ASSESSMENT OF LESSER PRAIRIE-CHICKEN USE OF WILDLIFE WATER GUZZLERS

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Abstract.—Man-made water sources have been used as a management tool for wildlife, especially in arid regions, but the value of these water sources for wildlife populations is not well understood. In particular, the value of water as a conservation tool for Lesser Prairie-Chickens (*Tympanuchus pallidicinctus*) is unknown. However, this is a relevant issue due to a heightened conservation concern for the species and its occupancy of an arid landscape anticipated to experience warmer, drier springs and winters. We assessed if Lesser Prairie-Chickens would use commercially available wildlife water guzzlers and if there was any apparent selection between two design types. We confirmed that Lesser Prairie-Chickens would use bird friendly designed wildlife water guzzlers. Use was primarily during the lekking-nesting period (March–May) and the brood rearing period (June–July) and primarily by males. Although both designs were used, we found significantly greater use of a design that had a wider water trough and ramp built into the tank cover compared to a design that had a longer, narrower trough extending from the tank.

Although we were unable to assess the physiological need of surface water by Lesser Prairie-Chickens, we were able to verify that they will use wildlife water guzzlers to access surface water. If it is found surface water is beneficial for Lesser Prairie-Chickens, game bird friendly designed guzzlers may be a useful conservation tool for the species.

The Lesser Prairie-Chicken (*Tympanuchus pallidicinctus*) is a prairie grouse species endemic to the central and southern Great Plains of North America. It has recently received substantive research and conservation attention due to estimated $>$ 90% decreases in distribution and population size since the 1800's (Taylor and Guthery 1980, Hagen et al. 2004). Primary factors contributing to these declines have been identified as habitat loss, degradation and fragmentation by conversion of native plant communities to cropland, overgrazing, and other factors such as energy development (see U.S. Fish and Wildlife Service 2011 for review). Currently, the species is being considered for federal protection under ESA (U.S. Fish and Wildlife Service 2011). Although the heightened conservation concern has led to substantive research of Lesser Prairie-Chickens, there is a paucity of data on the species' ecology, which has hampered implementation of published management guidelines (Hagen et al. 2004).

Water is an important component of habitat for terrestrial wildlife; when not available in adequate amounts, either freely or through food, water can be a limiting factor to wildlife populations (Leopold 1933). Thus, installation of water sources for wildlife has become a common wildlife management tool in arid regions (Broyles 1995, Krausman et al. 2006). However, the value of these water sources for wildlife populations is not well understood (Broyles 1995) and a review of evidence suggests equivocal results (Rosenstock et al. 1999). Although water availability can influence the distribution and or abundance of some game birds, such as Chukar partridge (*Alectoris chukar*), Mourning (*Zenaida macroura*) and White-winged (*Z. asiatica*) doves, and Wild Turkey (*Meleagris gallopavo*), it is generally thought that succulent vegetation meets the water needs for many game birds (Krausman et al. 2006). However, when available, it is not uncommon for game birds to use water sources (Krausman et al. 2006). Although surface water is not thought to

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be critical for survival of Lesser Prairie-Chickens (Hagen and Giesen 2005), it will be used when it is available (Copelin 1963, Jones 1964, Crawford and Bolen 1973, Crawford 1974). Opinions diverge on the importance of free water and whether man-made water sources may serve as a tool to improve habitat for the species (Hoffman 1963), or present risks such as drowning (Andrew et al. 2001) or increased predation. Regardless, free water use by Lesser Prairie-Chickens is a contemporarily relevant issue due to a lack of information on the subject in context of a heightened conservation concern for the species (U.S. Fish and Wildlife Service 2011). Water availability may become especially relevant due to the potential influences of a changing climate (Grisham et al. 2013). The Southern High Plains is expected to experience warmer, drier springs and winters and changes in spring phenology (IPCC 2007). Thus, Lesser Prairie-Chickens may be exposed to increased temperatures and decreased humidity that would result in a greater moisture need than can be obtained through preformed sources; severe drought can result in Lesser Prairie-Chickens forgoing reproduction or experiencing substantial reproductive failure (Grisham et al. in revision).

