FINAL PERFORMANCE REPORT

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Assessment and Survey of the Presence, Distribution, and Habitat of the Texas Kangaroo Rat, *Dipodomys elator*, in Oklahoma

Oklahoma Department of Wildlife Conservation

October 1, 2014 through September 30, 2017

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A. ABSTRACT

Surveys conducted during three years (2014-2017) provide the most extensive documentation to date for the presence (or absence) of the Texas kangaroo rat (*Dipodomys elator*), a Tier II species of greatest conservation need, in seven counties in southwestern Oklahoma. The project encompassed 15 surveys on 93 nights; 266 localities were surveyed for a total of 9,094 trap nights and more than 20,150 miles of paved and unpaved roads were surveyed for potential habitat and activity. No Texas kangaroo rats were captured or observed. However, 2,178 individuals of 18 mammal species were captured and individuals of 12 additional mammal species were collected and/or observed. New locality and natural history information for mammal species was obtained and 11 county records were recorded based on specimens and/or observations. Project results and historical information suggest that the Texas kangaroo rat (*Dipodomys elator*) is likely extirpated from the state of Oklahoma.

B. INTRODUCTION

The Texas kangaroo rat, *Dipodomys elator*, was identified as a Tier II species of greatest conservation need by the Oklahoma Department of Wildlife Conservation (Appendix E, Oklahoma Comprehensive Wildlife Conservation Strategy). In 1996, the International Union for Conservation of Nature (IUCN) listed *Dipodomys elator* as vulnerable, based on its decline throughout its historic range (Linzey et al. 2008). Habitat degradation, fragmentation, and loss of habitat from conversion to agricultural uses and development were cited by the IUCN as major threats. Although the species was listed as a category 2 candidate species by the United States Fish and Wildlife Service (USFWS) in 1982 (47 FR 58454), the practice of maintaining a category 2 candidate list was discontinued in 1996 (61 FR 64481). In Texas, *Dipodomys elator* is listed as threatened by the Texas Parks and Wildlife Department because of its scarcity and its limited geographic range. In 2010, WildEarth Guardians petitioned the USFWS to federally list

the Texas kangaroo rat. In 2011, the USFWS found that "the petition presents substantial scientific or commercial information indicating that listing the Texas kangaroo rat throughout its entire range may be warranted" and a status review was initiated (FWS-R2-ES-2011-0011). Thus, there was a critical and immediate need to assess the presence, distribution, and habitat of the Texas kangaroo rat to determine its status, particularly in the State of Oklahoma where it was little known and presumed extirpated.

The Texas kangaroo rat, *Dipodomys elator*, was described in 1894 from Henrietta, Clay County, Texas (Merriam 1894). However, it was not reported for Oklahoma until the early 1900s when two specimens were collected in November 1904 and July 1905 in southwestern Oklahoma near Chattanooga, Comanche County (Bailey 1905). Bailey (1905:149) reported that "while not numerous, they seem to be well distributed in the vicinity" and were found or known to be living under houses and outbuildings and feeding on Kafir corn (a predecessor of milo and grain sorghums). This species was only known for Oklahoma from these two specimens, until a specimen was collected in 1969 just north of the Red River in Cotton County in association with Ord's kangaroo rat, *Dipodomys ordii* (Baumgardner 1987). Despite a long history of mammal surveys in Oklahoma (see Caire et al. 1989), knowledge of the biology of mammals in the state remains limited, especially for some species and some geographic areas. For example, just in the past two decades through dedicated and concentrated field effort, investigators have expanded our understanding of the distribution and natural history of mammals of Oklahoma with the addition of approximately 375 new county records for 74 of the 105 species known in the state (e.g., Braun and Revelez 2005; Braun et al. 2011; Roehrs et al. 2008).

It was possible that the Texas kangaroo rat had been extirpated from the State of Oklahoma, as had been suggested by some researchers (e.g., Baumgardner 1987; Moss and Mehlhop-Cifelli 1990; Stangl et al. 1992). However, it also was clear that relatively little effort had been made to determine its presence in the state. For example, road surveys were conducted two nights in 1970 (Martin and Matocha 1972), road surveys totaling 396 miles were made in Comanche (61.9 mi), Tillman (74.4 mi), and Cotton (259.7 mi) counties between 1985 and 1987 (Jones et al. 1988), and an undetermined amount of sampling was conducted by personnel of Midwestern State University in the area of the specimen reported from Cotton County (Baumgardner 1987). In summer 1988, the survey by Moss and Mehlhop-Cifelli (1990) only consisted of 354 trap nights and 66 km of road surveys; most efforts were focused on the examination of aerial photographs and soil maps. And, Martin (2002) reported conducting road surveys during June to August from 1996 to 2000 in 12 Texas and 2 Oklahoma counties; however, no data are presented in the report for the Oklahoma counties.

In contrast, extensive research has been conducted in counties in northern Texas to better understand the distribution, ecology, diet, behavior, reproduction, and natural history of the Texas kangaroo rat (e.g., Dalquest and Collier 1964; Chapman 1972; Martin and Matocha 1972; Packard and Roberts 1973; Roberts and Packard 1973; Webster and Jones 1985; Jones et al. 1988; Martin and Matocha 1991; Stangl et al. 1992, 2005; Goetze et al. 2007, 2008; Nelson et al. 2009; Stasey et al. 2010). These data, among others, constitute the majority of the knowledge of the biology of the Texas kangaroo rat.

Information was needed for the Oklahoma Department of Wildlife Conservation and the USFWS to evaluate the status of this species of greatest conservation need in Oklahoma and, if

documented, to develop and implement scientifically sound management and conservation initiatives.

C. OBJECTIVES

To determine the presence of the Texas kangaroo rat (*Dipodomys elator*) in Oklahoma using observation and trapping surveys in seven counties over three years. The locations and number of *Dipodomys elator*, and habitat and natural history data, recorded during the project, will be provided in each Performance Report.

D. APPROACH

Localities that were accessible (e.g., roadsides, private land where permission was secured, parks, state and city property), one historic site (Bailey 1905), and one recent site (Baumgardner 1987) were surveyed for the presence of burrows and activity of the Texas kangaroo rat. Surveys also were conducted along paved and unpaved roads and by walking in potential habitat. The three-year project surveyed localities in seven counties in southwestern Oklahoma, including Harmon, Jackson, Tillman, Cotton, Greer, Kiowa, and Comanche. These counties were selected based on their proximity to areas in Texas where *Dipodomys elator* is, or was, known to occur and because they are the historical reference sites for the only known specimens from Oklahoma.

Dipodomys elator is not reported to hibernate and is active year round (Dalquest and Collier 1964); thus, the survey and inventory approach included surveys during all seasons, including winter (February). Localities surveyed were selected based primarily on soil and vegetation preferences described for *Dipodomys elator* in Texas (Martin 2002, Nelson et al. 2013). Texas kangaroo rats have been reported to inhabit arid areas not prone to flooding (Martin 2002), characterized by short, sparse grasses (Goetze et al. 2007; Nelson et al. 2009), and containing little woody canopy cover (Goetze et al. 2007). Although they have been reported to occur only in localities where the soil contains a significant clay component (Bailey 1905; Dalquest and Collier 1964; Roberts and Packard 1973; Martin and Matocha 1991), they are not restricted to such soils (Martin and Matocha 1991).

Localities were examined for the presence of burrows, distinct trails, and dust-bathing areas. Trapping to test for burrow occupancy was conducted by placing 7.5 X 8.8 X 30 cm folding Sherman Live Traps (extended length to minimize damage to tails) within 0.10 to 0.50 m of each burrow entrance, with the open end of each trap facing the burrow entrance. If no burrows were present, traps were placed in survey lines. Traps were baited with oatmeal each evening and checked each morning.

Small mammal species that were captured were released or were euthanized, prepared as scientific voucher specimens including tissue samples, and deposited in the Collection of Mammals and Oklahoma Collection of Genomic Resources at the Sam Noble Oklahoma Museum of Natural History, respectively. All protocols followed guidelines described by Sikes et al. (2011) for the use of wild mammals in research.

