) - This forest species seems to have maintained numbers fairly well; but definitely seems less numerous than in the past. (Recent taxonomic treatments now call this species the Western Rat Snake (Collins and Taggart 2002)).
- Prairie Kingsnake (*Lampropeltis calligaster*) - A tallgrass species; it has become much scarcer with few records in recent years at FNHR.
- Speckled Kingsnake (*Lampropeltis getula*) - Long ago, there were a few records, on or near the edge of FNHR. At present, this species is long gone from FNHR.
- Milk Snake (*Lampropeltis triangulum*) - Few records in recent years but persists on NESAs and may occasionally wander onto FNHR.
- Gopher Snake [traditionally "Bullsnake"] (*Pituophis catenifer*) - A shortgrass species that is long gone from FNHR. Since the 1950s, there probably has

been no resident population. This species persists with at least one living at the nearby BSHF site on NESAs.

Northern Watersnake (*Nerodia sipedon*) - Never more than a small number present on FNHR, but persists at the FNHR pond and apparently maintains its population. There seems to be reproduction in most years.

Brown Snake (*Storeria dekayi*) - Persists in moderate numbers, mainly in the vicinity of the FNHR pond.

Common Garter Snake (*Thamnophis sirtalis*) - Has become common in former pastures (House Field and Quarry Field), and in the vicinity of the pond.

Smooth Earth Snake (*Virginia valeriae*) - This species may still be present, although there are no records in last 20 years. This species was never very common and the woodland where it had been found has changed little.⁷

Copperhead (*Agkistrodon contortrix*) - Has undergone drastic reduction, no doubt correlated with the decline of its favorite prey, the Prairie Vole. Compared with Copperheads on the adjoining BSHF site at NESAs, which has a relatively high vole population, those on FNHR are scarcer, do not grow as large, and average fewer young per litter.

Timber Rattlesnake (*Crotalus horridus*) - Long gone from FNHR, as a resident species, but persists in small numbers on NESAs. Actually, most records in recent years have been from private land in neighbors' yards demonstrating that such anthropogenic habitats are attractive to the species, and that when readily noticed by humans when in such habitats.⁸

⁷ A population of the Smooth Earth Snake was found on the McColl Nature Reserve, just west of FNHR, in 2005 (Pisani 2005).

⁸ During 2014, a reliable report of a Timber Rattlesnake on the FNHR was received. Staff from the National Ecological Observatory Network (NEON) reported encountering an adult Timber Rattlesnake on several occasions on the rock outcrop south of the NEON tower in the unit of FNHR known as V Woods.

Mammals of the Fitch Natural History Reservation

Thirty-six species⁹ of mammals have been recorded (confirmed) from FNHR since 1948 (see checklist in Appendix I). A hypothetical list of species that may have occurred, or may still occur, on FNHR has 17 additional species including five that were extirpated in Kansas in the late 19th century: Gray Wolf (*Canis lupus*), Black Bear (*Ursus americanus*), Mountain Lion (*Felis concolor*), Wapiti (*Cervus elaphus*), and Bison (*Bison bison*); six wide-ranging bats: Big Brown Bat (*Eptesicus fuscus*), Silver-haired Bat (*Lasionycteris noctivagans*), Hoary Bat (*Lasiurus cinereus*), Evening Bat (*Nycticeius humeralis*), Eastern Pipistrelle (*Pipistrellus subflavus*), and Brazilian Free-tailed Bat (*Tadarida brasiliensis*); two semi-aquatic species known to live in the general area: River Otter (*Lutra canadensis*) and Mink (*Mustela vison*)¹⁰; species that have been found nearby including two species typical of shortgrass plains: Black-tailed Jackrabbit (*Lepus californicus*) and Badger (*Taxidea taxus*); one tallgrass species: Franklin's Ground Squirrel (*Spermophilus franklinii*); and one deciduous forest species: Southern Flying Squirrel (*Glaucomys volans*)^{11, 12}. Humans, as well as their domesticated (and feral) livestock and pets (especially dogs and cats), have not been included in this list even though their activity can have significant impact on the areas.

Geographical Characterization

The mammal community of FNHR, and the local area, is composed of species that characterize both forest and grassland biomes, as well as species that are wide-ranging. Of the 36 species actually recorded, 17 have transcontinental ranges, 11 others are most typical of the Eastern Deciduous Forest Biome (Virginia Opossum, Southern Short-tailed Shrew, Least Shrew, Eastern Cottontail, Gray Squirrel, Fox Squirrel, Eastern Chipmunk, Woodland Vole, Eastern Woodrat, White-footed Mouse, Southern Bog Lemming); six others are most typical of Great Plains grasslands (Thirteen-lined Ground Squirrel, Plains Pocket Gopher, Prairie Vole, Western Harvest Mouse, Plains Harvest Mouse, and Hispid Cotton Rat); and two are introduced commensals (House Mouse and Norway Rat).

⁹ As of 2016, the total is 39 species with the inclusion of the Southern Flying Squirrel in 2011, the Mink in 2012, and the Armadillo in 2013 (see footnotes below).

¹⁰ In 2012, a mink was observed entering FNHR near the bridge just south of the reservation entrance on East 1600 Road (D. Christopher Rogers, personal communication). This bridge was replaced in October of 2016.

¹¹ A Southern Flying Squirrel was observed near the residence on the FNHR in the summer of 2011, and heard calling in 2014 (D. Christopher Rogers, personal communication). There was a single record of a Southern Flying Squirrel captured in a wooded area (known as the NESAs Ravine) north of FNHR sometime in the late 1970s-early 1980s.

¹² A Nine-banded Armadillo (*Dasypus novemcinctus*) was sighted at the entrance gate of the FNHR in June 2013 by a resident of the FNHR house (D. Christopher Rogers, personal communication).

Successional Trends

Notable changes in the mammal fauna of the FNHR have occurred since its establishment in 1947. Many of these changes are no doubt related, directly or indirectly, to habitat shifts resulting from the increase in woodland and the loss of open grasslands and oldfield. Some mammal species dependent upon open habitats have been eliminated from FNHR with successional changes (e.g., Plains Pocket Gopher, Plains Harvest Mouse, and Deer Mouse) while other formerly common species have been eliminated, or reduced to a fraction of their earlier abundance (e.g., Prairie Vole, Woodland Vole, Western Harvest Mouse, Hispid Cotton Rat, Southern Bog Lemming, Meadow Jumping Mouse, Long-tailed Weasel, and Red Fox). In contrast, certain species with forest affinities that were common in the 1950s at FNHR have maintained their populations, or increased, commensurate with the increase in woodland habitat (e.g., Virginia Opossum, Southern Short-tailed Shrew, Least Shrew, Eastern Mole, Fox Squirrel, White-footed Mouse, and Raccoon).

For some species recorded at FNHR, changes in population numbers are not strongly related to succession, including: 1) Aquatic species: the Beaver and the Muskrat, sporadic residents dependent upon the aquatic environment at the pond, are less dependent upon terrestrial habitat changes; 2) Introduced species: the Thirteen-lined Ground Squirrel was captured only once as a disperser from an experimental introduction from a nearby area and the Eastern Chipmunk, presumably a member of the original fauna, was not introduced until the 1980s; and 3) Commensal species: the House Mouse and the Norway Rat are commensal species (associated with human dwellings) and activity and changes in their population is somewhat independent from succession.

Regional trends in population dynamics are more important than the local habitat changes at FNHR for some species. For example, the Spotted Skunk, common in the 1950s, has not been recorded at FNHR for decades - but it has become extremely rare regionally so its decline at FNHR cannot be attributed strictly to habitat change. By contrast, the White-tailed Deer, rare in the region in the late 1940s, has become significantly more abundant. Because of the dramatic increase in deer populations regionally, and the species larger home range which often includes areas external to FNHR, one cannot attribute population changes solely to habitat shift at FNHR.

Several species (larger than “mouse” size) are still seen on FNHR, but their populations are at lower levels than in earlier times (e.g., Eastern Cottontail, Coyote, and Striped Skunk); this observation is supported by knowledge that successional changes to woodland would not favor these species. For other species, present in low numbers, there is simply insufficient data to make strong statements about population trends (e.g., Woodchuck, Gray Squirrel, Gray Fox, Bobcat, Red Bat, and Little Brown Myotis). The Eastern Woodrat population on FNHR has been variable over the last five decades, presumably responding to factors other than succession.

