

Continued westward expansion of woodchucks (*Marmota monax*) in Nebraska

ASHLEY J. FORRESTER¹, BRIAN C. PETERSON¹, JOURDAN M. RINGENBERG¹,
SHANNON M. SCHLATER¹, AND KEITH GELUSO^{1,*}

¹Department of Biology, University of Nebraska at Kearney, Kearney, NE 68849

ABSTRACT.—During the last century, the distribution of the woodchuck (*Marmota monax*) has expanded westward in parts of the Great Plains. Expansive grasslands of the Great Plains were formerly a barrier to forest-dwelling species, but changes since European settlement have enabled some woodland species to colonize the region. By 2000, woodchucks generally reached across the central portion of Nebraska. We compiled new county records and estimated the continued westward expansion rate of this large, diurnal squirrel in Nebraska. We documented new records of *M. monax* along much of the former western distributional limits in central and southern parts of the state, including a large westward movement along the Platte River into central Keith County. Westward movements appear to follow wooded rivers and their tributaries throughout the state. We estimated that in the last 18 years, *M. monax* expanded westward along the Platte River from central to western Nebraska at a rate of 9–13 km/year. If not already present in northeastern Colorado, *M. monax* could reach the Colorado border in <5 years. We acquired many records of *M. monax* reported as nuisance/damage control to the Nebraska Game and Parks Commission. We suspect that as this species continues to advance westward in the state and other areas of the Great Plains, more residents will report this species as a nuisance. Although a novel species in much of this grassland region, *M. monax* will provide habitat for a number of other species with its elaborately constructed burrows.

RESUMEN.—Durante el siglo pasado, la distribución de la marmota canadiense (*Marmota monax*) se expandió en dirección al oeste hacia distintas zonas de las Grandes Llanuras (Great Plains). Las extensas praderas de las Grandes Llanuras fueron, en un principio, una barrera para las especies que habitan en los bosques. Sin embargo, los cambios generados a partir del asentamiento europeo permitieron que algunas especies forestales colonicen la región. Para el año 2000, las marmotas canadienses llegaron al área central de Nebraska. Recopilamos nuevos registros para el condado y estimamos su tasa de expansión hacia el oeste de Nebraska. Documentamos nuevos registros de *M. monax* a lo largo de gran parte de los antiguos límites de distribución occidentales, en las partes central y sur del estado, incluyendo un gran desplazamiento hacia el oeste, a lo largo del río Platte y hacia el centro del condado Keith. Los desplazamientos hacia el oeste parecen coincidir con el cauce de los ríos y sus afluentes a través del estado. Estimamos que, en los últimos 18 años, la *M. monax* se expandió hacia el oeste a lo largo del río Platte desde el centro hacia el oeste de Nebraska a una velocidad de 9 a 13 km/año. Si aún no está presente en el noreste de Colorado, la *M. monax* podría alcanzar la frontera de Colorado en <5 años. Muchos de los registros de *M. monax* se adquirieron gracias a denuncias realizadas a la Comisión de Parques y Juegos de Nebraska durante los controles de plagas. Sospechamos que a medida que esta especie continúe avanzando hacia el oeste del estado y hacia otras áreas de las Grandes Llanuras, más residentes las denunciarán como plagas perjudiciales. Aunque se trata de una especie novedosa en gran parte de esta región de pastizales, la *M. monax* proporciona hábitat para muchas otras especies gracias a sus madrigueras minuciosamente construidas.

Historically, the woodchuck (*Marmota monax*) occurred throughout much of the eastern United States, from the Atlantic coast to the eastern edge of the Great Plains (Hall and Kelson 1959, Hall 1981, Jones et al. 1983). Along its western limit, *M. monax* was known from eastern parts of North Dakota, South Dakota, Nebraska, Kansas, and Oklahoma (Hall

and Kelson 1959, Hall 1981). Expansive grasslands of the Great Plains act as a barrier for forest-dwelling species (Mengel 1970), but landscape changes to the Great Plains since European settlement have enabled some deciduous-forest species to move into these prairie ecosystems (e.g., Benedict et al. 2000, Geluso 2004, Geluso et al. 2005, Barceló and Faaborg

*Corresponding author: gelusok1@unk.edu

2012). Woodland expansion along west-to-east flowing rivers in the Great Plains (Johnson 1994) has created continuous habitat for woodland species to colonize westward (Benedict et al. 2000, Roehrs and Genoways 2004). Flood control and lack of wildfires in formerly treeless grasslands across the Great Plains can result in an invasion of woody vegetation (Wells 1970, Johnson 1994, Briggs et al. 2002).

