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Save for a Rainy Day:
Navigating Wildlife Water Needs in a Changing Climate

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Water is the essence of life on earth, and nowhere is this more evident than in arid regions. In these harsh yet remarkably diverse landscapes, water scarcity is the defining feature, exerting a profound influence on the distribution and abundance of wildlife. As the climate changes, increased and extended periods of drought are expected, leading to changes in the vegetation community, increased erosion, and ultimately water availability for wildlife.

Wildlife need water for normal metabolic function, waste excretion, and to transport nutrients and minerals throughout the body. Wildlife rely on three forms of water to meet their water requirements: free, preformed, and metabolic. Free water is standing water, such as lakes, ponds, streams, or rivers. Preformed water is water contained within food, and metabolic water is water produced during the breakdown of food, particularly carbohydrates, fats, and proteins. While some species, such as bobwhite and scaled quail, can survive almost entirely on metabolic water, and coyotes can depend on preformed water, free water remains crucial for many species.

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Case Study

To investigate the diversity of wildlife using free water sources in arid environments, we monitored three natural springs: Kibbee Spring, La Paloma Spring, and Window Spring, in the Chisos Basin of Big Bend National Park in West Texas (Fig. 1).

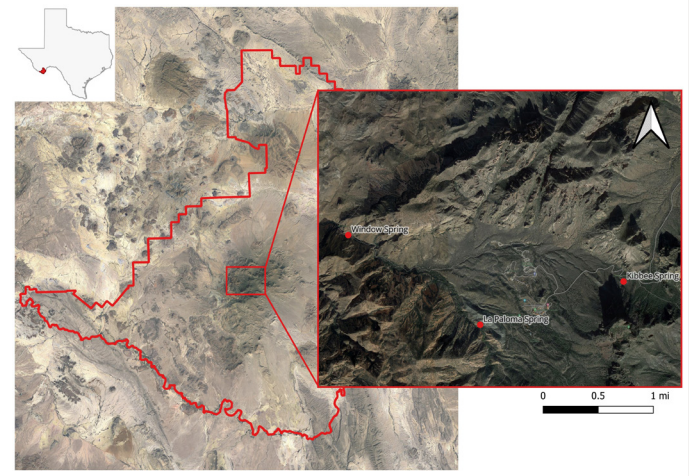

Figure 1. Chisos Basin in Big Bend National Park, Texas, USA with each camera-trap spring location, including Kibbee Spring, La Paloma Spring, and Window Spring.

The arid climate of the Chisos Basin is marked by monsoonal rainfall patterns with intermittent heavy rainfall during the summer months and extended dry periods of little to no precipitation in the winter, with an average annual rainfall of 16.9 inches (Fig. 2). Despite the challenging landscape,

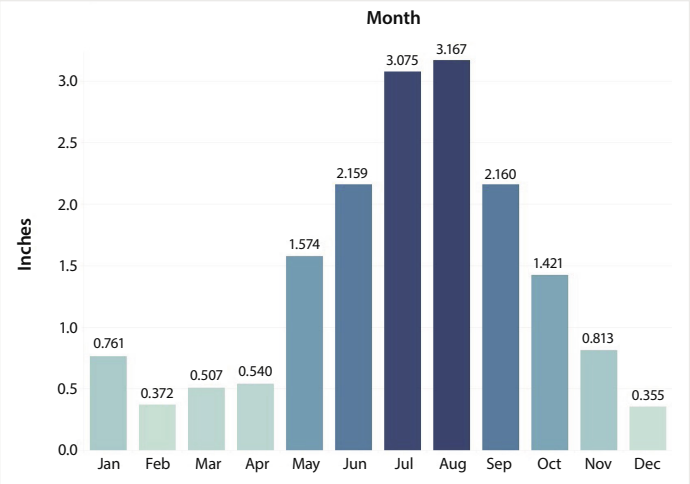

Figure 2. Average monthly precipitation in inches for the Chisos Basin in Big Bend National Park, Texas compiled from the Western Regional Climate Center data.

the area boasts more than 450 species of birds, 75 species of mammals, 56 species of reptiles, and 11 species of amphibians.

We monitored wildlife use of the springs by placing motion-activated game cameras set to a 5-minute delay at each spring and collected images from January 2015 to October 2016 (Fig. 3). In total, 3,217 animal photographs were collected containing more than 24 species (Table 1).