Methods

Information for the accompanying checklist of mammals and for accounts of individual species has come from a variety of sources. Several types of small live-traps have been used for mammal sampling at FNHR. Hundreds of thousands of "trap nights" were accumulated (a trap set for one night = one trap night). Much information on abundance for "mouse-size" species has been obtained from the funnel traps and the wooden and metal shelters that were routinely monitored for snake sampling.¹³ Relatively little sampling has been done with bat nets, and no electronic equipment has been used to detect the ultrasonic auditory signatures of bats. Information on mammal species larger than rabbit size is based mainly on sight records, tracks and other sign.¹⁴

¹³ Beginning in 2015, the National Ecological Observatory Network (NEON) established two, 100x100m sampling grids for small mammals on FNHR. These grids are to be sampled for several years, and data on small mammal populations, obtained by capture-recapture methods, will be available on the NEON website (www.NEONscience.org). These data may be useful in assessing current trends in small mammal populations at FNHR.

¹⁴ As mentioned earlier, D. Christopher Rogers (DCR), biologist at the Kansas Biology Survey, and his family moved into the house at the Fitch Reservation in 2011, and have resided there through 2016. DCR regularly circulated (2011-2016) throughout the FNHR in the course of birdwatching and observing wildlife. DCR has provided updates for several of the "larger than rabbit size" mammals at FNHR (e.g., Gray Fox, Red Fox, and Bobcat). Given the nine year gap between our observations (2002) and those of DCR beginning his observations at FNHR (2011), it is possible that some of these populations may have changed. It is also possible that because DCR has circulated the FNHR much more widely than GLP or WDK, or than HSF in his later years, that he would be able to provide additional information on animal presence.

Mammal Species Accounts

Brief accounts of those mammal species confirmed from FNHR are presented here to describe population dynamics, convey information on recent population status, and provide background on site-specific ecology. The reader should refer to the published literature for details on species biology and ecology.

Virginia Opossum (*Didelphis virginiana*) - In recent years there has been no sampling with lines of baited live-traps like that of the 1950s. Impressions of abundance are gained from occasional animals seen from near the residence, or in car headlights, or from tracks left in soft soil, mainly at the pond. The impression is that the species remains fairly common.

Southern Short-tailed Shrew (*Blarina hylophaga*) - This shrew was favored by the spread of forest and it remains common on FNHR. Throughout the years of observation it was seen frequently, in funnel traps, beneath shelters, and was palpated from the stomachs of various snakes, but records were too sporadic to show population trends.

Least Shrew (*Cryptotis parva*) - Open woodland, edge of woodland and grassland describe the places where least shrews were captured or seen. Population trends are difficult to discern, because of its inconspicuousness, but the species is believed to have held its own since the 1950s, on the basis of those seen beneath shelters or captured in wire funnel traps.

Eastern Mole (*Scalopus aquaticus*) - The species is hardly ever seen, but its sign is so ubiquitous that presence or absence and gross changes in numbers are fairly obvious. It is an ecologically important species and its numbers fluctuate from year to year. Its population abundance may be linked to the life cycle of the 17-year periodical cicada. The mole is an important predator on invertebrates, especially earthworms and cicada nymphs, but it also takes a variety of small vertebrates.

Red Bat (*Lasiurus borealis*) - Trends unknown since early records were obtained. Drastic reduction in bat populations has occurred in the United States and worldwide due primarily to human impacts such as habitat destruction, vandalism, disturbance of colonies, and use of pesticides.

Little Brown Myotis (*Myotis lucifugus*) - Like the preceding species, the Red Bat.

Eastern Cottontail (*Sylvilagus floridanus*) - Judging from the frequency of sightings, both diurnal and nocturnal, and sign left as droppings and cuttings, the species has declined to a fraction of the numbers present in the 1950s. Some of the change can be linked with the transition from grassland to forest at FNHR, with less abundant and diverse herbaceous

cover. Its main predators also have dwindled, including the Coyote, Red Fox, Red-tailed Hawk, Great-horned Owl, and Timber Rattlesnake.

Woodchuck (*Marmota monax*) - There have never been more than a few sightings in any one year (mostly made from the residence) of lone individuals that seemed to be exploring in the headquarters area. One seen in March 2000, was probably recently emerged from hibernation. Sightings were frequent in the headquarters area in May 2001 and in the fall of 2002.

Gray Squirrel (*Sciurus carolinensis*) - Mainly confined to oak-hickory woodland on FNHR. It seems that the population is at a low ebb, currently. Crops of mast, mainly chestnut oak, black oak, shagbark hickory, and black walnut vary from year to year, and with them the fortunes of the Gray Squirrel population, which is much more in evidence in certain years.

Fox Squirrel (*Sciurus niger*) - More than any other animal Fox Squirrels are seen from indoors, and one can form impressions of their abundance without doing field work. It seems that, presently, they are unusually scarce. The heavy crop of walnuts in 1999 was largely unused. It is not evident why the population is low, whether adult mortality or unsuccessful reproduction is involved. The number of stick nests in trees is probably correlated with the actual numbers of squirrels, and bears out the idea that there has been a substantial reduction.

Thirteen-lined Ground Squirrel (*Spermophilus tridecemlineatus*) - This species was introduced during the late 1970s on two fence-enclosed sites on NESAs (north of FNHR). A lone squirrel live-trapped on the FNHR near its northern edge, on a flat, grass hilltop, undoubtedly came from one of these colonies. Introduced populations at NESAs persisted only a short time, and lack of suitable shortgrass habitat will surely prevent this species from becoming established in the foreseeable future.

Eastern Chipmunk (*Tamias striatus*) - Chipmunks were initially introduced onto FNHR through efforts of the Kansas Department of Wildlife and Parks. Twenty six adults were brought to FNHR and released in the headquarters area during 1985, and subsequently 13 adults were released during 1990. During a period of years after the introductions, chipmunks were seen rather regularly, were reproducing, and seemed to be radiating into nearby areas. But in the late 1990s evidently they were no longer thriving and reduction had occurred. It is not known whether this was a temporary setback, with colonies or individuals surviving, or whether all were eliminated. Persistence of the population is indicated by four sightings from 1994-1997, three of these were on the nearby NESAs. The fourth was at a private residence, adjacent to the SW portion of FNHR, where a

domestic cat was seen with a chipmunk (M. Robbins, personal communication).¹⁵

Plains Pocket Gopher (*Geomys bursarius*) - Long gone from FNHR, they were never abundant in the early years. When livestock were removed, brome grass tended to crowd out weedy forbs that were probably better gopher food than the grass. A few individuals survived on the adjacent Rockefeller Prairie long after they were gone from FNHR.

Beaver (*Castor canadensis*) - During the 1800s beaver were almost eliminated from the present area of Kansas, and their valuable pelts provided incentive for western exploration. During the 1900s, with at least partial protection, the depleted populations increased gradually. It was not until the 1970s that at least one, probably a refugee from the Kansas River or its tributary, Mud Creek, made its way upstream to FNHR and settled at the pond. Here the aquatic environment was too limited to support a permanent population. The small stream provided only a trickle of water or went dry for much of the year. However, the pioneering individual(s) survived there for a period of months and substantially altered the pond environment by impeding the flow at an outlet pipe and a diversion ditch, raising the water level of the pond by about a foot, cutting down dozens of trees near the pond's edge, and excavating a system of bank burrows in the pond dike. There were two visitations at the pond in the 1990s and it is not known whether there was more than one animal each time. Many trees were cut, with a definite preference for hackberry. The individual beaver involved may have moved on or may have been eliminated, but its tree cutting and damming had important effects on the local environment.

Prairie Vole (*Microtus ochrogaster*) - Neither woodland nor heavily grazed pasture provided suitable habitat for the vole before the area was made a reservation and protected as a natural area. The pond east of the reservation headquarters had been fenced and in 1948 a narrow strip west of the pond dike (in Pond Field) harbored a small colony of voles. Doubtless, there were other such nuclear colonies at the edge of the woods where narrow strips of tall grass were protected by the fence line. After livestock were removed from the pastures and the grass-weed cover developed, voles reproduced explosively with many generations in 1949 and 1950 spreading throughout the formerly pastured areas. Throughout the grassland their sign became conspicuous, with extended families occupying communal burrow systems that had numerous nest chambers and tunnels, associated with radiating surface runways and a burrow mound marked by unusually tall herbaceous plants, fertilized by the voles'

¹⁵ Eastern Chipmunks have been seen occasionally along the lane to the residence on the FNHR (including 2011-2014, and 2016) and in most, though not all, years 2011-2016 on the west side of the county road in the area of Zapus, Middle, and Bluff Fields (D. Christopher Rogers, personal communication).

wastes, their food stores and their decomposing bodies. Study of the vole's food habits have shown that dominant grasses are used as well as many kinds of weedy forbs and that each is preferred at some particular stage (as new shoots, flowers, fruits or seeds). After 1951 the vole population declined as the grass-weed mixture underwent gradual change with forbs becoming scarcer or disappearing, leaving a less diverse plant association. Further habitat deterioration occurred with the invasion of woody plants. By the 1970s, vole populations had been drastically reduced from most of the formerly pastured areas and were virtually eliminated from the FNHR by the 1990s.