Wildlife water guzzlers are tanks designed to collect and store rain water so that it is available to wildlife. Wildlife water guzzlers are manufactured in a variety of configurations for different wildlife species, and can be used as part of state and federal wildlife habitat improvement programs. However, the suitability of wildlife water guzzlers for conservation of Lesser Prairie-Chickens has not been assessed. We investigated the utility of commercially available wildlife water guzzlers serving as a management tool for Lesser Prairie-Chicken conservation. Our goals were to determine if 1) Lesser Prairie-Chickens would use commercially available in-ground wildlife water guzzlers designed for game birds, and 2) if there would be a differential use between the two typical designs of wildlife water guzzlers designed for game birds.

STUDY AREA

Our study was located on a large private ranch in Cochran County, Texas. The area falls within the Southern High Plains, and is topographically flat terrain with intermixed sand dunes. Our study area was dominated by sand shinnery oak (*Quercus havardii*) and sand sagebrush (*Artimisia filifolia*) with grasses such as sand bluestem (*Andropogon gerardii* spp. *hallii*), little bluestem (*Schizachyrium scoparium*), sand dropseed (*Sporobolus cryptandrus*), purple three-awn (*Aristida purpurea*), blue grama (*Bouteloua gracilis*), buffalo grass (*Buchloe dactyloides*), and various forbs (Crawford and Bolen 1976). The dominant soil type was a Brownfield-Trivoli fine sand (Pettit 1979). Cattle grazing and crop production were the primary uses of the study area as well as substantial amounts of oil production. There were few active oil wells located in the study area, but anthropogenic features such as abandoned oil pads, cattle watering areas, and corrals were present. Between January 2010 and October 2013, temperatures in the study area ranged from 43.2° C to -19.4° C; June was the hottest month with a mean maximum temperature of 41.3° C and January was the coldest month with a mean minimum temperature of 12° C. Average annual precipitation for the study area from 2010 through 2013 was 32.47 cm (± 18.9 SD) but varied dramatically among months (Fig. 1). Temperature and precipitation data are from the mesonet station at Sundown, Texas (http://www.mesonet.ttu.edu; last accessed 12 December 2013).

METHODS

Water Guzzler Selection

We selected water guzzlers for this study based on the following criteria. First, we presumed that a guzzler requiring construction or complicated assembly and installation would be less attractive to landowners. Therefore, we considered only water guzzlers that were prefabricated, appeared to be easily installed, and were readily available from suppliers. Second, we wanted to assess water guzzlers that were designed for, but not necessarily exclusive to, upland game bird use. Third, given speculation that Lesser Prairie-Chickens may avoid vertical structures, we only considered units that could be installed below ground so that the top was at or near ($<$ 30 cm) level with the ground surface. Finally, we found among the commercially available wildlife water guzzlers that a primary difference was in the size and dimensions of the trough and ramp by which birds accessed water. Essentially, the reservoir feeds water into a trough with a sloped ramp bottom; birds access the water by walking down the ramp to the water edge. Therefore, our final criterion was to select guzzlers of different