Because Ord's kangaroo rat (*Dipodomys ordii*) also is known to occur in the seven counties that were surveyed, all individuals of *Dipodomys* that were captured were carefully identified. *Dipodomys elator* and *Dipodomys ordii* easily are distinguished from each other using external

characteristics. The Texas kangaroo rat has a white-tipped tail and four toes on the hind feet, whereas the tail seldom is white-tipped in Ord's kangaroo rat and the hind feet have five toes (Caire et al. 1989; Carter et al. 1985).

Owl pellets have been shown to provide a reasonable representation of the local mammalian fauna, both qualitatively and quantitatively, particularly for some species that are rare, uncommon, or difficult to capture by traditional methods. Although *Dipodomys elator* was found to be disproportionately under-represented as a dietary element of the barn owl in north Texas (Stangl et al. 2005), they were present. This method of detection, although high-risk, provides yet another survey method for detecting the presence of this species in Oklahoma.

The following methods and procedures would have been used if *Dipodomys elator* had been captured or observed during the project. If burrows of *Dipodomys elator* had been located, the diameter and orientation of entrance/exit hole would have been recorded (see Fig. 3 in Stangl et al. 1992) and the specific location of each burrow would have been recorded in decimal degrees using a GPS unit. If captured, Texas kangaroo rats would have been photographed, sexed, checked for reproductive condition, relative age and condition, and marked with hair dye in order to determine recapture rates. A small ear biopsy would have provided a small tissue sample for studies involving DNA. Contents of check pouches would have been extracted and analyzed to determine diet. The site of each capture would have been recorded using a GPS and the animals released at the point of capture.

Soil and vegetation would have been sampled and analyzed at each site where *Dipodomys elator* had been captured or sighted. The habitat would have been photographed and described in general terms; the capture or sighting site also would have been described according to its association in the landscape. A 1-m^2 quadrat would have been placed directly over burrows or locations where *Dipodomys elator* had been captured. Within each quadrat, vegetative richness would have been recorded as the total number of species present. Percentage cover of grass, forbs, bare ground, woody vegetation, and rocks would have been recorded. Average herbaceous vegetation height would have been obtained by averaging the height of the herbaceous vegetation 15 cm interior to each corner of the quadrat. The height of woody vegetation also would have been recorded as the height of the lowest branch. Specimens of dominant plants would have been collected, placed in a plant press, and deposited in the Bebb Herbarium at the University of Oklahoma to serve as voucher specimens. Vegetation and soil data between quadrats would have been analyzed and compared.

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E. RESULTS AND DISCUSSION

Results

Fifteen surveys were conducted from 2014-2017 to document the presence (or absence) of the Texas kangaroo rat (*Dipodomys elator*) in seven counties in southwestern Oklahoma. Surveys were conducted during a total of 93 nights in October 2014 (10 nights), February 2015 (7 nights), May 2015 (4 nights), July 2015 (6 nights), August 2015 (5 nights), April 2016 (7 nights), May 2016 (7 nights), June 2016 (6 nights), July 2016 (7 nights), August 2016 (5 nights), September 2016 (3 nights), May 2017 (7 nights), June 2017 (7 nights), July 2017 (7 nights), and August 2017 (5 nights).

A total of 266 localities were surveyed (Table 1 and Appendices 1 - 9), with the total number of localities for each county varying from 7 (Comanche) to 83 (Tillman). Although fewer localities were surveyed in Year 1 (84), 91 localities were surveyed in both Year 2 and Year 3.

A total of 9,094 trap nights (a trap night is equal to one trap set for one night) of effort was achieved during the three-year project (Year 1 2,302; Year 2 3,022; Year 3 3,770) (Table 2). This effort is about 25.7 times the effort of the previous survey by Moss and Mehlhop-Cifelli (354 trap nights; 1990). Trap success for all small mammals varied from 0 to 100%, but averaged 24.6% across all sites (25.04% Year 1; 33.86% Year 2; 9.76% Year 3).

Visual surveys also were conducted along roads for major areas of each of the seven counties. Habitats along more than 20,150 miles of paved and unpaved roads were surveyed for the presence of potential *Dipodomys elator* habitat, burrows, and activity (7,000 miles Year 1; 7,000 miles Year 2; 6,150 miles Year 3). This effort is estimated at more than 43.6 times the efforts from previous surveys (Martin and Matocha 1972; Jones et al. 1988; Moss and Mehlhop-Cifelli 1990).

No *Dipodomys elator* was captured or observed in Years 1, 2 or 3. However, 2,178 individuals of 18 mammal species were captured (Table 2, Table 3). Of these, 561 were prepared as scientific voucher specimens including tissue samples, and deposited in the Collection of Mammals and Oklahoma Collection of Genomic Resources at the Sam Noble Oklahoma Museum of Natural History, respectively. The remaining 1,617 individuals of the 2,178 individuals captured were identified and released (Table 2).

The most common mammal species captured were (Table 3): *Sigmodon hispidus* (*n*=1,200), *Chaetodipus hispidus* (*n*=211), *Peromyscus maniculatus* (*n*=183), *Neotoma micropus* (*n*=177), *Dipodomys ordii* (*n*=153), and *Peromyscus leucopus* (*n*=133). Other mammal species were captured less frequently (Table 3): *Onychomys leucogaster* (*n*=51), *Perognathus merriami* (*n*=24), *Neotoma floridana* (*n*=18), *Mus musculus* (*n*=8), *Reithrodontomys montanus* (*n*=4), *Ictidomys tridecemlineatus* (*n*=3), *Reithrodontomys fulvescens* (*n*=3), *Baiomys taylori* (*n*=2), *Xerospermophilus spilosoma* (*n*=2), *Didelphis virginiana* (*n*=2), *Sylvilagus floridanus* (*n*=2), and *Peromyscus* sp. (*n*=2).

Individuals of 12 additional mammal species were collected and/or observed during Years 1, 2, and 3 (Table 3). These include one insectivore (*Scalopus aquaticus*), one edentate (*Dasypus novemcinctus*), one lagomorph (*Lepus californicus*), three rodents (*Cynomys ludovicianus*,

Sciurus niger, *Geomys bursarius*), four carnivores (*Procyon lotor*, *Taxidea taxus*, *Mephitis mephitis*, *Canis latrans*), and two artiodactyls (*Odocoileus virginianus*, *Sus scrofa*). No regurgitated pellets of barn owls were found.

The actual accomplishments during Years 1, 2, and 3 met the goals and objectives of the award as outlined in the approved scope of work. Although no *Dipodomys elator* was captured or observed in Years 1, 2, or 3, captures and observations (or lack of observations) of other mammal species expand our knowledge of small mammal diversity in the state. The small mammal fauna is not well known for Harmon, Jackson, Tillman, Cotton, Greer, Kiowa, and Comanche counties. The information from Years 1, 2, and 3 add new locality and natural history information for mammal species in these counties. Below are highlights based on comparisons with information in the published literature (e.g., Caire et al. 1989) or collection data available through on-line data portals.

- The Virginia Opossum, *Didelphis virginiana*, captured in Kiowa County is the first specimen-based record of this species for Kiowa County.
- The Nine-banded Armadillo, *Dasypus novemcinctus*, collected in Kiowa County is first specimen-based record of this species for Kiowa County.
- The Eastern Cottontail, *Sylvilagus floridanus*, captured in Greer County is the first specimen-based record of this species for Greer County. The record from Cotton County is the fourth for the county and adds a third locality for this species in the county.
- We did not observe or capture many of the two ground squirrels (*Xerospermophilus spilosoma* and *Ictidomys tridecemlineatus*) reported for southwestern Oklahoma during the project. The paucity of data for these species may be of interest to the Oklahoma Department of Wildlife Conservation in their development of conservation strategies for small mammals.
- The Thirteen-lined Ground Squirrels, *Ictidomys tridecemlineatus*, that were captured are the eighth specimen-based record for Tillman County and the second locality from which it has been reported from that county, the second specimen-based record for Harmon County, and the second specimen-based record for Cotton County.
- The Spotted Ground Squirrels, *Xerospermophilus spilosoma*, captured in Tillman County are the second and third specimen-based records of the species for the county and increase the known localities from one to three.
- The Merriam's Pocket Mice, *Perognathus merriami*, captured in Greer County increase the known scientific specimens of this species from the county from one to four and the known localities from one to three. The individuals captured in Jackson County increase the known scientific specimens of this species from the county from 5 to 25 and the known localities from two to eight.
- The Hispid Pocket Mice, *Chaetodipus hispidus*, captured in Greer County are the first specimen-based records of this species for Greer County.
- Few specimens of the Fulvous Harvest Mouse, *Reithrodontomys fulvescens* are known from Greer County. The individuals captured increase the known scientific specimens of these species from the county from four to seven.
- The Plains Harvest Mouse, *Reithrodontomys montanus*, captured in Tillman County is the second known record of the species for the county. The individuals captured in Greer County increase the known scientific specimens of this species from the county from one to four.

