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HISTORICAL BIOGEOGRAPHY OF THE WOODCHUCK (*MARMOTA MONAX BUNKERI*) IN NEBRASKA AND NORTHERN KANSAS

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Key words: biogeography, Kansas, Mammalia, Marmota, Nebraska, riparian forests.

Jones et al. (1983) described the western limit of *Marmota monax* in the United States as the eastern edge of the northern Great Plains in Oklahoma, Kansas, Nebraska, and the Dakotas. Mengel (1970) introduced the idea of the Great Plains grasslands as a barrier to contact between birds of eastern and western North American forests. In his studies of bird biogeography on the Platte River, Knopf (1986) reported that this barrier has eroded with development of riparian forests along river courses of the Great Plains. This concept can also be applied to mammalian faunal distributions (Benedict et al. 2000).

Choate and Reed (1986), Choate and Haner (1992), and Wilson and Choate (1996) have documented westward movement of *M. monax* along wooded riparian streams in Kansas. *Marmota monax* was described by Jones et al. (1983) as an edge species, inhabiting areas where forests meet grassland or savannas. In Nebraska, as in Kansas, the majority of this habitat is along river systems, although forest edge situations also are created by tree planting in cities, around farmsteads, and for shelterbelts. Recently, Benedict et al. (2000) attributed western range extensions of 8 species of mammals (including *M. monax*) to westward development of riparian forests in Nebraska. The purpose of this paper is to document westward expansion of *M. monax* and rates of its expansion in Nebraska, and to compare these data with observations from northern Kansas.

Records were taken from museum specimen tags and literature accounts. Distance measurements were derived using a metric ruler on U.S. Geological Survey 1:500,000 topographical maps of Nebraska and Kansas. These

measurements were converted to kilometers. Rates were calculated by taking the straight-line distance between records and dividing it by the number of years between records. Specific locality information is reported in units recorded on specimen tags or as recorded by authors that first published the location record. Specimens are housed in the following collections: Hastings Museum of Natural and Cultural History (HM); Natural History Museum, University of Kansas (KU); Sternberg Museum of Natural History, Fort Hays State University (MHP); University of Nebraska State Museum (UNSM).

Marmota monax in Nebraska was first reported by Thomas Say, naturalist on Major Stephen H. Long's expedition to the Rocky Mountains, when he observed the species in the vicinity of the Engineers Cantonment between 19 September 1819 and 5 June 1820 (James 1823). The expedition was camped on the west bank of the Missouri River in southeastern Washington County in Section 28, T17N, R13E (Goodman and Lawson 1995; Fig. 1). Later Aughey (1880) reported that in Nebraska, *Arctomys monax* [= *Marmota monax*] "is found at long intervals." Cary (1905) noted from his investigations that *M. monax* was "said to occur sparingly along the Missouri River in northeastern Nebraska"; however, he was unable to locate any specimen records for the state. Swenk (1907) took Aughey's statement further by stating that *M. monax* occupied the riparian timbers of the Missouri River but was rare. He further stated that in 1906 Professor Lawrence Bruner of the University of Nebraska reported that woodchucks were regularly taken around Peru in Nemaha County along the Missouri River (Swenk 1907).