Woodland Vole (*Microtus pinetorum*) - This microtine was abundant along woodland edge in the headquarters area and elsewhere during the early years of fieldwork on FNHR, but it has not been observed for several decades. A single individual was captured on a trapping grid near the headquarters in 1979 and 1980.

Eastern Woodrat (*Neotoma floridana*) - This rat-like cricetid was remarkably abundant in 1948 but its numbers underwent fairly rapid reduction from unknown factors apparently not related to succession. Its numbers seem to have been subject to much variation in the decades since observation began, but it has never again approached the numbers present in 1948. At the peak of abundance its dome-shaped houses were common throughout the woodland, especially at the bases of large Osage orange trees. However, as the population shrank it withdrew to crevices in hilltop limestone outcrops. In these locations the bulky dome-shaped houses were not built, but rather the rats merely lined the crevice openings with a collection of sticks. For the past fifty years the population has been mainly confined to the hilltop rock outcrops, but when numbers increase there is some movement into other habitats.

Muskrat (*Ondatra zibethicus*) - This large microtine invaded the pond area and established a colony there *ca* 1950, but the animals soon consumed their main food supply (cattails) and disappeared. At the onset of the breeding season adult muskrats are known to become intolerant with fighting and chasing that results in an exodus of surplus adults from established colonies and the colonization of vacant habitats. The nearest breeding colony that probably contributed these surplus adults was in a slough two miles south of FNHR, but was eliminated in the early years. Muskrats reappeared briefly in the late 1970s and dug bank burrows on the north side of the pond. They have periodically been observed on other ponds nearby at NESAs during the 1980s and to the present.

White-footed Mouse (*Peromyscus leucopus*) - This large cricetid mouse, preferring woodlands and edge habitat, has perhaps been the most successful of all local mammals. It was present throughout the woodland

half of FNHR in 1948, and now is present on all formerly pastured areas, which to varying degrees have become wooded.

Deer Mouse (*Peromyscus maniculatus*) - This species, characteristic of grassland habitat in eastern Kansas, was originally present in low densities on heavily grazed pastures. However it underwent rapid reduction and disappeared after livestock were removed and tall grasses, along with other lush vegetation, developed on the former pastures. It persisted longest (1970s) in the relatively barren Road Field / High Field area.

Western Harvest Mouse (*Reithrodontomys megalotis*) - As a tallgrass species this diminutive cricetid was virtually absent from FNHR in 1948 when pastures in the area had been heavily grazed. However, there must have been ungrazed refugia such as grassy areas along fence lines and other areas protected from grazing that supported small populations. By 1950 tall grasses had sprung up on the former pastures (e.g., Reithro Field) and harvest mice had colonized them in such numbers that population studies were underway. Subsequently, as invading woody vegetation shaded out the grass, harvest mouse habitat deteriorated and by the year 2000 the mice were limited to small areas where some grass still persists (e.g., Quarry Field and Dry Field).

Plains Harvest Mouse (*Reithrodontomys montanus*) - As a shortgrass species this cricetid mouse was able to survive in small numbers on the closely grazed pastures, but disappeared soon after the livestock were removed.

Hispid Cotton Rat (*Sigmodon hispidus*) - This cricetid rat seems to prefer local areas of dense weedy vegetation. Along with the Prairie Vole it came into prominence on formerly pastured areas in the early years after removal of livestock, but its abundance tapered off rapidly after 1951, as weeds were replaced by grass and trees shaded out the grass. By the year 2000 it was gone from FNHR but remained in suitable habitat on adjacent areas, including NESAs.

Southern Bog Lemming (*Synaptomys cooperi*) - This lemming was never seen in the years of trapping in House Field, but came into prominence in Quarry Field in the late 1960s and was studied there by a visiting mammalogist. Presumably, the species is long gone from FNHR, but some are still present in adjacent areas to the north on NESAs.

House Mouse (*Mus musculus*) - During the 1950s when extensive live trapping of small mammals was carried on at FNHR, House Mice were abundant in the vicinity of the buildings. They lived on spilled and stored bait where there were weedy patches. Evidently, weed seeds were the main food of these feral populations, and as trees invaded, they dwindled.

Norway Rat (*Rattus norvegicus*) - In the early 1950s, a small colony was established in the vicinity of FNHR headquarters and also where several truckloads of corn, ruined in the 1951 flood, had been dumped on a grassy hilltop of Quarry Field. Both these colonies were eliminated by natural causes over a period of months. As forest invaded FNHR, in subsequent decades, the species did not reappear. The individuals that established these two colonies were thought to have found their way onto FNHR from neighboring farms, but may have been brought in accidentally with the truckloads of waste corn.

Meadow Jumping Mouse (*Zapus hudsonius*) - Lines of live traps set out to sample populations of small mammals on FNHR usually caught no Meadow Jumping Mice, and it seemed that they preferred succulent grass plants over the grain baits that were routinely used. Wire funnel traps put out for snakes were more likely to capture jumping mice. Tallgrass prairie, woodland edge, and open woodland with herbaceous ground cover were the habitats preferred; but as these habitats were eliminated from FNHR, jumping mice declined and have not been seen there in recent years.

Coyote (*Canis latrans*) - As the largest local predator, the Coyote was important in the local ecology before the area was made a reservation. The animals were heard and seen frequently and their trails crossed the area, with habitually used defecation stations. Local farmers reviled the University of Kansas and its reservation for providing a refuge and breeding place for pests, referring specifically to the Coyote. An early study of scats collected on the area showed that cattle provided a major food source, as carrion from occasional carcasses and as afterbirth at calving time. Local farmers regularly lost sheep and chickens to coyotes and remains of both were found in the scats. After removal of livestock from the reservation at the end of 1948, Coyote use of the area gradually decreased and carrion from cattle was no longer found in the scats. Favorite prey species, such as Eastern Cottontail and Hispid Cotton Rat made up the difference. Many other kinds of small animals and some plant material were represented in the scats but each made up only a small percentage (Fitch and Packard 1958). A traditional denning area, used in the 1950s and early 1960s, was a low hill with scrubby woodland in Sugar Woods on the western edge of the FNHR called "Sugarloaf." As forest spread into formerly open areas, use of FNHR by Coyotes decreased. In recent years Coyotes use of FNHR has again increased.

Gray Fox (*Urocyon cinereoargenteus*) - Foxes were caught in live traps on several occasions. They used a den (evidently made by skunks) at the Toronto Limestone level on a slope southwest of the Quarry. From tracks and sightings, scrubby woodland is thought to be their preferred habitat. There have been no records on the FNHR for many years, but adequate sampling of FNHR has not been maintained in recent years and thus it

may have been overlooked, if present only in low densities. This is likely the case as there are records on a wooded west-facing hillside, adjoining the southwest part of FNHR, where a pair lived beneath the deck of a private residence and raised a litter of pups in 1999 and 2001 (M. Robbins, personal communication).¹⁶

Red Fox (*Vulpes vulpes*) - Throughout the 1950s, Red Foxes and their sign were seen from time to time on FNHR. A den in a limestone outcrop on a southwest-facing slope, in open woodland, was occupied in 1951-52, 1954-55, and 1957-58. In later decades, as forest replaced grassland, the species was no longer seen.¹⁷

Raccoon (*Procyon lotor*) - Best known from live trapping in the 1960s, the Raccoon is still present and seems to have maintained its numbers judging from occasional sightings and from sign (mainly tracks at the pond).

Striped Skunk (*Mephitis mephitis*) - Still present and detected by their occasional smell, in the headquarters area. As its grassland habitat has deteriorated, its numbers have also been reduced.