The most frequent visitor across sites was the gray fox (*Urocyon cinereoargenteus*), with 743 visits, accounting for nearly a quarter (23 percent) of all observed visits (Fig. 4). The second most observed species was the ringtail (*Bassariscus*

Table 1. The frequency of wildlife visits at three free water sources, Kibbee Spring, La Paloma Spring, and Window Spring, in the Chisos Basin of Big Bend National Park, Texas, USA, collected with motion-activated game cameras.

Scientific Name	Common Name	Kibbee Spring	La Paloma Spring	Window Spring	Total
Accipiter cooperii	Cooper's hawk	0	5	0	5
Ammospermophilus interpres	Texas antelope squirrel	1	0	2	3
Aphelocoma wollweberi	Mexican jay	41	46	47	134
Bassariscus astutus	Ringtail	274	53	248	575
Buteo jamaicensis	Red-tailed hawk	0	17	0	17
Buteogallus anthracinus	Common black hawk	0	1	0	1
Cardinalis sinuatus	Pyrrhuloxia	1	0	4	5
Cathartes aura	Turkey vulture	0	94	0	94
Conepatus mesoleucus	Hog-nosed skunk	86	3	67	156
Geococcyx californianus	Roadrunner	16	5	14	35
Lynx rufus	Bobcat	0	2	1	3
Mephitis macroura	Hooded skunk	4	0	0	4
Mephitis mephitis	Striped skunk	13	0	0	13
Odocoileus virginianus carminis	Carmen Mountain white-tailed deer	301	206	0	507
Otospermophilus variegatus	Rock squirrel	175	34	54	263
Pipilo erythrophthalmus	Rufous-sided towhee	16	0	0	16
Procyon lotor	Raccoon	7	137	46	190
Puma concolor	Rountain lion	1	7	6	14
Spilogale gracilis	Spotted skunk	7	0	29	36
Sylvitagus audubonii	Desert cottontail	13	0	0	13
Sylvitagus floridanus	Eastern cottontail	7	0	0	7
Urocyon cinereoargenteus	Gray fox	388	30	325	743
Ursus americanus	Black bear	28	27	59	114
Zenaida asiatica	White-winged dove	0	5	9	14
Unknown bird	*Unknown bird	93	28	26	147
Unknown mammal	*Unknown mammal	44	12	52	108
Grand Total		**1,516**	**712**	**989**	**3,217**

astutus) with 575 visits, followed by Carmen Mountain white-tailed deer (*Odocoileus virginianus carminis*) with 507 visits. A few species, including hooded and striped skunks (*Mephitis macroura*, *Mephitis mephitis*), desert cottontail (*Sylvilagus audubonii*), and eastern cottontail (*Sylvilagus floridanus*) visited Kibbee Spring and no other location. La Paloma Spring had the greatest number of raccoon (*Procyon lotor*) visits, totaling 137.

Species observed utilizing only La Paloma Spring were Cooper's hawk (*Accipiter cooperii*), common black hawk (*Buteogallus anthracinus*), red-tailed hawk (*Buteo jamaicensis*), and turkey vultures (*Cathartes*

Figure 3. Images captured at Kibbee Spring, La Paloma Spring, and Window Spring in Big Bend National Park, Texas, USA, in 2015. Pictured from left to right are a Carmen Mountain white-tailed deer, a mountain lion, and a black bear.