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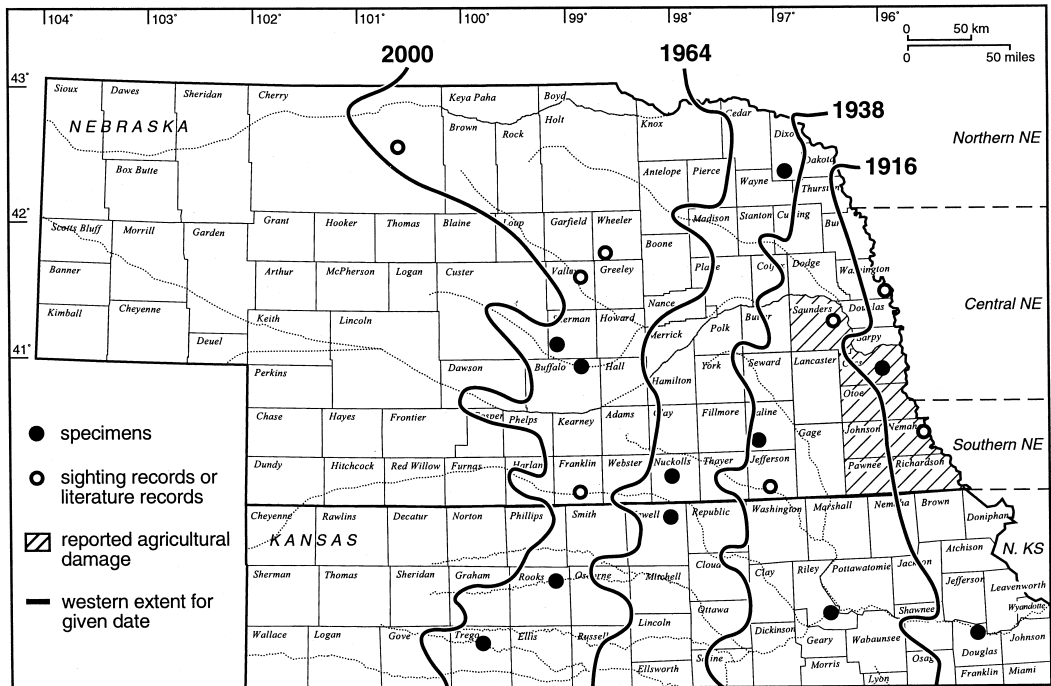


Fig. 1. Western distributional records of *Marmota monax bunkeri* in Nebraska and northern Kansas.

It is probable that *M. monax* was just beginning to move out of the Missouri Valley up the Platte, Little Nemaha, and Big Nemaha Rivers by 1916. The woodchuck's Missouri River range likely extended northward beyond Washington County, Nebraska. Despite these accounts, Howell (1915) noted the presence of *M. monax* in eastern Kansas in his revision of the genus, but he made no mention of this species in Nebraska. By 1916 *M. monax* was recorded in northern Kansas only from Douglas (Table 1, Fig. 1), Johnson, Leavenworth, and Wyandotte Counties (Kellogg 1915). If *M. monax* in Nebraska migrated north from Kansas up the Missouri River, as suggested by Black (1935) and Swenk (1938), then *M. monax* would have been in Atchison and Doniphan Counties (the 2 counties to the north of Leavenworth and Wyandotte on the Missouri River) before the earliest specimens were acquired (KU 3928 on 5 May 1923 and KU 3906 on 3 March 1923, respectively) in these counties.

In Nebraska the 1st specimens of *M. monax* were obtained west of the Missouri River lowlands in Cass County (Table 1, Fig. 1), and in

Jefferson County (Swenk 1938) in 1916. Woodchucks in Jefferson County likely entered the state by way of the Little Blue River from Kansas rather than overland from the Missouri River. When Black (1935) described *Marmota monax bunkeri* from its type locality in Douglas County, Kansas (KU 3089), he suggested that the species "probably extended north into Nebraska and west in Kansas up the rivers for a considerable distance." However, Choate and Reed (1986) noted that the 1st specimen (KU 139205) taken in the Little Blue River watershed in Washington County, Kansas, was not obtained until 1983. This may be attributed to a lack of collecting, because *M. monax* was likely in Washington County some time before 1916.

In his survey of *M. monax* in Nebraska, Swenk (1938) assigned specimens to Black's (1935) subspecies *M. m. bunkeri* from Kansas. He also documented the increase in inquiries made to county agricultural agents of damage caused by woodchucks in Cass, Johnson, Nemaha, Otoe, Pawnee, Richardson, and Saunders Counties. The report in Saunders County was the westernmost record in central Nebraska

TABLE 1. Calculated rates of westward expansion, date, and locality information.