In recent decades, *M. monax* has expanded westward into the Great Plains along much of its western distributional edge, including in South Dakota (Higgins et al. 2002), Nebraska (Benedict et al. 2000, Roehrs and Genoways 2004), Kansas (Choate and Reed 1986, Choate and Haner 1992, Wilson and Choate 1996, Roehrs and Genoways 2004, Everhart 2018), and Oklahoma (Caire et al. 1989, Payne et al. 2001). In Nebraska, the first reports of *M. monax* were in the early 19th century, from Washington County along the Missouri River. Examination of *M. monax* records from 1916 to 2000 shows a gradual westward range expansion of 4–5 km/year associated mainly with development of riparian forests (Roehrs and Genoways 2004). As of 2000, the distribution of *M. monax* reached across central Nebraska (Benedict et al. 2000, Roehrs and Genoways 2004). Herein, we updated the continued westward expansion of *M. monax* into western Nebraska, estimated the rate of westward expansion along the Platte River, and compiled additional county records throughout eastern parts of the state.

To update the distribution of *M. monax* in Nebraska, we accrued specimens and sightings of this large, diurnal squirrel. Tumilson et al. (2007) stated that considering the appearance and size, visual observations of this species are likely more valid than other species of mammals that are not as easy to identify. To accrue locality data associated with museum specimens, we contacted the University of Nebraska State Museum in Lincoln (UNSM), examined the catalog of specimens in the natural history collection at the University of Nebraska at Kearney (UNK), obtained available locality data from publications, and queried a worldwide online database of vertebrate records (VertNet 2019).

We gathered reliable sightings of *M. monax* by 5 methods. First, we contacted colleagues and associates who commonly frequented, lived,

farmed, or ranched in counties along or west of the established edge of the last published distribution for the species as shown by Benedict et al. (2000) and Roehrs and Genoways (2004). Second, we contacted Nebraska Game and Parks Commission (NGPC) conservation officers for observations in central and western parts of the state. Third, we examined NGPC furbearer surveys sent to all furbearer permit holders in the state from 2003 to 2017. Those reports consisted of annual numbers of species harvested as well as animals reported as damage control. Woodchucks are classified as a nongame bycatch, and nongame bycatch was first recorded in 2003. About 20% of permit holders return questionnaires (S. Wilson, NGPC, personal communication). Fourth, we recorded personal observations. Lastly, we contacted the Animal and Plant Health Inspection Service (APHIS) in areas where we did not obtain sightings by other methods.

We documented 36 county records of *M. monax* in Nebraska, including many eastern counties where limited prior records were known (Fig. 1, Appendix 1). Records included 11 counties with observations west of the last published distributional edge for *M. monax* in Nebraska: Custer, Dawson, Furnas, Garfield, Gosper, Harlan, Kearney, Keith, Lincoln, Loup, and Phelps. Records with specific localities were generally from along waterways, roadways, and homesteads. Observations from Keith and Lincoln counties greatly expand the distribution of *M. monax* westward along the Platte River. We calculated that from the Kearney-Phelps county line to Ogallala in Keith County, the rate of expansion was about 12.6 km/year (227 km/18 years from 2000 to 2017); this distance was based on the former westernmost extent of actual distributional observations shown in Roehrs and Genoways (2004). From about Cozad (Dawson County) to Ogallala (Keith County), rate of expansion was 8.7 km/year (157 km/18 years); this distance was based on the predicted westernmost extent in 2000 shown by Roehrs and Genoways (2004).