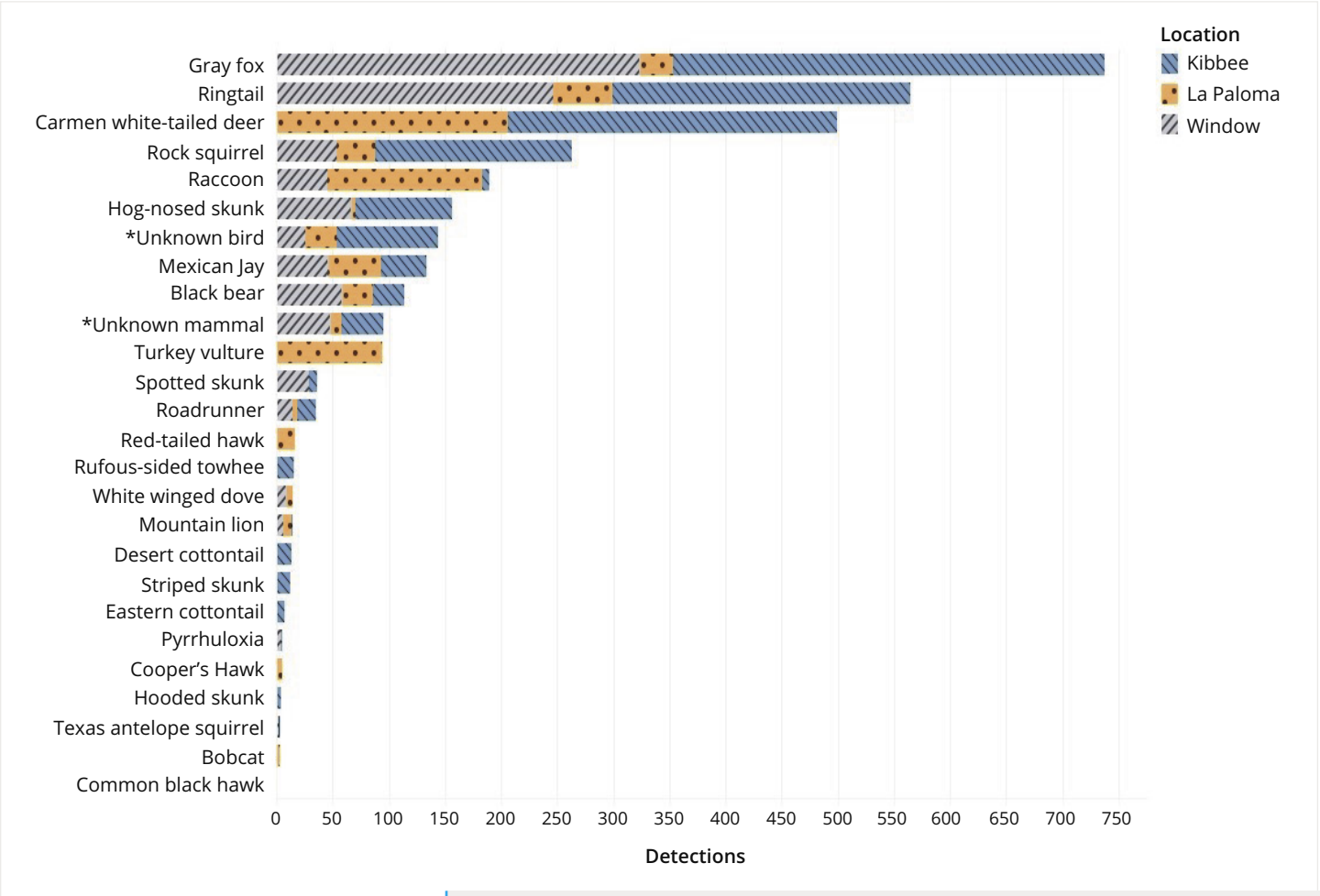

Figure 4. Total visits of each species at Kibbee Spring, La Paloma Spring, and Window Spring from January 2015 to October 2016, organized by greatest to least.

aura). The abundance of large birds at this site may be due to the open nature of the location; the water is not obscured by vegetation and is more easily accessed from above. Window Spring recorded twice as many black bear (*Ursus americanus*) visits as the other two spring sites. Notably, black bears are predators of Carmen Mountain white-tailed deer (*O. virginianus carminis*), and no deer were recorded visiting this location.

Rainfall in Texas

Climate change is expected to markedly alter global weather patterns, increasing periods of drought and the frequency of extreme weather events. These changes have become evident in Texas. According to climatologists, daily temperature averages have increased by 1.5° Fahrenheit (F) since the beginning of the 20th century, and the number of 100-degree days recorded annually has doubled in the past four decades. While a dramatic difference in precipitation patterns exists between eastern and western Texas, projections indicate a decrease of up to 10 percent of annual precipitation by the mid-21st century (Fig. 5).