Geographic area	Date		Location		Distance (km)	Rate (km·year ⁻¹)
	From	To	From	To		
REACHED BY 1938 Central Nebraska	1916	1925	northeast of Weeping Water, Cass County (UNSM 4239)	near Mead, Saunders County (Swenk 1938)	49	5
Southern Nebraska	1906	1937	around Peru, Nemaha County (Swenk 1907)	Western, Saline County (UNSM 1133)	125	4
Northern Kansas	1907	1925	Lawrence, Douglas County (KU 443)	Manhattan, Riley County (Choate & Reed 1986)	116	6
REACHED BY 1964 Southern Nebraska	1937	1959	Western, Saline County (UNSM 1133)	vicinity of Nelson, Nuckolls County (KU 79202, HM 28506)	77	4
REACHED BY 2000 Northern Nebraska	1960	1985	6 mi NW Wakefield, Dixon County (KU 84884)	Hackberry Lake, Valentine National Wildlife Refuge, Cherry County (Bogan 1997)	350	12
Central Nebraska	1925	1998	near Mead, Saunders County (Swenk 1938)	1.25 mi N, 2 mi W Litchfield, Sherman County (UNSM 25277)	224	3
Southern Nebraska	1959	2000	vicinity of Nelson, Nuckolls County (KU 79202, HM 28506)	1 mi S, 0.5 mi W Franklin, Franklin County (Benedict et al. 2000)	77	3
Northern Kansas	1925	1985	Manhattan, Riley County (Choate & Reed 1986)	Near Lovewell Reservoir; expansion up the Kansas and Republican Rivers to a tributary of White Rock Creek, Jewell County (MHP 22595)	160	3
Northern Kansas	1925	1991	Manhattan, Riley County (Choate & Reed 1986)	1 mi E Woodston; expansion up the Kansas, Solomon, and South Fork Solomon Rivers, Rooks County (MHP 26794)	218	3
Northern Kansas	1925	1993	Manhattan, Riley County (Choate & Reed 1986)	3 km S, 5 km W Wakeeney; expansion up the Kansas and Smoky Hill Rivers to Big Creek, Trego County (MHP 31000)	291	4
AVERAGE (km·year ⁻¹)						4.7

by 1938 and constituted a westward shift 49 km ($5 \text{ km}\cdot\text{year}^{-1}$) in distribution from Cass County (Table 1, Fig. 1). By this time *M. m. bunkerii* likely had expanded up the Platte River to inhabit much of Saunders and Dodge Counties in Nebraska. The western extent of *M. m. bunkerii* distribution in southern Nebraska shifted 125 km ($4 \text{ km}\cdot\text{year}^{-1}$) to the west from Nemaha County to Saline County (Table 1, Fig. 1). *Marmota m. bunkerii* was established in the lower reaches of the Little and Big Blue Rivers, including parts of Saline and all of Jefferson and Gage Counties by 1938 (Swenk 1938, Jones 1964). In adjacent areas of northern Kansas, the geographic range of *M. m. bunkerii* expanded west from Douglas County to Riley County (Table 1, Fig. 1). This expansion was approximately 116 km up the Kansas River ($6 \text{ km}\cdot\text{year}^{-1}$).

Jones (1964) associated the distribution of *M. m. bunkerii* in Nebraska with drainages of the Blue, Nemaha, Missouri, and eastern Platte Rivers. In 1960 a woodchuck was collected in Dixon County on South Logan Creek in northern Nebraska (Table 1). This creek has no direct ties to the Missouri River except through the Elkhorn and Platte River systems over 129 km to the southeast. Findley (1956) recorded an individual of *M. monax* in 1954 in Clay County, South Dakota, which is the county across the Missouri River from Dixon County, Nebraska. In these accounts Jones made the statement that the geographic range of *M. m. bunkerii* is "in the vicinity of the Missouri River at least as far as Dixon County." Jones (1964) also added a record to the westernmost distributional limits of *M. m. bunkerii* in southern Nebraska in Nuckolls County on Elk Creek, a tributary of the Little Blue River (Table 1). Date of collection for this specimen is uncertain; however, based on Jones's field notes and accession records at the Natural History Museum, University of Kansas, the individual definitely was collected before 1959. Thus, by 1964 the western limit of *M. m. bunkerii* range in southern Nebraska had shifted west 77 km ($4 \text{ km}\cdot\text{year}^{-1}$) from Saline County to Nuckolls County (Table 1, Fig. 1). No rates were calculated from 1938 to 1964 for northern and central Nebraska or northern Kansas because of a paucity of specimens collected during this period.