- The Northern Pygmy Mice, *Baiomys taylori*, captured in Jackson County are the first and second specimen-based records of this species for Jackson County.
- The captures of individuals of the Northern Grasshopper Mouse, *Onychomys leucogaster*, in Greer, Harmon, Jackson, Kiowa, and Tillman counties greatly increase our knowledge of the distribution of this species in southwestern Oklahoma. For example, the known scientific specimens from Greer County increased from 1 to 20 and the known localities from 1 to 12.
- Hispid Cotton Rat (*Sigmodon hispidus*) populations were extremely high in Year 2. Individuals of all ages were active during the day as determined by visual observations of animals. In most counties, they were observed in large numbers along roadsides and crossing roads often resulting in mortality. This likely is a result of the mild weather during late 2015 and early 2016 or from the break in the drought. Populations of this species during Year 3 were noticeably decreased.
- The Eastern Woodrats, *Neotoma floridana*, captured in Tillman County from two localities are the first specimen-based records of this species for Tillman County. The *Neotoma floridana* captured in Cotton County is the fourth record for Cotton County and adds a second locality for this species in the county.
- The Coyote, *Canis latrans*, that was collected in Greer County is the first specimen-based record for the county. Large numbers of Coyotes (*Canis latrans*) were found dead at a site in Cotton County. Forty-four (44) skulls were collected for deposition in the Collection of Mammals at the Sam Noble Museum, but many more skeletons were present. Animals were found on the ground and hanging from fence posts. Three of the skulls have what appear to be bullet holes or damage consistent with a gun shot. None of the other 41 skulls have bullet holes suggesting that those animals were killed by a method other than being shot in the head.

Discussion

The surveys during three years provide the most extensive documentation to date for the presence (or absence) of the Texas kangaroo rat (*Dipodomys elator*) in Oklahoma. In Oklahoma, this Tier II species is of greatest conservation need, with a low population status and an unknown population trend. It recently has been petitioned for potential listing as an endangered or threatened species under the Endangered Species Act. The results of this project provide critical information for the Oklahoma Department of Wildlife Conservation and the USFWS for evaluation of the status of this species and for the development and implementation of scientifically sound management and conservation initiatives.

Surveys of 266 sites and observations along more than 20,150 miles of paved and unpaved roads found no specimens and few areas of what might be considered the preferred habitat of *Dipodomys elator*—short grass with open areas of bare ground and clay soils, such as mesquite-buffalo grass pastures. Habitat degradation, fragmentation, and habitat loss from conversion to agriculture, as well as fire suppression and decreased grazing (Figs. 1-4), likely have contributed to the changes in suitable habitat for *Dipodomys elator*. As noted by Martin and Matocha (1972), "urbanization and cultivated areas apparently limit the habitat available to the species in its known range."

The historical distribution of *Dipodomys elator* may have overlapped or coincided with the area known as the Big Pasture (Fig. 5), located in what is now parts of Comanche, Cotton, and

Tillman counties (Cooper 1957). Although the surplus lands of the Apache, Comanche, and Kiowa were opened to white settlement by lottery from 9 July to 6 August 1901, the 488,000-acre Big Pasture was set aside for grazing reserves of the Apache, Comanche, and Kiowa. In December 1906, however, the Big Pasture, the last large tract of land unavailable for white settlement in Oklahoma Territory, was opened by sealed bids (Cooper 1957).

The impact of the opening of this area to settlement and conversion of land to agriculture cannot be overstated. Within a year of the opening of the Big Pasture in 1906, 2,337 families had settled in the area (Cooper 1957). Even before the opening of the Apache, Comanche, and Kiowa lands in 1901, the Big Pasture had been leased to Texas ranchers for grazing and quarter sections leased for agriculture. Stipulations in agricultural leases included the provisions that at least 120 acres had to be "broken out" and quarter sections fenced with a four-wire fence. Agriculture developed very rapidly in the Big Pasture (e.g., cotton, wheat, sorghum, and milo) as well as statewide. Between 1890 and 1900, the number of farms in the state of Oklahoma increased from 8,826 to 108,000 and to 190,192 by 1910, making Oklahoma one of the most rapidly settled agricultural frontiers in U.S. history (Fite 2009).

The discovery of *Dipodomys elator* in Oklahoma in 1904 and 1905 and then a complete lack of records (with a lone exception) thereafter corresponds directly to these major events in Oklahoma history. The rapid conversion of habitat, fragmentation, suppression of fire, and decreased grazing likely had an immediate impact on any populations of this habitat specialist in the state. As noted earlier, these two specimens were not captured in native habitat, but in an area converted to agriculture (kafir corn) and human habitation. Although *Dipodomys elator* is known to inhabit edges and road banks in Texas, most areas in southwestern Oklahoma are cultivated from section line to section line or roadsides are covered with dense areas of native and non-native grasses (Fig. 1-4).

This project provides the first accurate determination of the existence of populations of the Texas kangaroo rat in Oklahoma, particularly relative to its known historical locations, since 1988 (Moss and Mehlhop-Cifelli 1990). Although, more recently, Martin (2002) reported conducting road surveys during June to August from 1996 to 2000, no data for Oklahoma were presented in the report. Project results and historical information suggest that the Texas kangaroo rat (*Dipodomys elator*) is likely extirpated from the state of Oklahoma. These results will be useful to the State of Oklahoma and USFWS in making decisions about the status of this species and will provide scientific data for the basis of future conservation measures and management strategies in areas where populations are present.

This project also provides new locality and natural history information on 30 other mammal species in seven counties in southwestern Oklahoma. This information continues to expand the knowledge of mammal species throughout the state.

Presentations and Publications

Coyner, B. S. It's all about Kangaroo Rats. Science in Action/ID Day at the SNM

Allen, A. G., Coyner, B. S., J. K. Braun, and M. A. Mares. Status of the Texas Kangaroo Rat (*Dipodomys elator*) in Oklahoma. Oklahoma Academy of Sciences, Claremore.

Coyner, B. S., J. K. Braun, and M. A. Mares. Status of the Texas Kangaroo Rat (*Dipodomys elator*) in Oklahoma. Southwestern Association of Naturalists, Lawton.

F. SIGNIFICANT DEVIATIONS:

There were no significant deviations to the project and all of the project's objectives were met.

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H. DATE: 10 November 2017

I. APPROVED BY:

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J. LITERATURE CITED:

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Table 1.—The number of localities surveyed during all years, 2014-2017. Y=Year, T=Trip.

Year Trip	**County**							**Total**
	Comanche	**Cotton**	**Greer**	**Harmon**	**Jackson**	**Kiowa**	**Tillman**	
Y1T1				5	18			23
Y1T2		8					12	20
Y1T3							9	9
Y1T4			10			8		18
Y1T5	3					6	5	14
Total Y1	3	8	10	5	18	14	26	84
Y2T1			7	4	7		2	20
Y2T2			1	7	7			15
Y2T3		4					8	12
Y2T4			12		7		3	22
Y2T5	3	4				2	4	13
Y2T6		9						9
Total Y2	3	17	20	11	21	2	17	91
Y3T1			8	8	2		3	21
Y3T2				7	7		11	25
Y3T3		18					6	24
Y3T4	1						20	21
Total Y3	1	18	8	15	9		40	91
Grand Total	7	43	38	31	48	16	83	266

Table 2.—The total number of mammals captured per trip during all years, 2014-2017. The number of mammals released is given in parentheses. A trap night is equal to one trap set for one night. Average trap success is presented for each trip with the range given in parentheses. Trap success is the number of mammals captured divided by number of trap nights. Y=Year, T=Trip.