From 2003 to 2017, NGPC furbearer surveys recorded 2289 observations of *M. monax*, with 72% reported as “damage control.” Counties on the western edge of the distribution had relatively few observations, suggesting low population densities along the westward

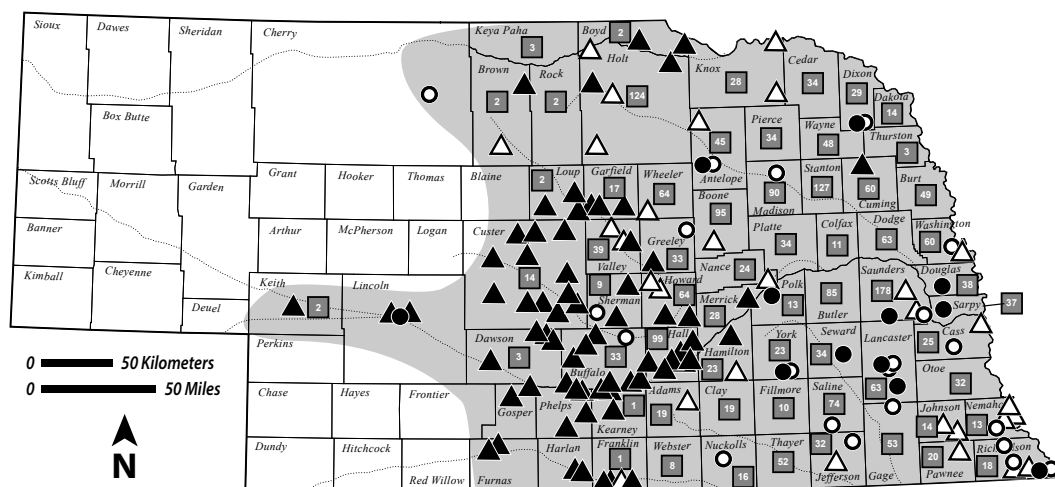


Fig. 1. Distribution of the woodchuck (*Marmota monax*) in Nebraska through 2018, represented by the shaded area. Black and gray symbols represent new records in this study, whereas white symbols represent previously published records in Jones (1964), Benedict et al. (2000), and Roehrs and Genoways (2004). Circles represent museum specimens, triangles represent sightings, and squares represent furbearer and nuisance/damage control surveys by the Nebraska Game and Parks Commission (2003–2017). We omitted prior records and new sightings with no specific locality.

moving front. Custer County had 14 observations, but considering the size of the county, the relative density of observations was lower compared to many counties in eastern Nebraska (Fig. 1). We did not document additional observations of *M. monax* in Cherry County of north-central Nebraska. All of our sightings were documented via our first 4 methods (i.e., from colleagues, NGPC conservation officers, furbearer surveys, and our sightings), whereas no additional sightings were obtained from APHIS agents in areas where we did not obtain sightings by other methods.

Human activities during the past century have caused dramatic changes in the distributions of mammals across Nebraska (Benedict et al. 2000, Hoffman and Genoways 2005, Bieber et al. 2018). As noted in Nebraska and other states, the continued westward expansion of *M. monax* in the Great Plains is attributed mainly to an increase in forest and woodland habitats, primarily along rivers and smaller waterways (Benedict et al. 2000, Roehrs and Genoways 2004, this study). Conversion of grasslands to agricultural lands has also introduced farmsteads with trees, hedgerows, and shelterbelts. Establishment of edge habitats between rivers and smaller tributaries also has contributed to the continued westward expansion of *M. monax* (Roehrs and Genoways

2004, this study). Schmidt and Wardle (1998) estimated that from 1983 to 1994, the area of forested land in Nebraska increased by 32%. Forested areas had generally declined before that time and since European settlement (Schmidt and Wardle 1998, Meneguzzo et al. 2008). Overall, it is unclear how climate change will affect continued movements of *M. monax* in Nebraska and throughout the Great Plains. However, one study predicted that native (*Populus*) and exotic (*Tamarix*) species in riparian forest might increase with various climate change and general circulation models in the region (Ikeda et al. 2014), which would likely expand the distribution of *M. monax* in western parts of the Great Plains.