Westward movement of *M. m. bunkerii* in Nebraska continued though the end of the

20th century. In his studies of vertebrates of Fort Niobrara and Valentine National Wildlife Refuges, Cherry County, Bogan (1997) listed woodchucks as an "invading species" based on a photograph of *M. m. bunkerii* taken in the Valentine National Wildlife Refuge (photo preserved in refuge headquarters; Table 1). Individuals moving up Gordon and Schlage Creeks from the Niobrara River are probably responsible for colonizing this wetlands region of the sandhills. Benedict et al. (2000) also reported records of woodchucks along Cedar River in Wheeler County in 1991, Calamus River in Valley County in 1990, Mud Creek in Buffalo (UNSM 18676) and Sherman (Table 1) Counties in 1991 and 1998, respectively, and the Republican River in Franklin County in 1983 (Fig. 1).

Based on the revised distributional map in Benedict et al. (2000), the western distributional limit of *M. m. bunkerii* in northern Nebraska along the Niobrara River and its tributaries shifted west 350 km ($12 \text{ km}\cdot\text{year}^{-1}$), from Dixon County to the Valentine National Wildlife Refuge, Cherry County. In central Nebraska along the Platte River and its tributaries, *M. m. bunkerii* distribution shifted westward 224 km ($3 \text{ km}\cdot\text{year}^{-1}$) from Saunders County to Sherman County, and in southern Nebraska it shifted 77 km ($3 \text{ km}\cdot\text{year}^{-1}$) from Nuckolls County to Franklin County (Table 1, Fig. 1). From 1938 to 2000 the western distribution of *M. m. bunkerii* in northern Kansas expanded from the Manhattan area 291 km ($4 \text{ km}\cdot\text{year}^{-1}$) up the Kansas and Smoky Hill Rivers to Big Creek in Trego County; 218 km ($3 \text{ km}\cdot\text{year}^{-1}$) along the Kansas, Solomon, and South Fork Solomon Rivers into Rooks County; and 160 km ($3 \text{ km}\cdot\text{year}^{-1}$) up the Kansas and Republican Rivers to a tributary of White Rock Creek in Jewell County (Table 1, Fig. 1).

An examination of records documenting the rate of westward range expansion of *M. m. bunkerii* between 1916 and 2000 yields a mean of $4.7 \text{ km}\cdot\text{year}^{-1}$ (Table 1). The mean for records from 1916 to 2000 in Kansas is $4 \text{ km}\cdot\text{year}^{-1}$, $5.2 \text{ km}\cdot\text{year}^{-1}$ in Nebraska, and $3.8 \text{ km}\cdot\text{year}^{-1}$ in Nebraska without northern records. It should be noted that the rates calculated in this paper are only conservative estimates of *M. monax* westward expansion, because the straight-line distance between locations likely does not reflect the actual distance moved by

this species, especially if *M. m. bunkeri* followed riparian corridors. The higher rate of expansion in northern Nebraska may be attributable to the presence of well-established riparian forest communities along the central Niobrara River that provided appropriate habitat for *M. m. bunkeri* to rapidly expand its distribution westward. A relictual population of the eastern woodrat, *Neotoma floridana baileyi*, is confined to the forests along the central Niobrara River, indicating that a well-defined forest has been present in this valley for a considerable period of time.

Armstrong et al. (1986) stated that on the plains “unlike a number of other eastern taxa, they [*M. monax*] have not become widespread by following riparian corridors westward.” Our evidence does not support this statement. These results document the westward expanding distribution of *M. m. bunkeri* in Nebraska as demonstrated by Choate and Reed (1986), Choate and Haner (1992), and Wilson and Choate (1996) in Kansas. Westward movement of *M. m. bunkeri* in Nebraska and Kansas is the result of gradual westward development of riparian forests that provide forest edge corridors to enable *M. m. bunkeri* expansion.

As early as the late 19th century, Aughey (1880) and Bessey (1899) documented the expansion of forest in Nebraska, which they attributed to the control of prairie fires. This trend continued through the 20th century along all major watercourses in the state and is attributed to both control of fire and changes in water regimes of these rivers (Tolstead 1942, Weaver 1960, Knopf 1986, Sidle et al. 1989, Roedel 1992, Johnson 1994, Schmidt and Wardle 1998). Sidle et al. (1989) reported a 29%–75% increase in riparian forests on the North Platte and Platte Rivers from 1938 to 1985. Between 1983 and 1994, Schmidt and Wardle (1998) documented that forestland increased by 32% in Nebraska.