Year Trip	**County**							**Total**	**No. Trap Nights**	**Average % Trap Success**
	Comanche	**Cotton**	**Greer**	**Harmon**	**Jackson**	**Kiowa**	**Tillman**			
Y1T1				35 (4)	139 (17)			174 (21)	946	20.3% (2.5-75%)
Y1T2		38 (16)					90 (55)	128 (71)	445	29.4% (8-50%)
Y1T3							33 (9)	33 (9)	255	16.5% (0-73%)
Y1T4			16 (0)			27 (0)		43 (0)	397	9.3% (0-20%)
Y1T5	25 (9)					81 (59)	24 (17)	130 (85)	259	52.8% (0-100%)
Total Y1	25 (9)	38 (16)	16 (0)	35 (4)	139 (17)	108 (59)	147 (81)	508 (186)	2302	
Y2T1			73 (50)	17 (5)	39 (18)		19 (6)	148 (79)	498	29.4% (0-70%)
Y2T2			7 (4)	74 (37)	23 (11)			104 (52)	415	22.6% (0-53%)
Y2T3		82 (65)					63 (48)	145 (113)	388	39.5% (3.3-90%)
Y2T4			114 (100)		173 (165)		14 (13)	301 (278)	790	36.0% (6.7-78.3%)
Y2T5	27 (26)	158 (157)				28 (27)	44 (44)	257 (254)	521	45.0% (12-79.6%)
Y2T6		353 (343)						353 (343)	410	85.7% (68-92.5%)
Total Y2	27 (26)	593 (565)	194 (154)	91 (42)	235 (194)	28 (27)	140 (111)	1308 (1119)	3022	
Y3T1			42 (33)	39 (30)	14 (1)		14 (12)	109 (76)	879	13.1% (0-40%)
Y3T2				7 (6)	36 (27)		34 (34)	77 (67)	1037	7.2% (0-27.5%)
Y3T3		85 (83)					10 (8)	95 (91)	1015	9.6% (0-40%)
Y3T4	7 (7)						74 (71)	81 (78)	839	9.7% (0-22.5%)
Total Y3	7 (7)	85 (83)	42 (33)	46 (36)	50 (28)		132 (125)	362 (312)	3770	
Grand Total	59 (42)	716 (664)	252 (187)	172 (82)	424 (239)	136 (86)	419 (317)	2178 (1617)	9094	24.6 (0-100%)

Table 3.—Mammal species captured and kept or released, observed (e.g., living or dead, sign), or collected (e.g., found skull) for seven counties surveyed during all years, 2014-2017. The total number of individuals captured is presented; the number of individuals released is given in parentheses. Species that were observed at one or more localities in each county are indicated by an "O." Species that were collected at one or more localities in each county are indicated by an "C."

Genus	**Species**	**County**							**Total (# released)**
		Comanche	**Cotton**	**Greer**	**Harmon**	**Jackson**	**Kiowa**	**Tillman**	
Didelphis	*virginiana*			1O		1O	1 (0)	1 (0), 1O	2 (0)
Scalopus	*aquaticus*					2O	1O		
Dasypus	*novemcinctus*		1O	2O			1C, 2O	1O	
Lepus	*californicus*		2O	5O	8O	8O	2O	4O	
Sylvilagus	*cf. floridanus*		1 (0), 11O	1 (0), 3O	9O	11O	10O	11O	2 (0)
Cynomys	*ludovicianus*		2O		3O	2O		3O	
Ictidomys	*tridecemlineatus*		1 (0)		1 (0)			1 (0)	3 (0)
Xerospermophilus	*spilosoma*					1O		2 (0)	2 (0)
Sciurus	*niger*						1O		
Geomys	*bursarius*		2O	12O	18O	10O	4O	14O	
Perognathus	*merriami*			3 (0)	1 (0)	20 (3)			24 (3)
Chaetodipus	*hispidus*	9 (3)	28 (21), 1O	23 (8)	28 (8)	81 (18)	10 (1)	32 (21)	211 (80)
Dipodomys	*ordii*		7 (1)	36 (23)	41 (21)	30 (17), 1O	1 (0)	38 (20), 2O	153 (82)
Reithrodontomys	*fulvescens*			3 (0)					3 (0)
Reithrodontomys	*montanus*			3 (0)				1 (0)	4 (0)
Peromyscus	*leucopus*		23 (16)	27 (25)	14 (8)	20 (5)	7 (0)	42 (25)	133 (79)
Peromyscus	*maniculatus*	3 (0)	36 (17)	18 (11)	5 (1)	15 (1)	5 (0)	101 (74)	183 (104)
Peromyscus	sp.		1O		2 (0)			1O	2 (0)
Baiomys	*taylori*					2 (0)			2 (0)
Onychomys	*leucogaster*			19 (8)	9 (4)	5 (0)	4 (0)	14 (6)	51 (18)
Sigmodon	*hispidus*	45 (37)	609 (600), 2O	83 (83)	40 (20)	163 (135)	89 (77)	172 (160)	1200 (1112)
Neotoma	*floridana*		12 (9)					6 (2)	18 (11)
Neotoma	*micropus*	2 (2)		36 (29)	30 (20)	85 (60)	15 (8)	9 (9)	177 (128)
Mus	*musculus*				1 (0)	3 (0)	3 (0)	1 (0)	8 (0)
Procyon	*lotor*		1O	4O		5O	1O	1C, 1O	
Taxidea	*taxus*			1O	1O	2O			
Mephitis	*mephitis*			1O	1C, 2O	2O		1C, 4O	

Table 3.—Continued.

Genus	Species	County							Total (# released)
		Comanche	**Cotton**	**Greer**	**Harmon**	**Jackson**	**Kiowa**	**Tillman**	
Canis	*latrans*		3O, 1C	1C	1C, 2O	2O	1O	3O	
Odocoileus	*virginianus*		3O	1O	4O	7O	1O	3O	
Sus	*scrofa*							2O	

Table 4.—Non-mammal species captured and kept or released, observed (e.g., living or dead, sign), or collected (e.g., found skull) for seven counties surveyed during all years, 2014-2017. The total number of individuals captured is presented; the number of individuals released is given in parentheses. Species that were observed at one or more localities in each county are indicated by an "O." Species that were collected at one or more localities in each county are indicated by a "C."

Genus	**Species**	**County**						
		Comanche	**Cotton**	**Greer**	**Harmon**	**Jackson**	**Kiowa**	**Tillman**
Aves								
Athene	*cunicularia*					2O		1O
Meleagris	*gallopava*							1O
Amphibians								
Anaxyrus	*speciosus*			1 (0)		2 (0)		
Lithobates	*sphenocephalus*		1O					
Rana	sp.							1O
Lizards								
Phrynosoma	*cornutum*	1C	1O		5O			2O
Plestiodon	*obsoletus*		1 (0)		1 (1)	1 (1)		2 (2)
Sceloporus	*consobrinus*		1O					
Scincella	*lateralis*		3O					
Snakes								
Agkistrodon	*piscivorous*		1O					
Coluber	*constrictor*				1O			
Crotalus	*atrox*				1 (1), 1O			
Crotalus	*viridis*				1 (1), 1O			
Masticophis	*flagellum*		1O		1 (0)			1O
Rattlesnake					1 (1)			
Turtles								
Terrapene	*ornata*		1 (1), 2O	1O	1 (1)			1 (1), 1O
Invertebrates								
Aphonopelma	*hentzi*		1O					1O
Dung beetles								1O

Figure 1.—Oklahoma: Tillman Co.: 1 mi N, 6 mi W Chattanooga, 350 m; Site 248. Photo taken 10 August 2017 by J. K. Braun.

Figure 2.—Oklahoma: Harmon Co: 3.25 mi S, 0.5 mi W Gould, 471 m; Site 198. Photo taken 15 June 2017 by J. K. Braun.

Figure 3.—Oklahoma: Tillman Co.: 4 mi N Loveland, 341 m; Site 243. Photo taken 9 August 2017 by J. K. Braun.

Figure 4.—Oklahoma: Tillman Co.: 2.25 mi S Loveland [site 47 (30/32). Photo taken 4 May 2015 by J. K. Braun.