Long-tailed Weasel (*Mustela frenata*) - In the 1950s, when fall live-trapping of snakes along hilltop outcrops of the Oread Limestone constituted a major effort at FNHR, weasels were caught occasionally in unbaited traps. It was assumed that this was their main habitat because (in 1957 and later years) when the traps were used with drift fences in the former pastures, weasels were never captured or seen. Despite fairly extensive trapping along the hilltop limestone in the decades of the 1980s and 1990s, no weasel sightings were recorded, and presumably by then they had been eliminated from the area.

Eastern Spotted Skunk (*Spilogale putorius*) - In the early years of field work Eastern Spotted Skunks were common, as indicated by the fact that in 1950 eighteen were captured in an extensive line of live traps extending through both grassland and woodland. For unknown reasons they dwindled and disappeared, and presumably have been absent in recent decades, but intensive sampling has not been maintained. In Kansas and throughout the Great Plains, populations have declined drastically in recent decades and this species is now virtually absent from a large part of its former range.

¹⁶ D. Christopher Rogers reports seeing Gray Fox in the southeastern part of the FNHR 2011-2016, and in September 2016 just north of the entrance gate to FNHR.

¹⁷ D. Christopher Rogers reports seeing Red Fox regularly on the FNHR from 2011-2016, and M. Robbins has reported seeing Red Fox from 1993-2016.

Bobcat (*Felis rufus*) - Always few in numbers, it is known only from tracks and rare sightings. It seems to have maintained its numbers with little change over the years.¹⁸

White-tailed Deer (*Odocoileus virginianus*) - White-tailed deer were eliminated from Kansas by overhunting in the 1800s. Apparently, they reinvaded from Missouri. With the suppression of prairie fires, woody vegetation spread into formerly open areas on farms in northeastern Kansas. This vegetation provided food and shelter and thus deer increased and spread rapidly. The first sighting on the FNHR was in 1949. In the following years, a resident population became established, and numbers peaked in the mid-1960s. As a browser, feeding on the foliage of low trees, shrubs, and vines, the deer has been a potent force in determining the course of succession. Trees such as Osage orange, protected both by spiny stems and toxic sap, are free from deer browsing while competing kinds may be heavily browsed. Without the browsing pressure of a moderately high deer population, the developing forest of FNHR might have had a much different aspect. Even with virtually no natural predation and no legal hunting, the deer population seems to have attained some stability at FNHR (although the home range of individuals extends well out from FNHR). There is persistent poaching on adjoining land and sometimes on the FNHR. Also, there is considerable mortality from disease. On many occasions deer have been found sick, dying or recently dead but the causal organism has not been identified.¹⁹

¹⁸ D. Christopher Rogers reports seeing Bobcat tracks regularly on FNHR, with a sighting at least once a year from 2011-2016.

¹⁹ The following is extracted from an abstract of an oral presentation entitled "Deer Populations at the University of Kansas Field Station" presented at the January 2017, Kansas Natural Resources Conference (Wichita, KS). The authors were Robert Hagen, Christian Schillo, and Lloyd Fox (Hagen and Schillo, University of Kansas Environmental Studies Program, and Fox from the Kansas Department of Wildlife, Parks, and Tourism). The FNHR was a part of the area surveyed, and the results indicate trends in deer populations from 2008-2016 on FHHR and the KUFS. ABSTRACT: "Systematic efforts to estimate deer abundance around the University of Kansas Field Station (KUFS) began in fall 2008, as a partnership between KUFS, the Kansas Department of Wildlife, Parks and Tourism (KDWPT), and the KU Environmental Studies Program. From its start, the research has emphasized participation by undergraduate students. Spotlight-distance surveys have been conducted each fall, as part of the statewide KDWPT program to monitor deer population trends. In 2015 and 2016 we used wildlife cameras to obtain a second, independent estimate of population size. Results from the spotlight-distance surveys indicate that densities during the first three years (2008-2010) were markedly higher (~30 deer/sq. mi.) than in the following six years (2011-2016: ~15 deer/sq. mi.) The drop between 2010 and 2011 followed the onset of drought conditions and an outbreak of epizootic hemorrhagic disease (EHD) among deer."

Birds of the Fitch Natural History Reservation²⁰

Since 1948, 188²¹ species of birds have been observed at FNHR (this includes species that have been seen only flying over the area but not stopping). By comparison, 349 species have been recorded in Douglas County (in which FNHR is located), and 460 species for the entire state of Kansas. All common species have been recorded, but some of the rarer species, which may occur as migrants in the spring and fall or as brief visitants in the winter, may not have been recorded. A better indication of the potential number of species present would be similar to that found on the adjacent NESAs where 234 species have been recorded during the last 25 years. Also, NESAs include a greater variety of aquatic habitats that attract a more diverse avifauna than the small pond at FNHR.

Geographical Characterization

The list of bird species recorded from FNHR is diverse, consistent with the historically diverse habitats of forest, open grassland, oldfield, and the small pond. The avifauna from FNHR, and from the surrounding area, is primarily an eastern fauna with several species at the western limit for their distribution.

Of the species at FNHR, 16% are year-round residents, 12% are winter residents, 30% are summer residents, and 42% are strictly migrants or temporary visitants. 66 species have been recorded as breeding on FNHR, which is comparable to the total of 80 breeding species at NESAs. Thus the species encountered at FNHR on any particular day is highly dependent upon the season.

²⁰ Several checklists of birds of the KU Field Station (formerly called the Kansas Ecological Reserves) were produced after 1980. Three checklists, with the first published in the mid-1980s and the third produced in May 1998, were compiled by G.L. Pittman based on his extensive records combined with those of H. Fitch, R. Boyd, C. Cink, R. Johnston, and M. Robbins. These lists provided seasonal abundance information. In 2015, W. Busby took these data, and other records, and produced bird lists for the different geographical areas of the KU Field Station (see <https://biosurvey.ku.edu/field-station>).

²¹ As of 2016, the total is 191 species with the inclusion of three species: the Northern Shrike (*Lanius excubitor*), the Lazuli Bunting (*Passerina amoena*), and the Common Poorwill (*Phalaenoptilus nuttallii*). The Northern Shrike is included based on visual records and photographs in the winter of 2008-2009. The Lazuli Bunting is included based on visual observations (three consecutive years, 2012-2014). The Common Poorwill is included based on communication with D. Christopher Rogers, who reported hearing the species call in the evening near the FNHR residence in April 2013 and on 21 March 2015. The Common Poorwill records are somewhat atypical in terms of expected geographic range and habitat, and a March record being very early in the season. All three of these species would be included on List #5, "Species present only rarely on FNHR".

Successional Trends

Species comprising the avifauna of FNHR were placed in groupings that depict their abundance, seasonality, and use of FNHR. Species accounts of 20 ecologically important breeding species, which are permanent residents, is provided in a later section. For the remaining 168 species recorded from FNHR, we have used five functional groupings to designate the species use of FNHR. Species in these five lists are of lesser importance because they are less common, or only transitory in their occurrence, or because they have been eliminated from the area by the replacement of open grassland and oldfield with woody vegetation. These lists are provided to clarify their statuses but each species is a special case somewhat different from any other.

Bird List #1, Summer residents

Bird List #2, Winter residents or visitants

Bird List #3, Species attracted to aquatic habitats

Bird List #4, Migrants only

Bird List #5, Rare species

LIST #1: Summer residents that have previously or may currently breed on FNHR.

Species that are summer residents and have bred on FNHR. Most of these species are migratory and are present on FNHR from spring through fall, but generally migrate south in winter. Some of these species are occasionally known to spend mild winters in the vicinity of FNHR. Those that can be expected every year as regular breeders and are current nesters are marked with an asterisk (*). The designations of rare (R), moderately common (M), and common (C) are used to indicate relative abundance, both past and present.