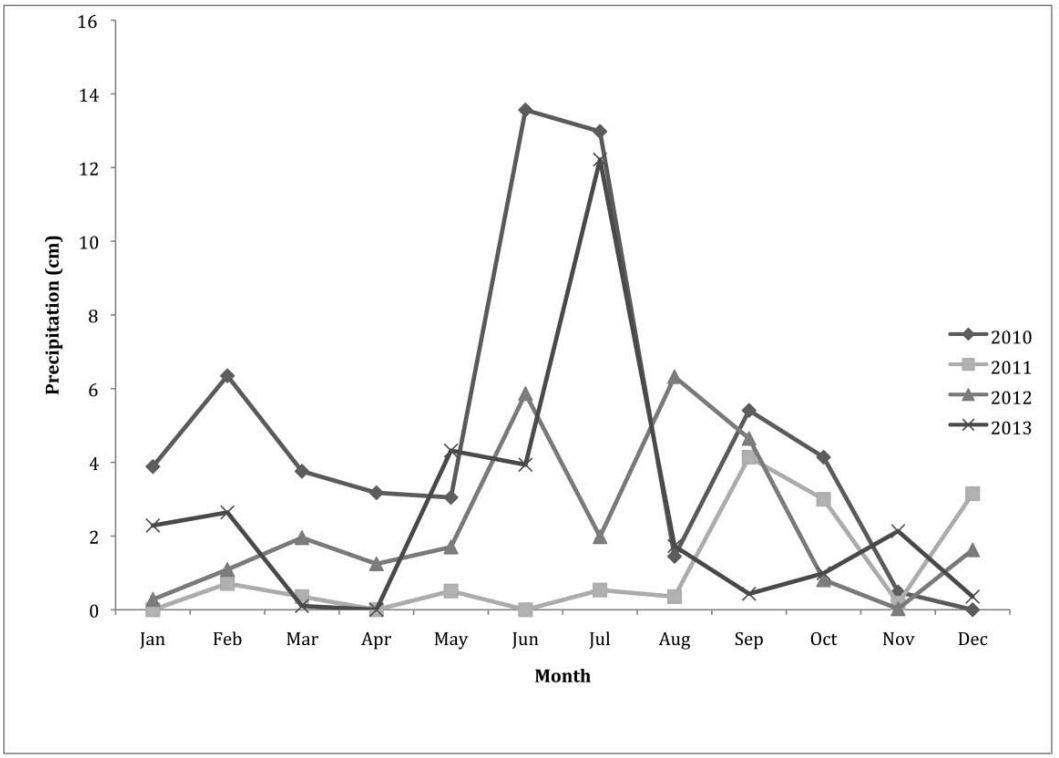

Figure 1. Monthly precipitation for the study area during 2010–2013, Cochran County, Texas.

trough design to assess differences in use by Lesser Prairie-Chickens.

We selected two wildlife water guzzler designs to test. The first was produced by Wildlife Water Guzzlers LCC in Canyon, TX (http://www.wildlife-waterguzzler.com/index.html). The manufacturer's design for upland game birds consists of a circular covered tank with a separate trough attached by a flexible hose (Fig. 2). The tank and trough are constructed of fiberglass and is a dark green color that is of a UV inhibiting pigment. The cover of this model functions as an, albeit small, water collection device in that rainwater is funneled into the reservoir. We selected the 200 gallon (757 liter) model which measures 1.22 m across and 0.61 m deep, with a total surface area of 2.33 m^2. The trough is 1.83 m long, 30.5 cm wide, and has a 19.5 degree slope. Hereafter, we refer to this model as the 'green guzzler'.

The second was produced by Rainmaker Wildlife in Bellingham, WA (http://rainmakerwildlife.com/). The manufacturer's design for upland game birds (i.e., the 'full ramp guzzler') consisted of two pieces; a rectangular 500 gallon (1893 liter) reservoir and a cover with a built in ramp (Fig. 3). The tank measures 2.34 m long, 1.66 m wide and 0.71 m deep. The ramp is 2.21 m long, 1.0 m wide at the ground level end and narrows to 0.74 m wide at the deep end. The ramp is at a 25 degree slope with the deep end being 0.68 m from the cover to the bottom of the trough. The guzzler was constructed of polyethylene and was gray in color using UV inhibitors. The cover of this guzzler does not function as a rain collection device; rather, construction of a rain collection apron would be required unless the tank is manually filled. Hereafter, we refer to this model as the 'gray guzzler'.

In both guzzler types, the ramps were textured to reduce slippage by birds, and the distance that birds walked into the ramped troughs depended on the water volume in the tank; when the tank was full, water reached almost to the end of the troughs.

Water Guzzler Placement

For this study, we selected three leks (hereafter Leks 1, 2, and 3) that did not have an available water source (e.g., spring, stock tank) within 1.5

Figure 2. Installed 757 liter (200 gallon) wildlife water guzzler produced by Wildlife Water Guzzlers LCC in Canyon, TX (http://www.wildlifewaterguzzler.com/index.html).

Figure 3. Installed 1893 liter (500 gallon) wildlife water guzzler produced by Rainmaker Wildlife in Bellingham, WA (http://rainmakerwildlife.com/).