Since the last published distribution (Benedict et al. 2000, Roehrs and Genoways 2004), *M. monax* colonized 5 new counties along the Platte River in Nebraska (Dawson, Kearney, Keith, Lincoln, and Phelps; Fig. 1). Current records from Keith County represent the farthest west *M. monax* is known to occur in the Great Plains (Jones et al. 1983, Benedict et al. 2000). We documented an expansion rate of 9–13 km/year along the Platte River since 2000 from central to western Nebraska. Roehrs and Genoways (2004) demonstrated an average westward movement of 4.7 km/year across the state since the early 1900s. It is unclear

why recent expansion rates along the Platte River were faster than reported by Roehrs and Genoways (2004). Perhaps the species was already established farther to the west along the Platte River than reported in 2000 by Benedict et al. (2000) and Roehrs and Genoways (2004). If so, the distance moved and rate of colonization since 2000 was overestimated. Alternatively, this relatively straight-flowing river with continuous woodlands might provide a relatively fast dispersal corridor, compared with other habitats where individuals must cross open, non-wooded habitats. Roehrs and Genoways (2004) also predicted that *M. monax* could reach the Rocky Mountains with unknown impacts on the congeneric yellow-bellied marmot (*Marmota flaviventris*). Based on our calculations along the Platte River, *M. monax* could reach the Colorado border in <5 years via the South Platte River, if the species is not already present in north-eastern Colorado. In January 2019, we contacted a conservation officer of the Colorado Parks and Wildlife from northeastern Colorado, and to his knowledge, no observations of *M. monax* have been reported in the region (T. Schmidt, personal communication).

Along the Republican River in southern Nebraska (Furnas and Harlan counties) and Loup River systems in central parts of the state (Custer, Garfield, and Loup counties), we documented modest westward movements since 2000 (Fig. 1). Along the Republican River, we suspect that *M. monax* has colonized farther west than our records currently demonstrate. In west-central Kansas in 2007, *M. monax* was known from Gove County, a location farther west than any records along the Republican River (Schmidt et al. 2019). If *M. monax* has only colonized as far as our records demonstrate, it is unclear why there are different rates of movements compared to the Platte River and other river systems.

The North Loup, Middle Loup, South Loup, Dismal, and Calamus rivers all have their headwaters in the Sandhill Region of Nebraska. We predict that *M. monax* will have a difficult time colonizing western reaches of the Sandhills and will be limited only to river systems in central parts of the Sandhills, due to expansive grassland habitats. Woodland habitat, including farmsteads and shelterbelts, decreases as one moves farther west into the Sandhills (see Fig. 4 in Meneguzzo et al. 2008), which

could potentially slow or limit the advancing colonization front of *M. monax* in the region.

We did not document additional westward movements by *M. monax* in Cherry County. In fact, we did not document any new observations from the county (Fig. 1). The original documentation in Cherry County was a photograph taken on 12 May 1985 at Hackberry Lake of the Valentine National Wildlife Refuge (Benedict et al. 2000). We hesitate to speculate on why colonization has not occurred farther along the Niobrara River and surrounding areas in the last 30 years. One explanation is that we did not document the current distribution of *M. monax* in this region and that the species currently resides farther west than our data demonstrate. Alternatively, maybe the original observation represented an individual transported intentionally or unintentionally to the area by humans, as has been reported for other mammals in Nebraska (Benedict et al. 2000, Geluso and Forsberg 2017). We predict that if this individual was part of an established local population, or part of an advancing westward front at that time in the 1980s, additional sightings by biologists at the Valentine National Wildlife Refuge would be known by now.

We observed a general congruency between sightings data and nuisance reports for the distribution of *M. monax* in the state (Fig. 1). Either method would have resulted in documenting recent westward movements, with the limited exception that there were no reports of nuisance individuals in Furnas, Gosper, Harlan, and Phelps counties in south-central Nebraska. Damage control and nuisance reports are not a surprise for this species, as *M. monax* is a common pest in gardens and is known to burrow around human structures (Kwiecinski 1998). Roehrs and Genoways (2004) reported that this species was associated with agricultural damage in some eastern Nebraska counties. We suspect that as this species continues to advance westward and become more common across the Great Plains, more residents will report this species as a nuisance, which will further aid in documenting their continued movements and distribution. Although reported troublesome by humans, *M. monax* digs extensive burrow systems that in turn create habitat for a number of other species, including river otters, raccoon, mice, snakes, birds, and more (Kwiecinski 1998).