Ware and Smith (1939) estimated that about 8% of the state of Kansas was forested prior to settlement. They noted that by 1936 forestland was reduced to just over 4856 km² (2.4% of the state), through conversion to agricultural land. This conversion of eastern Kansas forests into farmland in the early to mid-19th century created more edge habitat by fragmenting larger forest blocks into smaller, more elongate blocks of forest. By 1994 forestland

had expanded once again to 6070 km² (3% of Kansas), and this expansion is expected to continue (Leatherberry et al. 1999). Kuchler (1974) noted, “Since man suppressed them [prairie fires], the eastern forests have tended to expand westward [in Kansas].”

Jones (1964) noted that “possibly the planting of many hundreds of miles of Osage orange hedgerows provided avenues of dispersal . . .” beyond the riparian forests for *M. m. bunkeri*. These hedgerows allow woodchucks access to areas outside watersheds and across drainage systems. Evidence exists that hedgerows, fencerows, and shelterbelts are used by *M. monax* (Petrides 1942, Forman and Baudry 1984, Johnson and Beck 1988). Fitch (1958) noted that in northeastern Kansas, *M. monax* preferred field edges near woods and fencerows for foraging. In Saunders County, Nebraska, 4 juvenile *M. monax* were collected from beneath a shed in a farmyard at least 1 mile from any developed riparian communities (UNSM 20928, 20929, 20930, 20931). The farmyard had a few trees but would not be characterized as having an understory or being forested. In Nebraska and northern Kansas, westward expanding distribution of *M. m. bunkeri* does not merely consist of fingers of occupied habitat along major rivers and unoccupied habitat between these rivers; instead, we are observing a front of westward expansion (Fig. 1). This front is led by expansions along the major rivers followed by expansion into edge habitat along tributaries, hedgerows, fencerows, and shelterbelts in areas between these major rivers.

At present, unoccupied habitat for this species still exists in the western portions of both Nebraska and Kansas. We predict that *M. m. bunkeri* will continue its westward movement across these states. If this westward expansion continues at current estimated mean rates of movement (4.7 km·year⁻¹), *M. m. bunkeri* could reach the Rocky Mountains in <100 years. The possible impact *M. monax* will have on western coniferous forest communities where they could potentially encounter the congeneric yellow-bellied marmot, *Marmota flaviventris*, can only be a matter of speculation at present.