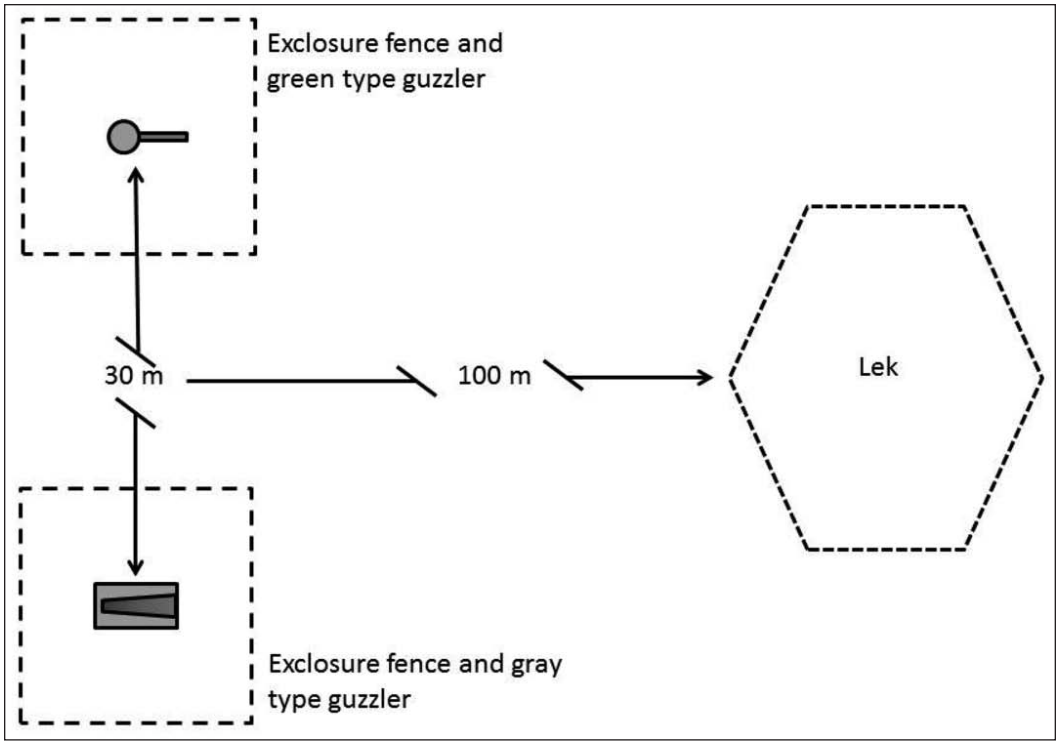

Figure 4. Example arrangement of wildlife water guzzler placement for a study of use by Lesser Prairie-Chickens. Green and Gray type guzzlers are placed within 9.7 m × 9.7 m exclosures and situated 30 m apart and 100 m from the edge of a Lesser Prairie-Chicken lek. Images not drawn to scale. Green Guzzler = manufactured by Wildlife Water Guzzlers LCC in Canyon, TX (http://www.wildlifewaterguzzler.com/index.html); design consists of a circular covered tank with a separate trough attached by a flexible hose; Gray Guzzler = manufactured by Rainmaker Wildlife (http://rainmakerwildlife.com/); the design consisted of a rectangular reservoir and with a ramp built into the cover.

km radius. All three leks were known to have been active display grounds for Lesser Prairie-Chickens in 2011. We installed pairs of each wildlife water guzzler type 30 m apart and at a distance of 100 m from the edge of each of the three leks (Fig. 4). Guzzlers were flush with the ground; this set-up allowed for guzzler types to be equally available to Lesser Prairie-Chickens. We placed fencing around each guzzler to exclude cattle, wild hogs (*Sus scrofa*), and deer (*Odocoileus* spp.); this was to protect guzzler integrity and to more easily maintain sufficient water levels (Fig. 5). All guzzler enclosures were constructed of 4.8 m cattle panels, 2.5 m t-posts, and chicken wire. Cattle panels were sunk 30 centimeters in the ground. The guzzler fence enclosure had one level of cattle panel that reached approximately 1 meter in height. We cut and evenly spaced 20 by 40 cm entrance holes in the cattle panels at ground level. We attached chicken wire fencing above the cattle panel to a height of 1.8 m. Thus, the fence enclosure dimensions were 9.75 m by 9.75 m square, with a height of 1.8 m. All guzzler installation, enclosure construction, and camera installation were completed by 21 December 2011.

We used a 125 gallon tank and gas motor powered water pump seated on a single axle trailer (approximately 1.2 m by 1.5 m) towed by a 450cc Honda Foreman ATV to refill guzzlers. We kept guzzlers filled to at least half capacity by refilling them at least once per month.