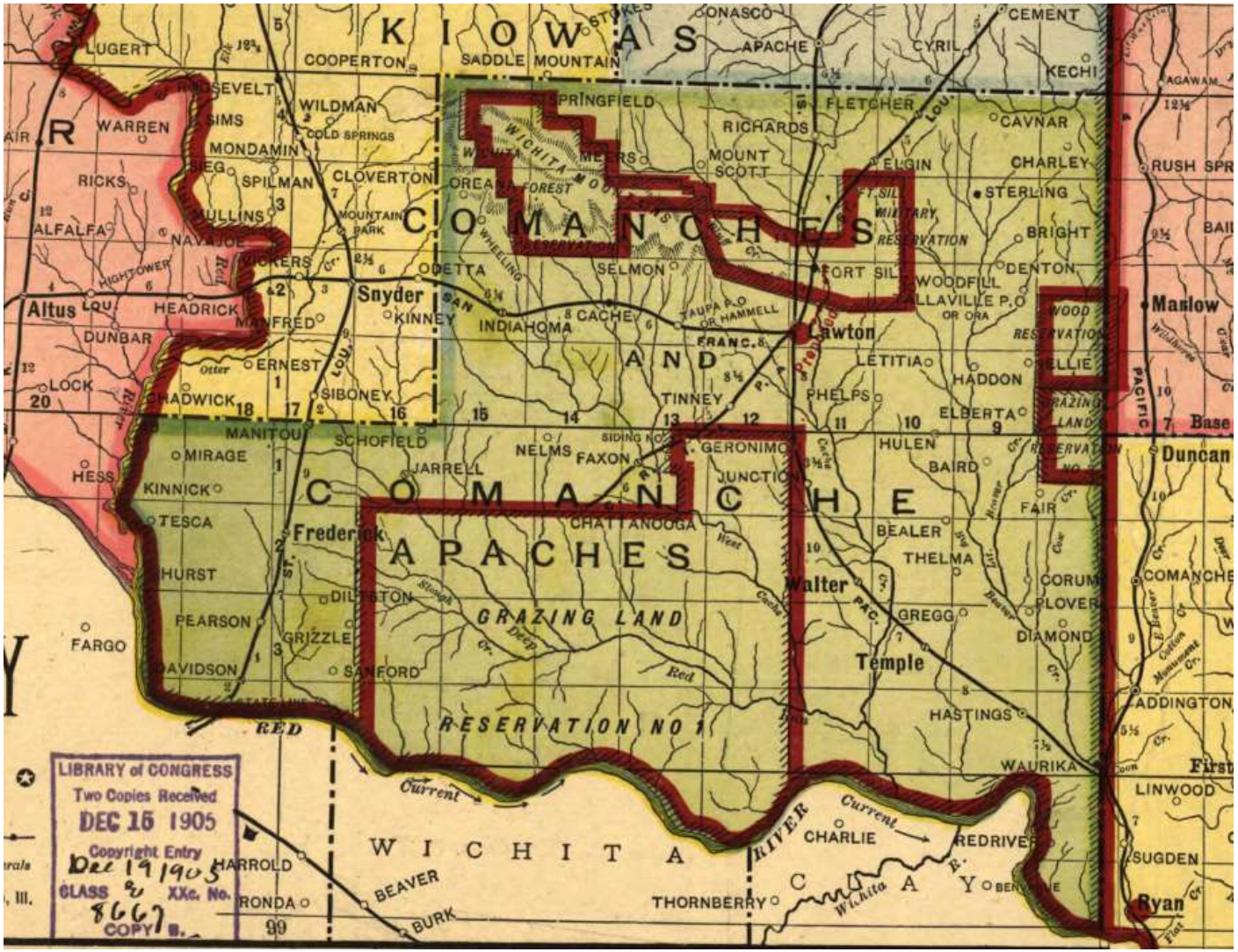
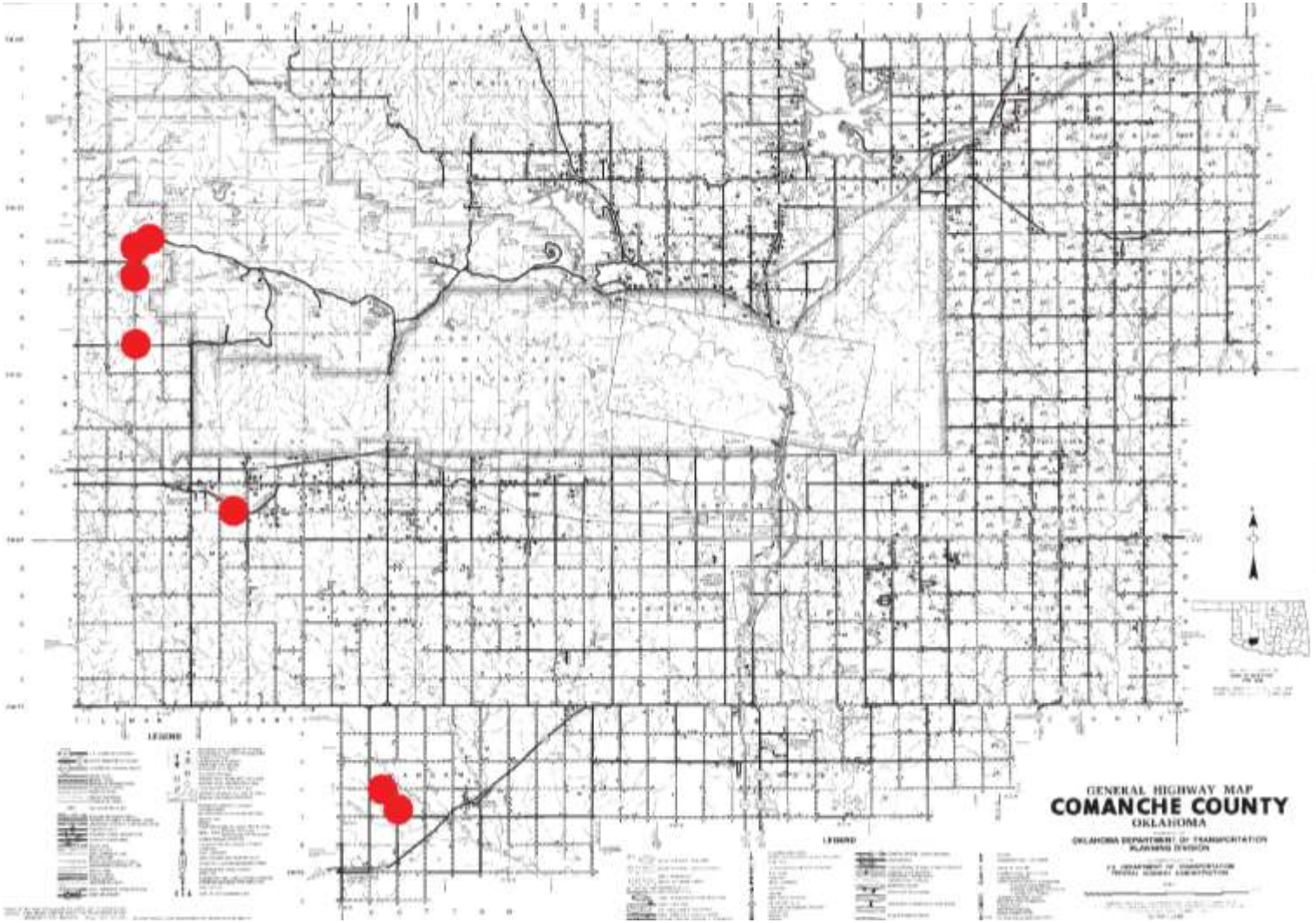
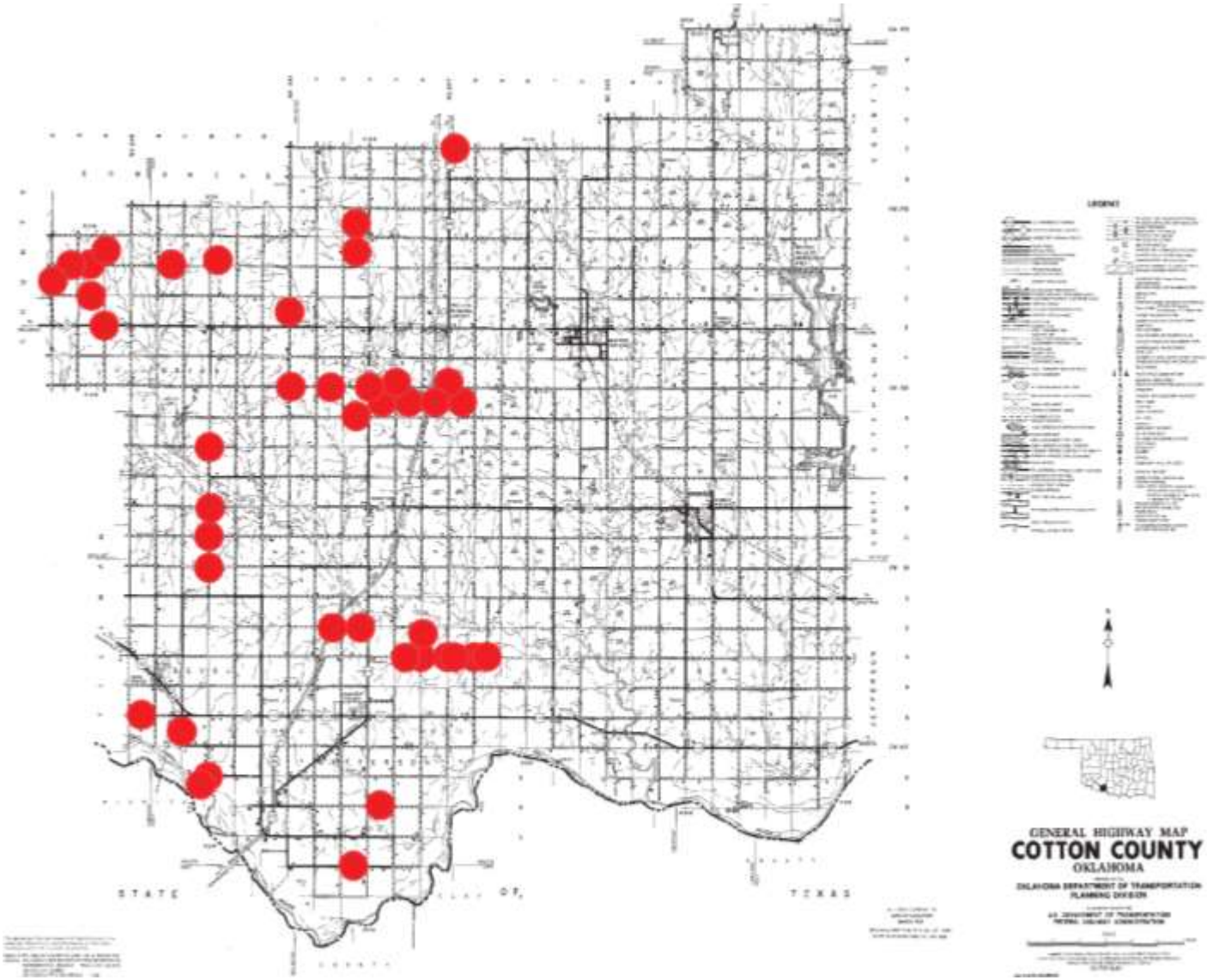