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APPENDIX 1. New localities of occurrence for the woodchuck (*Marmota monax*) in Nebraska via museum specimens and sightings. Museum acronyms are the following: University of Nebraska at Kearney (UNK), University of Nebraska State Museum (UNSM), and Charles R. Conner Museum (CRCM; via VertNet 2019). We started to ask individuals for sightings in 2017, but we also recorded dates of their earlier sightings. Acronyms below are the following: Nebraska Game and Parks Commission (NGPC), Platte River Recovery Implementation Program (PRRIP), University of Nebraska at Kearney (UNK), The Nature Conservancy (TNC), United States Fish and Wildlife Service (USFWS), and Central Nebraska Public Power and Irrigation District (CNPPID).

MUSEUM SPECIMENS.—**Antelope Co.:** 4 mi S, 8 mi W Neligh (15 August 1992, UNK 4082). **Dixon Co.:** 2 mi N, 2 mi W Wakefield (29 April 1979, UNK 3211). **Douglas Co.:** Stolley Prairie (30 April 1988, UNSM 19374). **Lancaster Co.:** Wilderness Park, Lincoln (April 1985, UNSM 15597); 7 mi N, 0.25 mi E Hickman (10 July 2005, UNSM 29896). **Lincoln Co.:** 1207 W 7th Street, North Platte (2 April 2014, UNSM 31004). **Polk Co.:** 6 mi N, 18 mi E Central City (1 July 1988, UNK 3999). **Richardson Co.:** 4 mi SE Rulo (20 July 1941, CRCM Mammals 41-233, VertNet 2019). **Sanders Co.:** 4.2 mi E Ceresco (June 1998, UNSM 20928–20931). **Sarpy Co.:** 4 mi S, 1.5 mi W Gretna (15 June 1989, UNSM 16989). **Seward Co.:** 2.0 mi S, 1.25 mi E Seward (10 September 1989, UNSM 17886–17887). **York Co.:** 11 mi S, 2 mi E York (4 October 1992, UNK 4078).