Turkey Vulture (*Cathartes aura*) M
 Cooper's Hawk (*Accipiter cooperii*) M
 Broad-winged Hawk (*Buteo platypterus*) M
 *Mourning Dove (*Zenaida macroura*) C
 *Yellow-billed Cuckoo (*Coccyzus americanus*) C
 Black-billed Cuckoo (*Coccyzus erythrophthalmus*) R
 Chuck-wills-widow (*Caprimulgus carolinensis*) R
 *Whip-poor-will (*Caprimulgus vociferus*) C
 Common Nighthawk (*Chordeiles minor*) R
 Chimney Swift (*Chaetura pelagica*) M
 *Ruby-throated Hummingbird (*Archilochus colubris*) M
 *Eastern Wood-Pewee (*Contopus virens*) M
 *Great Crested Flycatcher (*Myiarchus crinitus*) C
 *Eastern Phoebe (*Sayornis phoebe*) C
 Eastern Kingbird (*Tyrannus tyrannus*) R
 Bell's Vireo (*Vireo bellii*) M
 Warbling Vireo (*Vireo gilvus*) M
 White-eyed Vireo (*Vireo griseus*) M
 *Red-eyed Vireo (*Vireo olivaceus*) C
 Horned Lark (*Eremophila alpestris*) C
 Barn Swallow (*Hirundo rustica*) R
 *Blue-gray Gnatcatcher (*Polioptila caerulea*) M
 *Wood Thrush (*Hylocichla mustelina*) M
 American Robin (*Turdus migratorius*) C
 Gray Catbird (*Dumetella carolinensis*) M
 *Brown Thrasher (*Toxostoma rufum*) C
 Common Yellowthroat (*Geothlypis trichas*) C
 Yellow-breasted Chat (*Icteria virens*) M
 *Kentucky Warbler (*Oporornis formosus*) M
 *Louisiana Waterthrush (*Seiurus motacilla*) M
 *Scarlet Tanager (*Piranga olivacea*) M
 *Summer Tanager (*Piranga rubra*) M
 Grasshopper Sparrow (*Ammodramus savannarum*) C
 Lark Sparrow (*Chondestes grammacus*) M
 *Eastern Towhee (*Pipilo erythrophthalmus*) M
 Field Sparrow (*Spizella pusilla*) C

*Indigo Bunting (*Passerina cyanea*) C
*Rose-breasted Grosbeak (*Pheucticus ludovicianus*) M
Dickcissel (*Spiza americana*) C
Red-winged Blackbird (*Agelaius phoeniceus*) M
*Baltimore Oriole (*Icterus galbula*) M
*Brown-headed Cowbird (*Molothrus ater*) C
Eastern Meadowlark (*Sturnella magna*) C

LIST #2: Species present as winter residents or visitants on FNHR.

Migrant species that occur on FNHR from fall through spring but are generally winter residents. Some that are common winter residents are marked with an asterisk (*), others are more abundant and are marked with a double asterisk (**), and still others have either been eliminated or are uncommon on FNHR.

* = Common resident in winter, ** = Abundant resident in winter

Sharp-shinned Hawk (*Accipiter striatus*)
 Northern Harrier (*Circus cyaneus*)
 Red-breasted Nuthatch (*Sitta canadensis*)
 *Brown Creeper (*Certhia americana*)
 Winter Wren (*Troglodytes troglodytes*)
 *Golden-crowned Kinglet (*Regulus satrapa*)
 Cedar Waxwing (*Bombycilla cedrorum*)
 **Dark-eyed Junco (*Junco hyemalis*)
 *Song Sparrow (*Melospiza melodia*)
 Spotted Towhee (*Pipilo maculatus*)
 **American Tree Sparrow (*Spizella arborea*)
 *White-throated Sparrow (*Zonotrichia albicollis*)
 White-crowned Sparrow (*Zonotrichia leucophrys*)
 *Harris's Sparrow (*Zonotrichia querula*)
 Rusty Blackbird (*Euphagus carolinus*)
 Western Meadowlark (*Sturnella neglecta*)
 Pine Siskin (*Carduelis pinus*)
 Purple Finch (*Carpodacus purpureus*)

LIST #3: Species recorded on FNHR that are attracted to aquatic habitats.

Species that have aquatic tendencies and have stopped at the pond or have merely been observed passing over the area, presumably headed for larger bodies of water. Most of these may be expected again in the future, but will probably not establish resident populations. Because the aquatic habitat is so limited on FNHR, many of these species are only transitory in nature. Some species that were considered regular in their occurrence and/or have nested are marked with an asterisk (*).

* = Regularly occurring on FNHR, R = Very rare on the FNHR.

Pied-billed Grebe (*Podilymbus podiceps*)
 American White Pelican (*Pelecanus erythrorhynchos*) R
 *Great Blue Heron (*Ardea herodias*)
 American Bittern (*Botaurus lentiginosus*) R
 Cattle Egret (*Bubulcus ibis*) R
 *Green Heron (*Butorides virescens*)
 Black-crowned Night-Heron (*Nycticorax nycticorax*) R
 *Wood Duck (*Aix sponsa*)
 Northern Pintail (*Anas acuta*)
 Northern Shoveler (*Anas clypeata*)
 Green-winged Teal (*Anas crecca*)
 *Blue-winged teal (*Anas discors*)
 *Mallard (*Anas platyrhynchos*)
 Gadwall (*Anas strepera*)
 Greater White-fronted Goose (*Anser albifrons*)
 Lesser Scaup (*Aythya affinis*)
 Redhead (*Aythya americana*)
 Ring-necked Duck (*Aythya collaris*)
 Canada Goose (*Branta canadensis*)
 Snow Goose (*Chen caerulescens*)
 Bald Eagle (*Haliaeetus leucocephalus*) R
 Osprey (*Pandion haliaetus*) R
 American Coot (*Fulica americana*)
 Sora (*Porzana carolina*)
 Virginia Rail (*Rallus limicola*)
 Sandhill Crane (*Grus canadensis*) R
 *Killdeer (*Charadrius vociferus*)
 Spotted Sandpiper (*Actitis macularia*)
 Pectoral Sandpiper (*Calidris melanotos*)
 Common Snipe (*Gallinago gallinago*)
 *American Woodcock (*Scolopax minor*)
 Lesser Yellowlegs (*Tringa flavipes*)
 Solitary Sandpiper (*Tringa solitaria*)
 Ring-billed Gull (*Larus delawarensis*)
 Franklin's Gull (*Larus pipixcan*)
 Belted Kingfisher (*Ceryle alcyon*)

LIST #4: Species present only as migrants on FNHR.

Migrant species that generally occur on FNHR during spring and/or fall migration. Some are fairly common in occurrence and are known to breed or even spend the winter in the general region of eastern Kansas but for various reasons there are no breeding records for FNHR.

American Kestrel (*Falco sparverius*)
 Upland Sandpiper (*Bartramia longicauda*)
 Alder Flycatcher (*Empidonax alnorum*)
 Least Flycatcher (*Empidonax minimus*)
 Western Kingbird (*Tyrannus verticalis*)
 Yellow-throated Vireo (*Vireo flavifrons*)
 Blue-headed Vireo (*Vireo solitarius*)
 Cliff Swallow (*Petrochelidon pyrrhonota*)
 Purple Martin (*Progne subis*)
 Bank Swallow (*Riparia riparia*)
 Northern Rough-winged Swallow (*Stelgidopteryx serripennis*)
 House Wren (*Troglodytes aedon*)
 Ruby-crowned Kinglet (*Regulus calendula*)
 Hermit Thrush (*Catharus guttatus*)
 Swainson's Thrush (*Catharus ustulatus*)
 European Starling (*Sturnus vulgaris*)
 Yellow-rumped Warbler (*Dendroica coronata*)
 Blackburnian Warbler (*Dendroica fusca*)
 Magnolia Warbler (*Dendroica magnolia*)
 Chestnut-sided Warbler (*Dendroica pensylvanica*)
 Yellow Warbler (*Dendroica petechia*)
 Blackpoll Warbler (*Dendroica striata*)
 Black-throated Green Warbler (*Dendroica virens*)
 Black-and-white Warbler (*Mniotilta varia*)
 Mourning Warbler (*Oporornis philadelphia*)
 Northern Parula (*Parula americana*)
 Ovenbird (*Seiurus aurocapillus*)
 Northern Waterthrush (*Seiurus noveboracensis*)
 American Redstart (*Setophaga ruticilla*)
 Orange-crowned Warbler (*Vermivora celata*)
 Tennessee Warbler (*Vermivora peregrina*)
 Nashville Warbler (*Vermivora ruficapilla*)
 Wilson's Warbler (*Wilsonia pusilla*)
 LeConte's Sparrow (*Ammodramus leconteii*)
 Swamp Sparrow (*Melospiza georgiana*)
 Lincoln's Sparrow (*Melospiza lincolni*)
 Fox Sparrow (*Passerella iliaca*)
 Vesper Sparrow (*Pooecetes gramineus*)
 Clay-colored Sparrow (*Spizella pallida*)
 Chipping Sparrow (*Spizella passerina*)

Blue Grosbeak (*Guiraca caerulea*)
Common Grackle (*Quiscalus quiscula*)

LIST #5: Species present only rarely on FNHR.