Figure 5.—Map of the Big Pasture (Grazing Land Reservation No. 1) 1905 from the Library of Congress and published in *The Daily Oklahoman* in 1905.

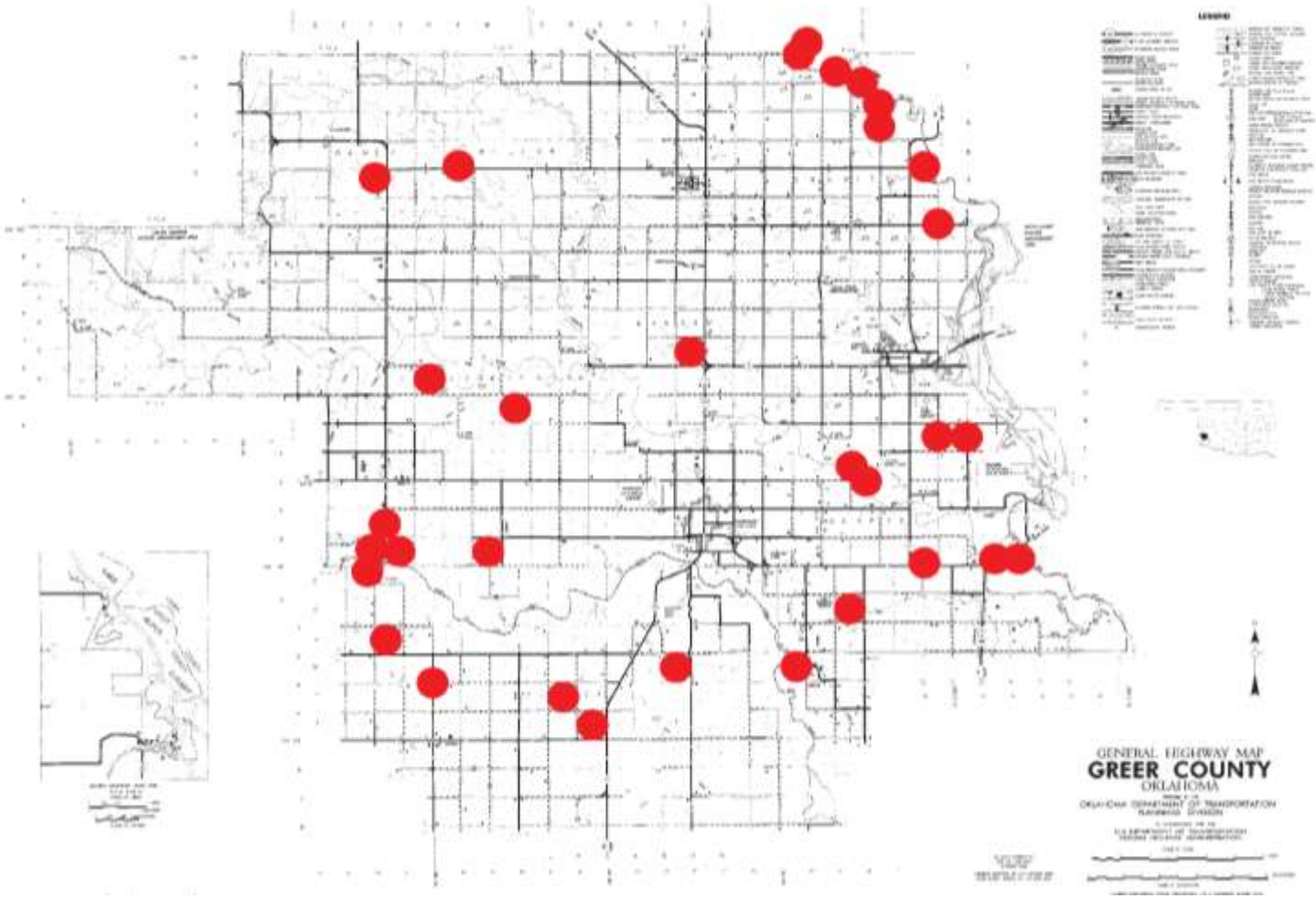
Appendix 1.—Map of localities for Comanche County.