SIGHTINGS.—**Boyd Co.:** 6.5 km S, 1.6 km W Spencer, 42.8146°N, 98.7211°W (2017; J. Andreasen, NGPC); 0.6 km S Monowi, 42.8235°N, 98.3303°W (P. George, NGPC; with many other observations since early 2000s throughout county). **Brown Co.:** 2.7 km N Long Pine, 42.5588°N, 99.6969°W (before 2002; A. Glidden, NGPC). **Buffalo Co.:** Kearney (2002–2018; >40 sightings within 15 km Kearney; M. Bresley, NGPC; B. Peterson, UNK; M. Perrion, NGPC; G. Rowles, UNK; A. Furman, NGPC; B. Meduna, NGPC; D. Zorn, CNPPID; M. Morten, UNK; R. Little; D. Conner; R. Norris, D. Sherrerd; R. Thomsen; D. Johnson, NGPC; K. Bergstrom, NGPC; J. Shaffer, UNK; B. Jacques, UNK; T. Rich); Rowe Sanctuary, 8.8 km S, 3.4 km W Gibbon, 40.6700°N, 98.8866°W (2013; A. Furman, NGPC); 4.6 km S, 2.5 km W Elm Creek, 40.6774°N, 99.4030°W (2017; B. Peterson, UNK; A. Furman, NGPC); 1.3 km S, 0.9 km E Amherst, 40.8272°N, 99.2579°W (2017; D. Baasch, PRRIP); 5.0 km S, 2.8 km E Gibbon, 40.7021°N, 98.8117°W (2010; R. Harding, UNK); 2.9 km N, 4.1 km E Gibbon, 40.7746°N, 98.7976°W (2017; Z. Ondrak); 1.4 km S, 14.4 km E Miller, 40.9145°N, 99.2234°W (2017; D. Trampe); 4.8 km N, 15.7 km E Miller, 40.9710°N, 99.2067°W (2017; D. Moos); 9.8 km N, 7.0 km E Miller, 41.0160°N, 99.3094°W (2018; D. Moos); Elm Creek, 40.7174°N, 99.3674°W (2018; R. Martin). **Cuming Co.:** 5.8 km N, 7.2 km E Wisner, 42.0375°N, 96.8257°W (2017; B. Mauler). **Custer Co.:** Ansley, 41.2867°N, 99.3824°W (2007–2017; R. Dierking, NGPC and J. Watts, UNK); Pressey State Wildlife Management Area, 41.1913°N, 99.7094°W (2017; R. Dierking, NGPC); 10 mi E Pressey State Wildlife Management Area, 41.1789°N, 99.5134°W (2017; R. Dierking, NGPC); Callaway, 41.2911°N, 99.9251°W (2008–2017; R. Dierking, NGPC); near Gates, 41.6445°N, 99.6355°W (2008–2017; R. Dierking, NGPC); Westerville area, 41.3971°N, 99.3820°W (2008–2017; R. Dierking, NGPC); Victoria Springs State Recreation Area, 41.6098°N, 99.7521°W (2017; R. Dierking, NGPC); Sargent area, 41.6264°N, 99.3725°W (2017; S. Ottun and B. Mauler); SE of Cumro, 41.0826°N, 99.4508°W (2017; S. Ottun); Mason City area, 41.2257°N, 99.3039°W (2017; J. Watts, UNK); Merna, 41.4834°N, 99.7653°W (2017; S. Wilson, NGPC). **Dawson Co.:** Cozad, 40.8602°N, 99.9823°W (2017; M. Thome, NGPC); Eddyville, 41.0076°N, 99.6249°W (2017; B. Beattie); SE Eddyville, 40.9687°N, 99.5834°W (2017; B. Beattie); Sumner, 40.9511°N, 99.5017°W (2017; B. Beattie). **Franklin Co.:** 2.6 km E Naponee, 40.0740°N, 99.1103°W (2017; P. George, NGPC); 3.1 km S Bloomington, Republican River, 40.0656°N, 99.0397°W (2017; P. George, NGPC); 4.8 km E Franklin, 40.0953°N, 98.8956°W (2017; J. Laux, NGPC). **Furnas Co.:** 2.6 km S, 4.5 km W Holbrook, 40.2784°N, 100.0627°W (2017; M. Andrews, NGPC); 4 km N, 0.5 km E Holbrook, 40.33780°N, 100.0058°W (2017; M. Andrews, NGPC). **Garfield Co.:** E side Burwell, 41.7836°N, 99.1441°W (2004 or 2005; B. O'Neal, NGPC); 1.6 km S, 14.4 km E Burwell, 41.7633°N, 98.9594°W (1998 or 1999; B. O'Neal, NGPC); 5.8 km WSW Burwell, Hwy. 91, 41.7694°N, 99.2015°W (2016; F. Woods). **Gosper Co.:** Elwood Reservoir, 40.6248°N, 99.8428°W (2016; B. Piernicky); 12.4 km N, 8.5 km E Smithfield, 40.683239°N, 99.6440°W (2018; A. Furman, NGPC). **Greeley Co.:** 3 km S Scotia, 41.4386°N, 98.70468°W (~2007; K. Geluso). **Hall Co.:** 9.3 km S, 2.8 km E Wood River, 40.7375°N, 98.5694°W (2013; C. Helzer, TNC); 5.6 km N, 2.1 km W Doniphan, 40.8222°N, 98.3981°W (2017; D. Fehlhafer); 1.7 km N, 8.0 km W Doniphan, 40.7881°N, 98.4655°W (2014–2017; B. Krohn, The Crane Trust; K. Geluso, UNK); 1 km N, 9.4 km W Wood River, 40.8301°N, 98.7121°W (2012; Z. Ondrak); 4 km S, 4.8 km E Alda, 40.8327°N, 98.4121°W (2017; Z. Ondrak); 8.8 km S, 2.1 km W Alda, 40.7915°N, 98.4931°W (2012; Z. Ondrak); Nebraska Law Enforcement Training Center, 40.9660°N, 98.3262°W (2017; T. Dixon, NGPC). **Hamilton Co.:** Aurora, 40.8667°N, 98.0078°W (2017; C. Helzer, TNC). **Harlan Co.:** Gremlin Creek, Harlan County Reservoir, 40.0883°N, 99.2156°W (early 2000–2017;

APPENDIX I. Continued.