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LITERATURE CITED

- ARMSTRONG, D.M., J.R. CHOATE, AND J.K. JONES, JR. 1986. Distributional patterns of mammals in the plains states. Occasional Papers of the Museum, Texas Tech University 105:1-27.
- AUGHEY, S. 1880. Sketches of the physical geography and geology of Nebraska. Daily Republican Book & Job Office, Omaha, NE. 120 pp.
- BENEDICT, R.A., H.H. GENOWAYS, AND P.W. FREEMAN. 2000. Shifting distributional patterns of mammals in Nebraska. Transactions of the Nebraska Academy of Sciences 26:55-84.
- BESSEY, C.E. 1899. Are trees advancing or retreating upon the Nebraska plains? Science 10:768-770.
- BLACK, J.D. 1935. A new woodchuck from Kansas. Journal of Mammalogy 16:318-320.
- BOGAN, M.A. 1997. Historical changes in the landscape and vertebrate diversity of north central Nebraska. Pages 105-130 in F.L. Knopf and F.B. Samson, editors, Ecology and conservation of Great Plains vertebrates. Springer-Verlag, New York.
- CARY, M. 1905. The mammals of Nebraska. Unpublished handwritten manuscript. U.S. Fish and Wildlife Service, Washington, DC. 143 pp.
- CHOATE, J.R., AND T.W. HANER. 1992. Probable distribution of the woodchuck in north central Kansas. Prairie Naturalist 24:65-66.
- CHOATE, J.R., AND K.M. REED. 1986. Historical biogeography of the woodchuck in Kansas. Prairie Naturalist 18:37-42.
- FINDLEY, J.S. 1956. Mammals of Clay County South Dakota. University of South Dakota Publications in Biology 1:1-45.
- FITCH, H.S. 1958. Home ranges, territories, and seasonal movements of vertebrates of the Natural History Reservation. University of Kansas Publications, Museum of Natural History 11:63-326.
- FORMAN, R.T.T., AND J. BAUDRY. 1984. Hedgerows and hedgerow networks in landscape ecology. Environmental Management 8:495-510.
- GOODMAN, G.J., AND C.A. LAWSON. 1995. Retracing Major Stephen H. Long's 1820 expedition: the itinerary and botany. University of Oklahoma Press, Norman. 366 pp.
- HOWELL, A.H. 1915. Revision of the American marmots. North American Fauna 37:1-80.
- JAMES, E. 1823. Account of an expedition from Pittsburgh to the Rocky Mountains, performed in the years 1819 and '20 by order of the Honorable J.C. Calhoun, Secretary of War; under the command of Major Stephen H. Long, H.C. Carey and I. Lea, Philadelphia, 1:1-503.
- JOHNSON, R.J., AND M.M. BECK. 1988. Influences of shelterbelts on wildlife management and biology. Agriculture, Ecosystems and Environment 22/23:301-335.
- JOHNSON, W.C. 1994. Woodland expansion in the Platte River, Nebraska: patterns and causes. Ecological Monographs 64:45-84.
- JONES, J.K., JR. 1964. Distribution and taxonomy of mammals of Nebraska. University of Kansas Publications, Museum of Natural History 16:1-356.
- JONES, J.K., JR., D.M. ARMSTRONG, R.S. HOFFMANN, AND C. JONES. 1983. Mammals of the northern Great Plains. University of Nebraska Press, Lincoln. 379 pp.
- KELLOGG, R. 1915. The mammals of Kansas with notes on their distribution, habits, life histories and economic importance. Master's thesis, University of Kansas, Lawrence. 318 pp.
- KNOPE, F.L. 1986. Changing landscapes and the cosmopolitanism of the eastern Colorado avifauna. Wildlife Society Bulletin 14:132-142.
- KUCHLER, A.W. 1974. A new vegetation map of Kansas. Ecology 55:586-604.
- LEATHERBERRY, E.C., T.L. SCHMIDT, J.K. STRICKLER, AND R.G. ASLIN. 1999. An analysis of the forest resources of Kansas. United States Department of Agriculture, Forest Service, Research Paper NC-334. North Central Research Station, St. Paul, MN. 114 pp.
- MENGEL, R.M. 1970. The North American central plains as an isolating agent in bird speciation. Pages 280-340 in W. Dort and J.K. Jones, Jr., editors, Pleistocene and Recent environments of the central Great Plains. University of Kansas Press, Lawrence.
- PETRIDES, G.A. 1942. Relation of hedgerows in winter to wildlife in central New York. Journal of Wildlife Management 6:261-280.
- ROEDEL, M.D. 1992. The increase of woody vegetation and associated expansion of range of *Peromyscus leucopus* (Rodentia) along the Republican River in southwestern Nebraska. Master's thesis, University of Nebraska, Lincoln. 60 pp.
- SCHMIDT, T.L., AND T.D. WARDLE. 1998. The forest resources of Nebraska. United States Department of Agriculture, Forest Service, Research Paper NC-322. North Central Research Station, St. Paul, MN. 114 pp.
- SIDLE, J.G., E.D. MOLLER, AND P.J. CURRIER. 1989. Changing habitats in the Platte River Valley of Nebraska. Prairie Naturalist 21:91-104.
- SWENK, M.H. 1907. A preliminary review of the mammals of Nebraska with synopses. Publications of the Nebraska Academy of Science 8:61-144.
- _____. 1938. Distribution of *Marmota monax* in the Missouri Valley region. Journal of Mammalogy 19:348-353.
- TOLSTEAD, W.L. 1942. Vegetation of the northern part of Cherry County, Nebraska. Ecological Monographs 12:255-292.

- WARE, E.R., AND L.F. SMITH. 1939. Woodlands of Kansas. Agricultural Experiment Station, Kansas State College of Agriculture and Applied Science, Bulletin 285:1-42.
- WEAVER, J.E. 1960. Flood plain vegetation of the central Missouri valley and contacts of woodland with prairie. Ecological Monographs 30:37-64.
- WILSON, G.M., AND J.R. CHOATE. 1996. Continued western dispersal of the woodchuck in Kansas. Prairie Naturalist 2:21-23.

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