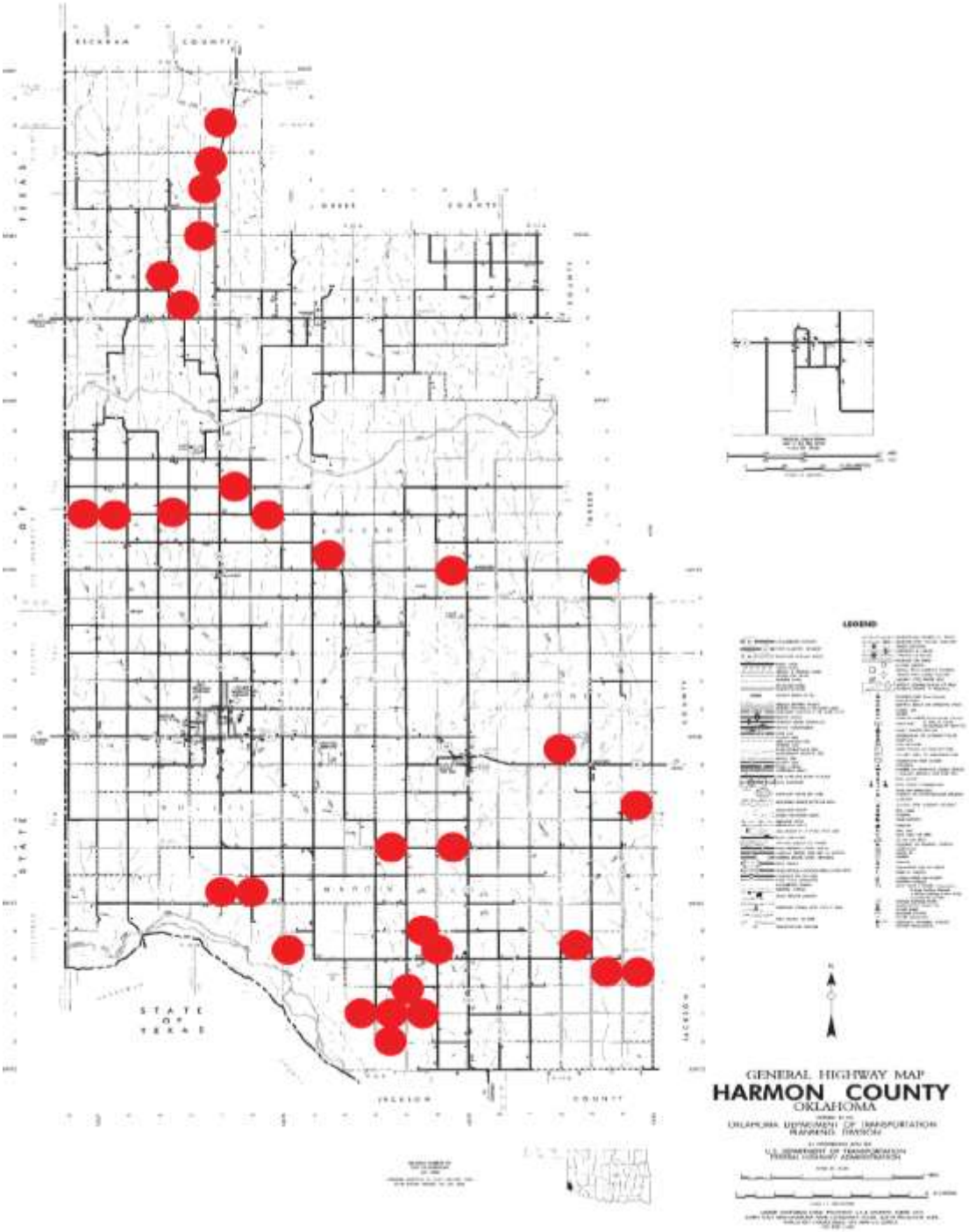
Appendix 2.—Map of localities for Cotton County.



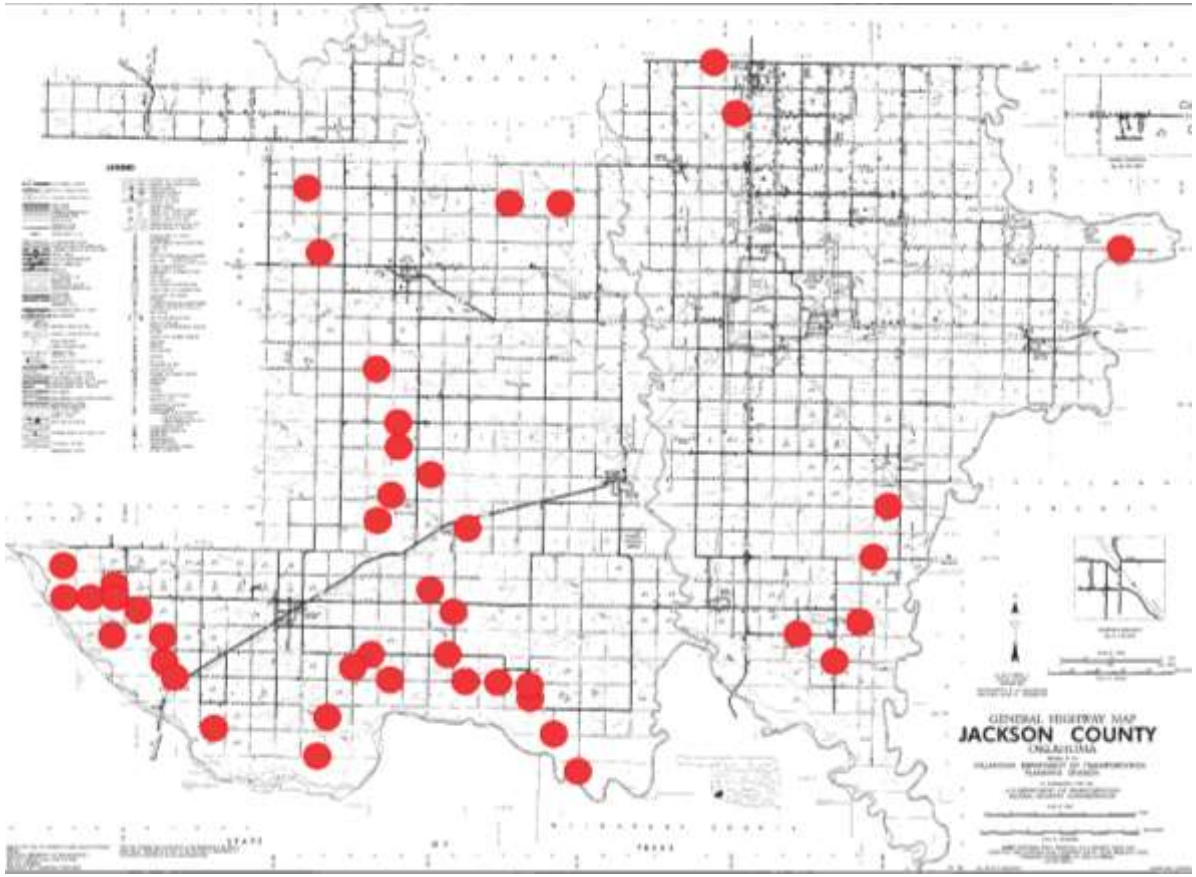
Appendix 3.—Map of localities for Greer County.



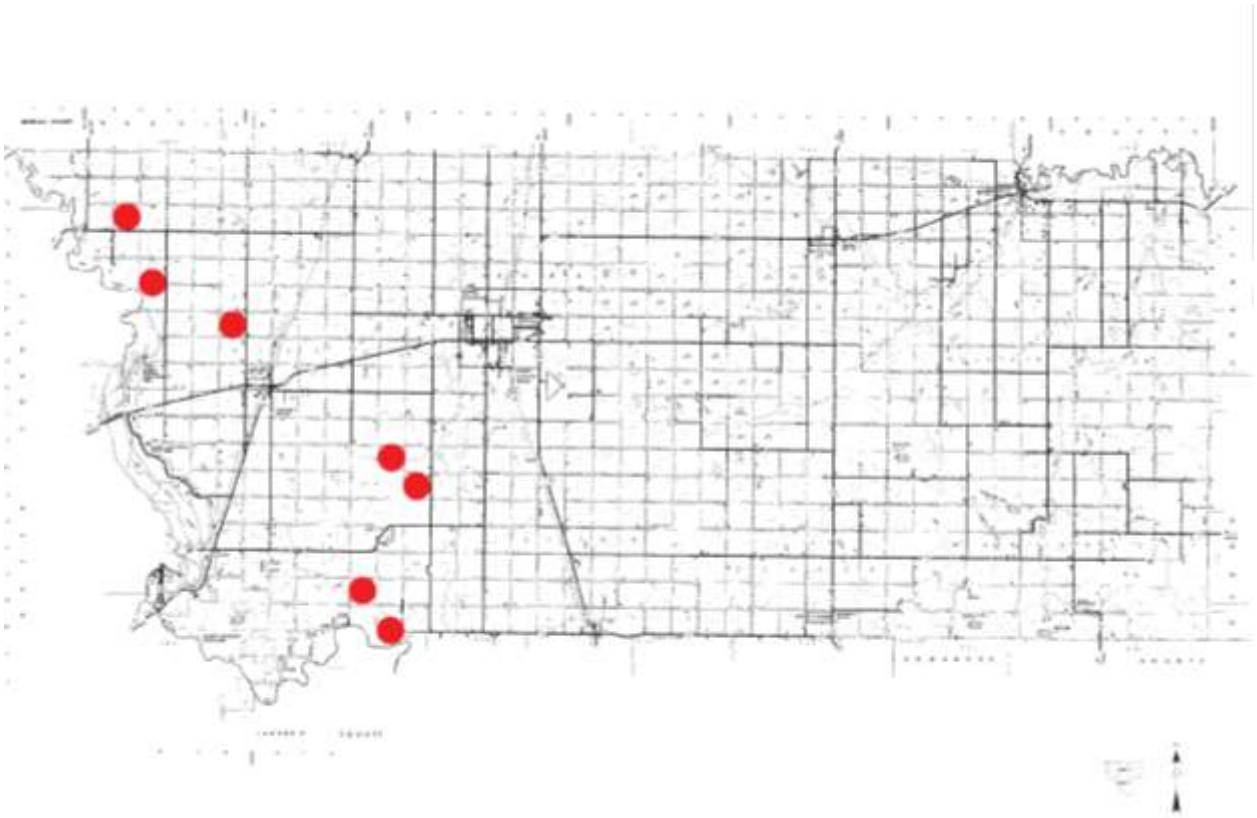
Appendix 4.—Map of localities for Harmon County.