Rare or occasional species, some seen only a few times on FNHR or only while flying over. Species marked with an asterisk (*) are considered very rare on FNHR.²² Note that “rare or occasional” refers only to the distribution of the species on FNHR. For example, Northern Mockingbird, House Finch, and House sparrow are common species that live nearby FNHR, but are only rarely seen at FNHR.

Northern Goshawk (*Accipiter gentilis*)
 Rough-legged Hawk (*Buteo lagopus*)
 Red-shouldered Hawk (*Buteo lineatus*)
 *Mississippi Kite (*Ictinia mississippiensis*)
 Merlin (*Falco columbarius*)
 Prairie Falcon (*Falco mexicanus*)
 *Barn Owl (*Tyto alba*)
 *Northern Saw-whet Owl (*Aegolius acadicus*)
 Long-eared Owl (*Asio otus*)
 *Pileated Woodpecker (*Dryocopus pileatus*)
 Yellow-bellied Sapsucker (*Sphyrapicus varius*)
 Olive-sided Flycatcher (*Contopus cooperi*)
 Yellow-bellied Flycatcher (*Empidonax flaviventris*)
 Scissor-tailed Flycatcher (*Tyrannus forficatus*)
 *Loggerhead Shrike (*Lanius ludovicianus*)
 *Sedge Wren (*Cistothorus platensis*)
 Veery (*Catharus fuscescens*)
 Gray-cheeked Thrush (*Catharus minimus*)
 Northern Mockingbird (*Mimus polyglottos*)
 Prothonotary Warbler (*Protonotaria citrea*)
 Golden-winged Warbler (*Vermivora chrysoptera*)
 Canada Warbler (*Wilsonia canadensis*)
 *Western Tanager (*Piranga ludoviciana*)
 *Painted Bunting (*Passerina ciris*)
 Orchard Oriole (*Icterus spurius*)
 *Yellow-headed Blackbird (*Xanthocephalus xanthocephalus*)
 House Finch (*Carpodacus mexicanus*)
 Evening Grosbeak (*Coccothraustes vespertinus*)
 House Sparrow (*Passer domesticus*)

²² Three species discovered after the 2002 list was produced would be included in List #5, above: The Northern Shrike (*Lanius excubitor*), the Lazuli Bunting (*Passerina amoena*), and the Common Poorwill (*Phalaenoptilus nuttallii*). These species would have an asterisk by their entry in the list above, indicating they are considered very rare on FNHR.

Methods

Early records of birdlife on FNHR were based on records of HSF, and students and visitors (Fitch 1999b). Later records emphasize data accumulated by G. L. Pittman on the entire KU Field Station.²³

Bird Species Accounts

The species discussed below are all ecologically important, resident breeding species. However, these species represent only a small part of the local avifauna, all of which are important in the functioning of the ecosystem.

Red-tailed Hawk (*Buteo jamaicensis*) - This common large raptor steadily lost ground as a result of successional changes on FNHR. In the early 1950s the long narrow flat hilltop dividing the FNHR into comparable northwestern and southeastern parts was the common territorial boundary for two pairs of hawks that, between them, utilized nearly every part of the area. By the 1990s, these traditional territories had been abandoned and the hawks were rarely seen on any part of the area. No doubt the shrinkage of grassland and the invasion by trees was a major factor in this decline; as Eastern Cottontails, Prairie Voles, and Cotton Rats, all major prey species, had become scarce.

Wild Turkey (*Meleagris gallopavo*) - Much of eastern North America, including Kansas, constituted the turkey's original range; however the species was eliminated from the state by early settlers. Conservation efforts by the Kansas Department of Wildlife and Parks (KDWP) resulted in a reintroduction program in northeast Kansas starting in 1980. KDWP released turkeys from Missouri stocks in two locations north of FNHR. Twelve turkeys were released in central Jefferson County (15 miles to the northwest) in 1980. In 1981, an additional 12 were released in northwest Leavenworth County (17 miles to the northeast). These two stocking efforts apparently were the source of the birds that began to be seen and /or heard occasionally in the mid 1980s, on the area. Roving bands used the area but were erratic in their movements making it difficult to estimate population density. Evidently successful reproduction has occurred throughout the 1990s, as almost every year either females were flushed from nests or flocks of partially grown young were seen. By the late 1990s, the population had probably stabilized at a level high enough to affect the ecology of the area. From time to time, extensive patches of overturned leaf litter in the forest have been found where flocks have been

²³ Beginning in 2015, the National Ecological Observatory Network (NEON) established two, 300x300 m sampling plots for birds on FNHR. These plots are to be sampled for several years, and data on bird populations will be available on the NEON website (www.NEONscience.org). These data may be useful in assessing current trends in bird populations at FNHR.

foraging by scratching. Two trends that may have been correlated with the presence of turkeys were: an increase in Coyote use in the area and the overall decrease in snake species (known to be preyed upon by Wild Turkey).

Northern Bobwhite (*Colinus virginianus*) - Forest edge and open woodland were the favorite habitats in the early years of FNHR. The long-term habitat changes that have occurred have been consistently unfavorable. Weedy herbaceous vegetation, which provides seeds that quail feed upon, has largely been replaced by forest trees. Northern Bobwhites have become much scarcer, but are still present and may be encountered occasionally on almost any part of the area.

Great Horned Owl (*Bubo virginianus*) - In the winter of 1950-1951, eight Great Horned Owl territories (each occupied by a pair of owls) were identified on FNHR. Three of these were almost or entirely confined to the area and each of the other five overlapped the area extensively. In the winter of 1951-1952, nine territories were present, but in 1952-1953 there were only six. That lower population density was thought to be correlated with deficient rainfall and the relative scarcity of prey animals that resulted. Territories are maintained year round, but change somewhat in size and shape from year to year. Territories were reconstructed based on monitoring owl calls as they moved about within their territory, calling to each other. Male and female have distinctive calls and were answered by those in neighboring territories. By the 1990s, hooting was not often heard on FNHR and it seemed that numbers had declined markedly from the levels of the 1950s. No doubt the reduction was closely correlated with population levels of the Eastern Cottontail, which also had become much scarcer.

Eastern Screech-Owl (*Otus asio*) - This species is a resident breeder on nearby areas and probably has bred on FNHR. Due to its secretive nature, records have been few and erratic leading to some uncertainty as to its past and present status.

Barred Owl (*Strix varia*) - This forest owl may have made some gain in numbers since 1949, when one pair was often heard near the eastern boundary of FNHR. With the increase in mouse and vole populations after grazing was discontinued in the early 1950s, these owls seemed to have increased and were often seen and heard on the western part of FNHR. The longtime trend is of a moderate increase, and by the year 2000 as many as three pairs could be heard simultaneously from near the headquarters calling and answering each other.

- Northern Flicker (*Colaptes auratus*) - The flicker may occasionally breed on FNHR. It is more common in winter because of an influx of northern birds. It is rather erratic in occurrence with high mobility.
- Red-bellied Woodpecker (*Melanerpes carolinus*) - This woodpecker is somewhat social and concentrates its activities in large, old trees in woodland or edge situations. There is no sound basis for judging population trends on FNHR. However, habitat quality may have improved with forest spreading and trees maturing. It can only be said that this woodpecker has not changed drastically in abundance since the 1950s.
- Red-headed Woodpecker (*Melanerpes erythrocephalus*) - A colony of more than a dozen individuals were permanent residents in East Woods, an area of more than 50 acres along the eastern edge of FNHR. Pioneering groups, which may have come from more distant colonies, appeared near FNHR headquarters in 1955 (10-19 September), 1956 (last week of August and the first week of September), and 1957 (4-6 September). In the late 1980s and early 1990s a group colonized the hillside south of FNHR headquarters and were present for perhaps a decade, but underwent gradual reduction until only one and then none remained. A lone individual was present in this area in 2002.
- Downy Woodpecker (*Picoides pubescens*) - This small species is by far the most common woodpecker on FNHR, using all kinds of woodland and edge. Most seem to be permanently paired and they are often found associated with loose flocks of small passerines such as Tufted Titmouse, Black-capped Chickadee, and kinglets. They move around less rapidly than the other kinds and are often left behind. Downy Woodpeckers seemed to be favored by the abundance of the introduced elm bark beetle (*Scolytus multistriatus*) in 1952 and 1953 when American Elms were dying as a result of beetle attacks and drought. Heavily infested trees, even though small, might have chips of bark accumulate around their bases to a depth of several inches as the same woodpecker might return consistently. By the year 2000 the species was still abundant and came to a feeder at the FNHR headquarters, regularly.
- Hairy Woodpecker (*Picoides villosus*) - Compared with the Downy Woodpecker, which it closely resembles except for size, the Hairy Woodpecker is less numerous. It forages on larger trees and is more nearly confined to forest. It is shyer towards humans but more aggressive towards other woodpeckers. Individuals are permanently paired and are the joint occupants of territories, which are in the forest, but may include open areas that are crossed from time to time. The members of the pair communicate by sharp metallic calls that are uttered from time to time and especially by one launching into flight. It seems that the numbers of Hairy Woodpeckers on FNHR have not changed much over the past 50 years.