L. Janicek and T. Zikmund, Army Corps of Engineers); 1.1 km S, 5.5 km E Alma, 40.0867° N, 99.2970° W (2016; T. Zikmund, Army Corps of Engineers). **Holt Co.:** 25 km N, 10.6 km E O'Neill, 42.6830° N, 98.5208° W (2017; S. Schainost, NGPC); 3.6 km S, 0.6 km W Stuart, 42.5674° N, 99.14981° W (2012; J. Murphy); 14.6 km E Chambers, 42.2036° N, 98.5732° W (early 2000; P. George, NGPC). **Howard Co.:** 2.3 km S, 2.6 km E St. Libory, 41.0618° N, 98.3258° W (T. Jansen, NGPC); near Dannebrog, 41.1158° N, 98.5516° W (2017; D. Teter, NGPC). **Kearney Co.:** near Fort Kearny State Historical Park, 2.2 km W Newark, 40.6411° N, 98.9896° W (2017; K. Cheng, UNK; K. Pedersen; B. Eifert, NGPC); S of Kearney, 9.8 km W Newark, 40.6416° N, 99.0785° W (2017; J. Laux, NGPC); 7.2 km S, 1 km E Newark, 40.5737° N, 98.9520° W (2018; B. Peterson, UNK). **Keith Co.:** N of Ogallala, intersection North Spruce Street and NE Highway 61, 41.163276° N, 101.7203° W (2017; N. Fix, NGPC). **Lincoln Co.:** west side of North Platte, 41.1506° N, 100.8071° W (2016; A. Hasenauer, NGPC); 1207 W 7th Street, North Platte, 41.1438° N, 100.7751° W (2014, 2017; T. Martinez); Front Street in Union Pacific Bailey Yard, North Platte, 41.1478° N, 100.8501° W (J. Geiser, NGPC). **Loup Co.:** 7.8 km N, 14.9 km W Taylor, 41.8420° N, 99.5600° W (2017; D. Pollard, NGPC); 4.1 km W Taylor, 41.7703° N, 99.4294° W (2014; C. Conard); 1.5 km S, 10.7 km E Taylor, 41.7565° N, 99.2494° W (2017; B. O'Neal, NGPC); 14.4 km N, 7.4 km E Taylor, 41.9010° N, 99.2887° W (2017; K. Geluso, UNK). **Merrick Co.:** 7.9 km NW Clarks, Hwy. 30, 41.2595° N, 97.7626° W (2017; B. Peterson, UNK). **Phelps Co.:** 23 km N, 6.1 km W Funk, 40.6696° N, 99.3228° W (2014; A. Furman, NGPC); 6.1 km N, 2.8 km E Funk, 40.5169° N, 99.2164° W (2017; L. Badura, USFWS); 4.9 km S Odessa, 40.6568° N, 99.2563° W (2017; A. Furman, NGPC); 3.4 km S, 3.3 km E Holdrege, 40.4083° N, 99.3317° W (2017; B. Meduna, NGPC). **Sherman Co.:** 18.9 km S Loup City, 41.1059° N, 98.9580° W (2017; J. Obermiller); 2.4 km N, 6.1 km E Loup City, Sherman Reservoir, 41.2965° N, 98.8931° W (prior to 2017; J. Obermiller). **Valley Co.:** 2.8 km S, 4.6 km E Ord, 41.5807° N, 98.8730° W (2017; D. Teter, NGPC); 2.8 km NW Elyria, 41.6980° N, 99.0304° W (2018; L. Hackworth).