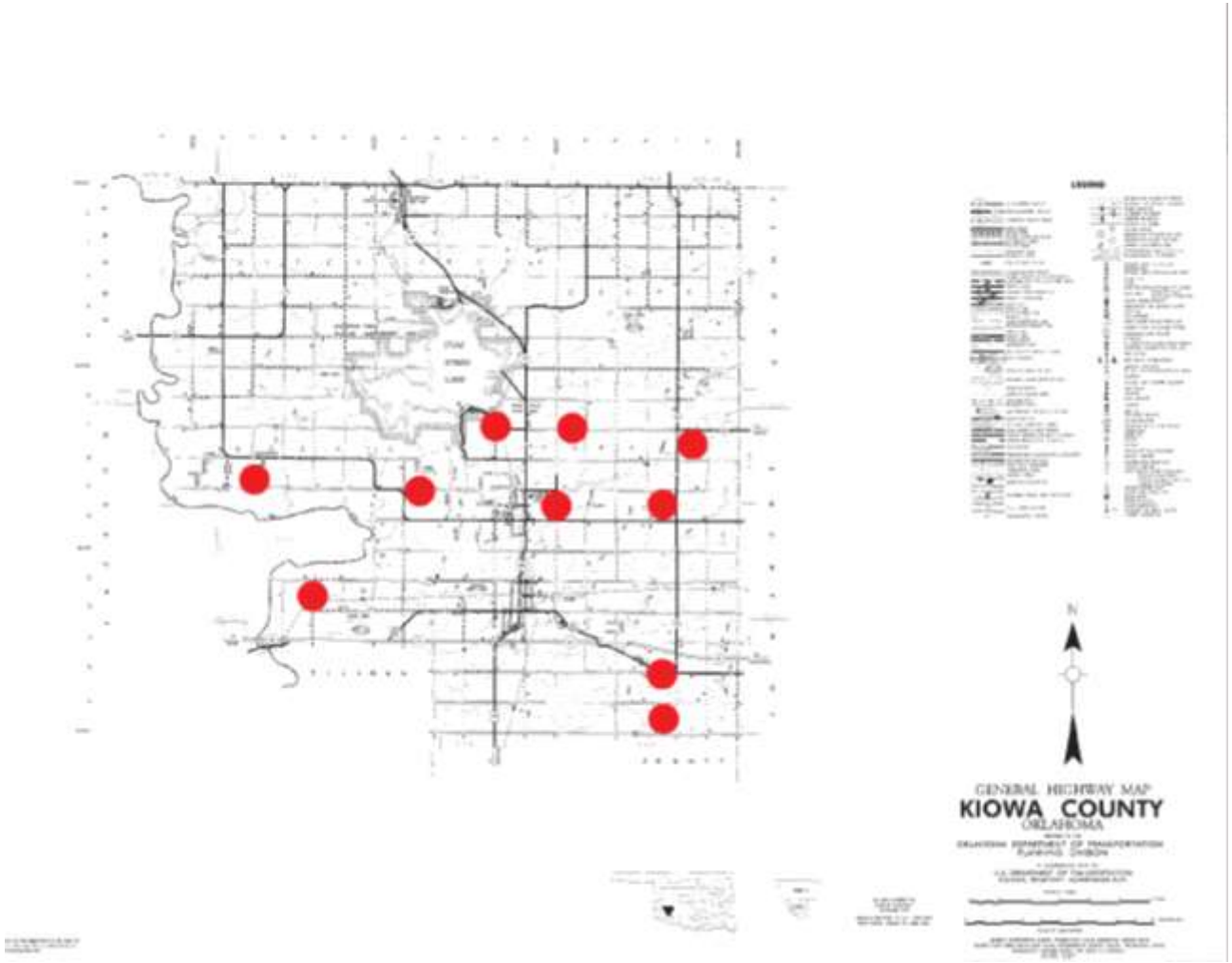
Appendix 5.—Map of localities for Jackson County.



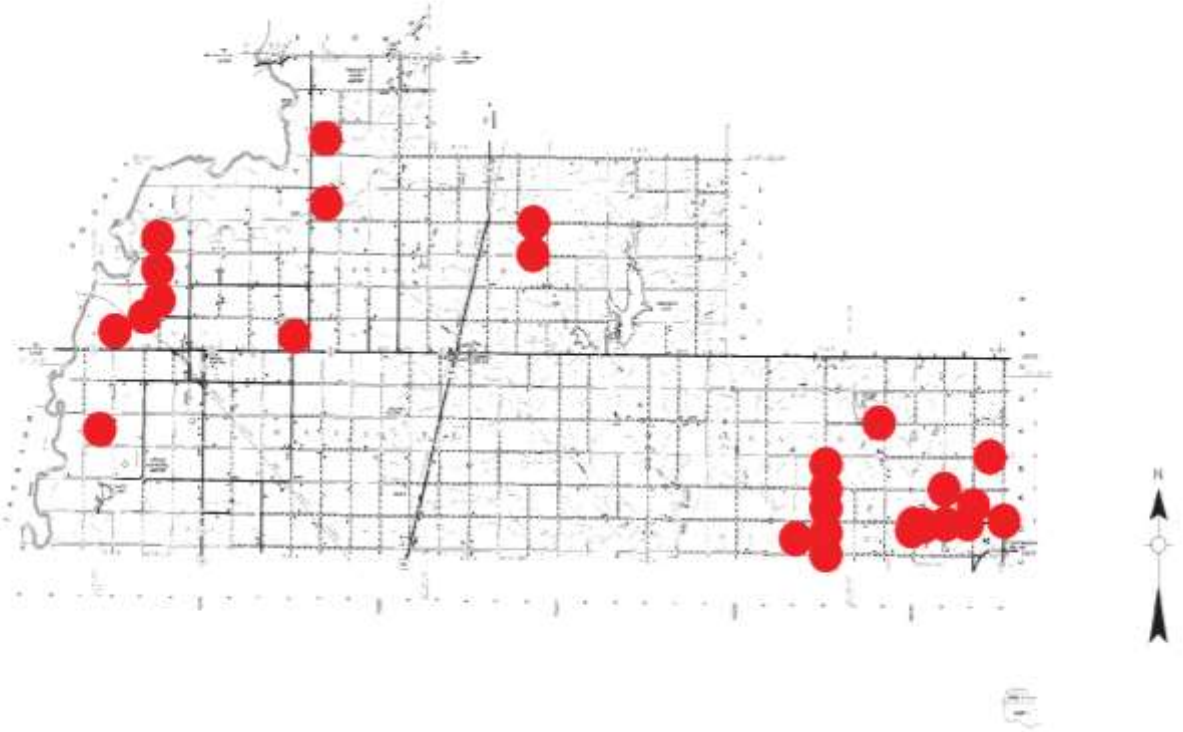
Appendix 6.—Map of localities for Kiowa County (part).



Appendix 7.—Map of localities for Kiowa County (part).



Appendix 8.—Map of localities for Tillman County (part).



Appendix 9.—Map of localities for Tillman County (part).