Trail Camera Monitoring

We used motion activated cameras with infrared nighttime flash to monitor Lesser Prairie-Chicken use of the guzzlers. Cameras were located inside each enclosure fence and oriented to face the trough of the guzzler. Each captured image was date and time stamped, and we replaced memory cards and batteries as needed. When analyzing the motion-

Figure 5. Exclosure fence constructed around a wildlife water guzzler to exclude large ungulates.

sensing camera pictures, we first wrote down the lek number and guzzler type, and the dates for which data were recorded on the data disk. We scanned through all pictures searching for images of Lesser Prairie-Chickens. To distinguish visits by different birds from continual presence and use during one visit by the same bird, we did not record a new visit unless there was a fifteen minute gap between sightings of the species. If a prairie-chicken was present for longer than fifteen minutes and a new prairie-chicken arrived, we counted it as the same visit but increased the total count of individuals using the guzzler. When a Lesser Prairie-Chicken was detected, we recorded the date and time, number of individuals, and sex (when discernible). All data were recorded into an excel file and photographic images were moved to an archive folder on a hard drive backup.

We allowed an acclimation period from December 2011 through February 2012 during which we kept guzzlers filled but were not collecting data. Starting March 2012, we collected data via the cameras continuously through July 2013. We decomposed the year into discrete units relevant to the ecology of Lesser Prairie-Chickens: March–May is the lekking and nesting period, June–August is the brood rearing period, September–February is the non-breeding season (Hagen and Giesen 2005). For analysis, we considered a trap-day as a 24 hr period in which the camera was present and collecting data at a guzzler. We calculated prairie-chicken use on basis of count of visits by birds per trap day. For example, 3 birds/ trap day could consist of one visit by a group of 3 prairie-chicken or 3 different visits (i.e., separated by $\geq$ 15 minutes) by single prairie-chickens.

Analyses

This is primarily an observational and descriptive exploration of Lesser Prairie-Chicken use, or lack-thereof, of commercially manufactured wildlife water guzzlers. We provide raw counts, means and standard errors where appropriate. To assess equitability in use of guzzler types, we used a Chi-square test for homogenous frequencies setting the expected values for each guzzler type as 50% of the total observed visits by prairie-chicken to the guzzlers (Fowler et al. 1998).

RESULTS

We collected data from March 2012 through July 2013, with 514 camera trap days at Lek 1, 510 camera trap days at Lek 2, and 478 camera trap days at Lek 3. We recorded 27,261 digital photographic images at the Lek 1 guzzlers, 61,753 images at the Lek 2 guzzlers, and 31,810 images at the Lek 3 guzzlers. We only detected Lesser Prairie-Chickens visiting guzzlers at Lek 1 and Lek 2. Although all three leks were active in 2011, we

subsequently confirmed that Lek 3 was inactive in 2012, which may explain the lack of any visits by prairie-chickens to the Lek 3 guzzlers. Therefore, we removed the Lek 3 guzzlers from all subsequent data analysis.

When considering only Leks 1 and 2, we conducted 1024 camera trap days and recorded 8,914 digital photographic images. Few of the images were of our target species, but we confirmed 43 visits by Lesser Prairie-Chickens to guzzlers with 1.34 (± 0.11 SE) prairie-chickens (n = 58) detected per visit. The majority of Lesser Prairie-Chicken visits occurred during the lekking and brood rearing periods of 2012 (Table 1). Only 3 visits were detected in the non-breeding period and no detections occurred during the lekking or brood rearing periods of 2013 (Table 1). We were able to identify 46 visiting prairie-chickens as male, 9 as female and 3 as unknown. Although male prairie-chickens were detected across several months, females were identified at guzzlers only during June 2012. There was a clear bimodal pattern of visits to guzzlers by prairie-chickens, with 74% of visits occurring between 0534 and 0919 hrs, and 26% of visits occurring between 1747 and 2033 hrs. Although Lesser Prairie-Chickens used both guzzler types, the majority of detections (81%) were at the gray guzzlers (Table 2). A test for homogenous frequencies indicated the difference in use was significant ($\chi^2_1 = 22.34$, $P < 0.001$).

DISCUSSION

It is reported that Lesser Prairie-Chickens will use surface water when it is available (Copelin 1963, Jones 1964, Crawford and Bolen 1973, Crawford 1974). We were able to expand on this and confirm that Lesser Prairie-Chickens will use wildlife water guzzlers designed for game bird use. Although Lesser Prairie-Chickens will use commercially manufactured guzzlers, we reject our second hypothesis that there would be no difference in use of game bird-friendly model types; indeed, we found substantial difference in use between the two models we examined.