American Crow (*Corvus brachyrhynchos*) - Crows usually forage on the ground in open places and the spread of forest trees into former pastures and cultivated fields has resulted in the loss of some habitat. However, a traditional group with perhaps four pairs has continued to nest on the wooded hillside east of the pond. Wintering crows from more northern regions were prominent in the 1950s. A group of perhaps 2000 roosted in a hillside Osage orange grove about ½ mile southeast of FNHR. Notable among their activities were the almost daily heckling of Great Horned Owls and spectacular pre-roosting maneuvers. In recent decades this large wintering group seems to have disappeared, but the resident population has undergone little change.

Blue Jay (*Cyanocitta cristata*) - This jay is a common woodland species on FNHR and its numbers are not known to have undergone any major changes. In fall and spring, migrating groups from more northerly populations pass through the area. Often these birds do not stop, and there is minimal interaction between them and the resident jays.

Tufted Titmouse (*Baeolophus bicolor*) - This titmouse is one of the most common birds of FNHR. It nests in local woodland and is a cavity nester. However, it is less social than the chickadee. Much of its foraging may be on the ground. In so far as is known, its numbers have not changed appreciably.

Black-capped Chickadee (*Poecile atricapillus*) - This chickadee is one of the smallest birds of FNHR. Like its close relative the Tufted Titmouse, it is one of the most common nesting birds of FNHR. This seasonally insectivorous species is an inhabitant of forest and edge and requires tree cavities for both nesting and roosting. In the nesting season, pairs are the joint occupants of territories, but at other times each bird is a member of a loose flock which moves about a large communal territory. Other species including the Tufted Titmouse, White-breasted Nuthatch, kinglets, Downy Woodpecker, Brown Creeper, Yellow-rumped Warbler, and Dark-eyed Junco may join this ephemeral flock and travel with it. Numbers have increased as woodland has increased over the past half century.

White-breasted Nuthatch (*Sitta carolinensis*) - Locally this nuthatch is fairly common resident of oak woodland. Inexplicably, it seemed to be absent from FNHR during the early 1950s. One appeared in November 1955. It was color-banded in December and was often observed over a period of months on the wooded slope south of the headquarters. Gradually others reached the area and by the year 2000 it had become a moderately common breeder on FNHR.

Carolina Wren (*Thryothorus ludovicianus*) - Because of its year-round singing, this wren is a familiar resident of FNHR and of the area near the headquarters. Actually, there are only a few pairs on the area and the total

population of breeders may be less than a dozen. Observed habitat seems to be in woodland but includes a deep gully with steep banks of bare soil. Insects and spiders make up much of its food. Here, near the northern edge of its geographic range, the species is vulnerable to extreme low temperature and is subject to die-off in unusually severe winters. As a result of such die-offs, wrens were absent from territories near the headquarters from February to late June 1952, from May until late December 1954, and for many weeks in late winter and again in early summer in 1955 (Fitch 1958). Again in March 2001 the resident birds disappeared after a period of unusually severe cold, and were absent for a number of months.

Eastern Bluebird (*Sialia sialis*) - This bluebird had previously been a common resident of FNHR with mobile flocks in winter and nesting pairs in summer. Its preferred habitat is grassland edge with elevated perches from which it scans the terrain and flies down to catch insects such as grasshoppers. The spread of woodland has caused habitat deterioration and perhaps nesting no longer occurs on the area. The mowed lawn at FNHR headquarters has attracted potential breeders in recent years, but because of the lack of suitable nesting cavities, reproduction did not occur.

Northern Cardinal (*Cardinalis cardinalis*) - The Northern Cardinal is a common breeding bird of the area. In winter, flocks of cardinals are often seen which greatly increases the numbers observed. However, this increase is due to a behavioral shift rather than an influx of birds from off the area since this species is a permanent resident on FNHR. Also, there seems to be year-to-year changes in the summer breeders. Successional trends towards more extensive forest on FNHR may have reduced the area of breeding habitat. It seems that the species may have become somewhat scarcer than it was formerly.

American Goldfinch (*Carduelis tristis*) - In the early years of FNHR, the goldfinch was one of the common breeding birds of the area. Stands of sunflower were the focus of its activities. The species is social, except when nesting, and each bird is associated with an extremely mobile flock that moves about restlessly to find feeding areas. During summer and fall weed seeds, like those of sunflower, are the preferred food; but in spring elm seeds, still green and not yet shed, are fed upon avidly by roving flocks, as the species is a late nester. In the fall of 2000 American Goldfinches were not seen on the area except at a feeder beside the house where sunflower seed was dispensed. Here a flock of perhaps a dozen came frequently, outnumbering all other species combined at any one time.

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APPENDIX I. Checklists of Amphibians, Reptiles, and Mammals

The following checklists provide a convenient synopsis of fish, amphibians, reptiles, and mammals that have been recorded from FNHR during its 54-year history, general habitat preferences, and coarse information on changes in populations.²⁴ For greater detail the reader is referred to the species accounts in this paper, and to information in the numerous scientific publications from FNHR, and adjacent KU Field Station sites, dealing with many of the species. General information on ecology and abundance of species occurring on FNHR, and the region, can be found by consulting the following sources: fish (Cross and Collins 1975), amphibians and reptiles (Collins 1982), and mammals (Bee et al. 1981). The lists are presented in phylogenetic sequence, with scientific and common names following Potts et al. (1999) for fish, reptiles, and mammals, and Collins (1997) for reptiles.

Generalized habitat preferences for each species is presented. These are broad categories that represent only in general the tendencies for animals. For species with small home range areas (e.g., Prairie Vole), or those species for which only a small amount of habitat exists on FNHR (e.g., deeper-water aquatic habitats for Beaver), assignment of habitat codes is a relatively accurate depiction. However, many of species with larger home ranges (e.g., White-tailed deer) and generalists species may utilize several habitat types. General habitat codes are as follows:

- A = aquatic or aquatic tendencies
- F = forest
- P = prairie or pasture
- E = edge or forest-grassland contact
- Co = commensals (with human habitation)
- Cu = cultivated land or oldfield

²⁴ Please refer to footnotes in the report for updated records and comments on species (i.e., no updates of information after 2002 is included in this Appendix).