If anthropogenic water sources are pursued as part of conservation efforts for Lesser Prairie-Chickens, the design of the wildlife water guzzlers we examined may be especially beneficial for hens with broods. We have evidence of hen prairie-chickens bringing their broods to areas were water has overflowed from above-ground stock tanks (unpublished data). We have observed chicks walking into the water to drink and, wading deep enough to wet their legs and possibly aid in thermoregulation by evaporative cooling (Costa et al. 2005). The guzzlers we tested may possibly allow access by prairie-chicken chicks with little risk of drowning. Although we never observed hens bringing broods to the guzzlers, this may have been due more to low reproduction during the study period. The study area had undergone severe drought in 2011 during which all radio-tagged hens in the study area experience nest failure (Grisham 2012); drought conditions persisted throughout 2012 and nesting success was poor (Boal unpub. data).

The primary purpose of the exclosures was to keep large mammals, such as deer, cattle, and feral hogs, away from the guzzlers so that water would be consistently available under our refill schedule. However, the exclosure did not prevent access by

Table 1. Detections of Lesser Prairie-Chickens at wildlife water guzzlers in Cochran County, Texas, March 2012–July 2013.

Perioda	Detections	Camera Trap Days	Detections/Day
Lekking-nesting 2012	35	180	0.194
Brood rearing 2012	20	184	0.109
Nonbreeding 2012-13	3	362	0.008
Lekking 2013	0	184	0.000
Brood rearing 2013	0	114	0.000
Total	58	1024	0.057

[a] Lekking-nesting = March – May; Brood rearing = June – August; Nonbreeding = September – February.

Table 2. Lesser Prairie-Chicken detection rates at two different guzzler types, Cochran County Texas, March 2012–July 2013.

Guzzler Type[a]	Detections	Camera Trap Days	Detections/Day
Green Guzzler	11	1024	0.011
Gray Guzzler	47	1024	0.046

[a]Green Guzzler = manufactured by Wildlife Water Guzzlers LCC in Canyon, TX (http://www.wildlifewaterguzzler.com/index.html); design consists of a circular covered tank with a separate trough attached by a flexible hose; Gray Guzzler = manufactured by Rainmaker Wildlife (http://rainmakerwildlife.com/); the design consisted of a rectangular reservoir and with a ramp built into the cover.

smaller animals and birds. Coyotes (*Canis latrans*), badgers (*Taxidea taxus*), and raptor species such as Swainson's Hawks (*Buteo swainsoni*) and Northern Harriers (*Circus cyaneus*), were able to enter the exclosures but no prairie-chicken were ever killed by predators within an exclosure. The fact that prairie-chicken readily visited guzzlers suggests that the exclosure fence did not deter them. If guzzlers were to be used as a conservation tool for Lesser Prairie-Chickens, or indeed, any other game bird species, similar exclosures could be beneficial in restricting access by large mammals. Large animals, especially aggregating domestic livestock, could quickly drain a guzzler and damage both the soil and vegetation around it. Exclosures could prevent this and insure water was available for game birds.

Surface water is not considered critical for Lesser Prairie-Chickens (Hagen and Giesen 2005). However, in a rapidly change landscape and climate (IPCC 2007, Grisham et al. 2013), natural moisture may become more limited and the physiological needs of Prairie Chickens may become greater due to temperature increases and lessened humidity. The issue of water use by Lesser Prairie-Chickens, and the possibility of any ecological or conservation benefit, is a topic of research that warrants more attention. Until more information becomes available, however, we have 1) demonstrated that the species will use game bird friendly wildlife water guzzlers, and 2) suggest the ramped design may be beneficial for brood survival in that water is accessible by chicks with little or no risk of drowning. If actions are initiated to provide water for conservation of prairie-chicken, we suspect that game bird friendly water guzzlers may be useful.

MANAGEMENT IMPLICATIONS

We confirmed that Lesser Prairie-Chickens will use surface water provided by bird friendly wildlife water guzzlers, but we do not know the influences, if any, that providing water will have on the species survival, reproductive output, or brood survival. Additionally, different types of guzzlers may provide different benefits or be more or less attractive to the species. These questions may warrant investigation prior to using wildlife water guzzlers as a conservation tool for Lesser Prairie-Chickens.

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