A generalized key to abundance provides coarse information for species at two periods: the 1950s and the 1990s. These are broad estimates of population abundances during the first decade after the FNHR was established and then during a decade 40 years later (1990s) after succession had proceeded. We emphasize that the abundance levels assigned are very general and based on “average” abundance estimates for each period. Note that for many species an occasional vagrant will appear at FNHR as a disperser from suitable habitat nearby. Codes for abundance are as follows:

a = abundant

m = moderately abundant

r = rare

t = transitory

* = extremely rare (only a few records) or possibly eliminated

0 = not present

Coarse trends in populations at FNHR between 1948 and 2002 are provided. In many cases population changes are associated with ecological succession, specifically the loss of open habitat as it was replaced by forest, but this is not always a straightforward relationship. For example, Prairie Voles made spectacular gains in the first four years after FNHR was established, but since 1952 their population has declined. In other cases, changes in population levels result from factors other than succession (e.g., Spotted Skunk), or factors interacting with successional changes. For several animal species, such as the Eastern Woodrat, their populations have fluctuated such that no clear trend is apparent. Some estimates of trend are based mainly on habitat change and not on direct sampling or observation. Even at broad scales there are uncertainties as to population attributes and those instances have been denoted with a question mark (“?”) in the checklist. Trends in populations at FNHR are coded as follows:

Increase

Decrease

NTO = No trend observed

Unknown

Introduced species

Checklist of Amphibians of the Fitch Natural History Reservation

Order

Family	Genus species	Common Name	Habitat	Abundance		Trend
				1950s	1990s	
Caudata (Salamanders)						
Ambystomatidae						
	<i>Ambystoma tigrinum</i>	Eastern Tiger Salamander	Cu	*	0	Decrease
Anura (Frogs and Toads)						
Pelobatidae						
	<i>Spea bombifrons</i>	Plains Spadefoot	Cu	*	0	Decrease
Bufonidae						
	<i>Bufo americanus</i>	Eastern American Toad	F	m	m	NTO
	<i>Bufo woodhousii</i>	Woodhouse's Toad	P	m	*	Decrease
Hylidae						
	<i>Acris crepitans</i>	Northern Cricket Frog	A	a	a	NTO
	<i>Hyla chrysoscelis</i>	Cope's Gray Treefrog	F	m	m	NTO
	<i>Pseudacris triseriata</i>	Western Chorus Frog	P	a	m	Decrease
Ranidae						
	<i>Rana blairi</i>	Plains Leopard Frog	A	m	m	NTO
	<i>Rana catesbeiana</i>	Bullfrog	A	a	a	NTO
Microhylidae						
	<i>Gastrophryne olivacea</i>	Great Plains Narrowmouth Toad	F	m	0	Decrease

Checklist of Reptiles of the Fitch Natural History Reservation

Order

Family	Genus species	Common Name	Habitat	Abundance		Trend
				1950s	1990s	
Testudines (Turtles)						
Chelydridae						
	<i>Chelydra serpentina</i>	Common Snapping Turtle	A	m	m	NTO
Emydidae						
	<i>Terrapene ornata</i>	Ornate Box Turtle	P	m	*	Decrease
Lacertilia (Lizards)						
Crotaphytidae						
	<i>Crotaphytus collaris</i>	Eastern Collared Lizard	P	r	0	Decrease ²⁵
Scincidae						
	<i>Eumeces fasciatus</i>	Five-lined Skink	F	a	m	Decrease
	<i>Eumeces obsoletus</i>	Great Plains Skink	P	m	*	Decrease
	<i>Eumeces septentrionalis</i>	Northern Prairie Skink	P	r	*	Decrease
	<i>Scincella lateralis</i>	Ground Skink	E	m	m	NTO
Teiidae						
	<i>Cnemidophorus sexlineatus</i>	Six-lined Racerunner	B	m	*	Decrease
Anguidae						
	<i>Ophisaurus attenuatus</i>	Slender Glass Lizard	P	m	r	Decrease
Serpentes (Snakes)						
Xenodontidae						
	<i>Carphophis vermis</i>	Western Worm Snake	F	m	m	Unknown
	<i>Diadophis punctatus</i>	Ringneck Snake	E	a	m	Decrease
	<i>Tantilla gracilis</i>	Flathead Snake	B	r	*	Decrease
Colubridae						
	<i>Coluber constrictor</i>	Eastern Racer	P	m	r	Decrease
	<i>Elaphe emoryi</i>	Great Plains Rat Snake	P	r	*	Decrease
	<i>Elaphe obsoleta</i>	Eastern Rat Snake	F	m	m	Decrease (?)
	<i>Lampropeltis calligaster</i>	Prairie Kingsnake	P	m	r	Decrease
	<i>Lampropeltis getula</i>	Speckled Kingsnake	E	*	*	Unknown
	<i>Lampropeltis triangulum</i>	Milk Snake	E	r	0	Decrease
	<i>Pituophis catenifer</i>	Gopher Snake	P	m	*	Decrease
Natricidae						
	<i>Nerodia sipedon</i>	Northern Water Snake	A	m	m	NTO
	<i>Storeria dekayi</i>	Brown Snake	E	m	m	NTO
	<i>Thamnophis sirtalis</i>	Common Garter Snake	A	m	a	Increase
	<i>Virginia valeriae</i>	Smooth Earth Snake	F	r	r	Unknown
Viperidae						
	<i>Agkistrodon contortrix</i>	Copperhead	E	a	m	Decrease
	<i>Crotalus horridus</i>	Timber Rattlesnake	E	m	*	Decrease

²⁵ Introduced species, see account.

Checklist of Mammals of the Fitch Natural History Reservation

Order

Family	Genus species	Common Name	Habitat	Abundance		Trend
				1950s	1990s	
Didelphimorpha (Marsupials)						
Didelphidae						
	<i>Didelphis virginiana</i>	Virginia Opossum	F, E	m	m	NTO
Insectivora (Insectivores)						
Soricidae						
	<i>Blarina hylophaga</i>	Southern Short-tailed Shrew	F, E	m	m	Increase (?)
	<i>Cryptotis parva</i>	Least Shrew	F, P, E	m	m	Increase (?)
Talpidae						
	<i>Scalopus aquaticus</i>	Eastern Mole	F, E	m	a	NTO
Chiroptera (Bats)						
Vespertilionidae						
	<i>Lasiurus borealis</i>	Red Bat	F	t	t	Unknown
	<i>Myotis lucifugus</i>	Little Brown Myotis	F	t	t	Unknown
Lagomorpha (Lagomorphs)						
Leporidae						
	<i>Sylvilagus floridanus</i>	Eastern Cottontail	E	a	m	Decrease
Rodentia (Rodents)						
Sciuridae						
	<i>Marmota monax</i>	Woodchuck	E	r	r	Unknown
	<i>Sciurus carolinensis</i>	Gray Squirrel	F	m	m	Decrease
	<i>Sciurus niger</i>	Fox Squirrel	F, E	a	a	Decrease
	<i>Spermophilus tridecemlineatus</i>	Thirteen-lined Ground Squirrel	P	0	0	Introduced
	<i>Tamias striatus</i>	Eastern Chipmunk	F	0	r	Introduced
Geomyidae						
	<i>Geomys bursarius</i>	Plains Pocket Gopher	P	m	0	Decrease
Castoridae						
	<i>Castor canadensis</i>	Beaver	A	0	*	(?)
Cricetidae						
	<i>Microtus ochrogaster</i>	Prairie Vole	P	a	*	Decrease
	<i>Microtus pinetorum</i>	Woodland Vole	F, E	m	*	Decrease
	<i>Neotoma floridana</i>	Eastern Woodrat	F, E	a	m	Variable
	<i>Ondatra zibethicus</i>	Muskrat	A	*	*	Decrease
	<i>Peromyscus leucopus</i>	White-footed Mouse	F, E	m	a	Increase
	<i>Peromyscus maniculatus</i>	Deer Mouse	P	m	*	Decrease
	<i>Reithrodontomys megalotis</i>	Western Harvest Mouse	P	a	m	Decrease
	<i>Reithrodontomys montanus</i>	Plains Harvest Mouse	P	m	*	Decrease
	<i>Sigmodon hispidus</i>	Hispid Cotton Rat	P	m	*	Decrease
	<i>Synaptomys cooperi</i>	Southern Bog Lemming	P, E	r	*	Decrease
Muridae						
	<i>Mus musculus</i>	House Mouse	Co	*	*	Decrease
	<i>Rattus norvegicus</i>	Norway Rat	Co	r	*	Decrease
Zapodidae						
	<i>Zapus hudsonius</i>	Meadow Jumping Mouse	E	r	*	Unknown
Carnivora (Carnivores)						
Canidae						
	<i>Canis latrans</i>	Coyote	P, E	m	r	Decrease
	<i>Urocyon cinereoargenteus</i>	Gray Fox	F	r	r	Decrease
	<i>Vulpes vulpes</i>	Red Fox	P, E	m	*	Decrease
Procyonidae						
	<i>Procyon lotor</i>	Raccoon	F	m	a	Increase
Mustelidae						
	<i>Mephitis mephitis</i>	Striped Skunk	P, E	m	r	Decrease
	<i>Mustela frenata</i>	Long-tailed Weasel	F	m	*	Decrease
	<i>Spilogale putorius</i>	Eastern Spotted Skunk	P	m	*	Decrease
Felidae						
	<i>Felis rufus</i>	Bobcat	F	r	r	Unknown
Artiodactyla (Even-toed Ungulates)						
Cervidae						
	<i>Odocoileus virginianus</i>	White-tailed Deer	E	*	a	Increase