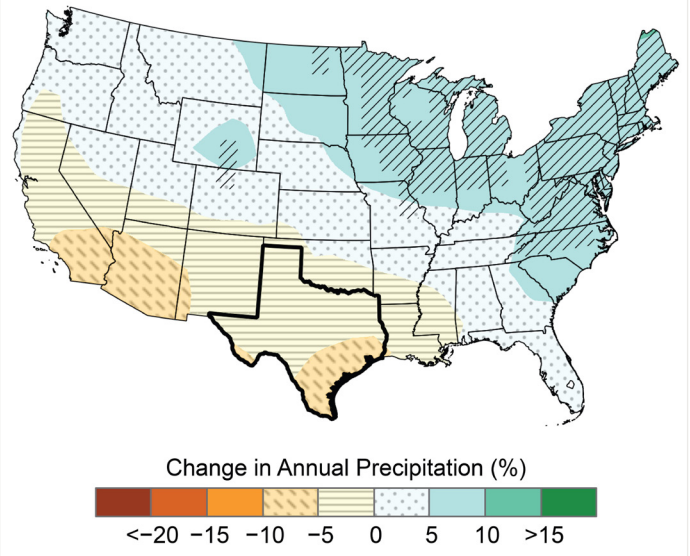

Figure 5. Projected change of annual precipitation (%) for the mid-21st century compared to late 20th century under a high emissions pathway. Hatching indicates areas of most significant change under most climate models (*statesummaries.ncics.org*).

Wildlife Water Availability

Daily water requirements for wildlife depend on many factors, including species, environmental conditions, and life history status. Some species are better adapted to conserve water and thus require less water to survive. During warmer temperatures, daily water requirements can increase as wildlife need additional water for thermoregulation. Certain life history events, such as lactation, can also increase daily water requirements.

Another consideration when determining water availability is an animal's ability to travel to a water source. Water distribution is an important factor in wildlife management (Table 2).

Table 2. Recommended water-source distribution according to animal group.
***Adapted from Cathey et al., *Harvesting Rainwater for Wildlife* (2006).**

Animal Group	Recommended Water Source Distribution
Large mammals (deer, coyotes, bobcats)	1 per 320–640 acres
Medium mammals (javelinas, fox, skunks, raccoons)	1 per 320 acres
Small mammals (armadillos, squirrels, rabbits)	1 per 80–160 acres
Wild turkey and mourning dove	1 per 320–640 acres
Quail and most songbirds	1 per 80 acres

Water and Wildlife Tax Valuation

Over 95 percent of Texas is privately owned, indicating that the stewardship for wildlife is in the hands of the public. Land managers can adopt wildlife-friendly land use practices that promote water conservation and enhance habitat suitability for wildlife, and there are incentives for those who do. Article 8 of the Texas Constitution allows property tax relief to landowners in exchange for managing their land for wildlife conservation with defined management practices such as providing supplemental food, shelter, and water. Amidst continuing habitat loss and climate change, prioritizing, protecting, and restoring water sources can help ensure a sustainable future for wildlife.

Ways to Provide Free Water for Wildlife

Water guzzlers – Rainwater catchment systems, in combination with a water trough, effectively harvest, store, and make rainwater available for wildlife.

Raingarden – A shallow depression in the land constructed with stones and native plants to create ephemeral puddles to collect storm runoff.

Farm ponds – Small ponds can provide a free water source while reducing nutrient runoff and erosion.

Riparian zone protection – Creating buffers to protect riparian areas is crucial for maintaining natural water sources.

Water-efficient landscaping – Utilizing drought-tolerant plants and water-saving irrigation techniques reduces competition for water resources with wildlife.

Habitat restoration – Restoring degraded habitats through native revegetation and erosion control measures helps stabilize soils, retain moisture, and enhance water infiltration. Native plants also provide food and habitat cover for wildlife to help reduce water stress.

Resources

agrilifeextension.tamu.edu/asset-external/wildlife-management-and-property-valuation-in-texas/

tpwd.texas.gov/landwater/land/private/agricultural_land/

https://tpwd.texas.gov/landwater/land/private/lip/

agrilifeextension.tamu.edu/asset-external/water-law/

fisheries.tamu.edu/pond-management/

rainwaterharvesting.tamu.edu/raingardens/

watersmart.tamu.edu/rain -garden/

watersmart.tamu.edu/

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- Cover banner, farm ponds, riparian zone protection, water efficient landscaping, and habitat restoration by Natalie Craig
- Water guzzlers by Kathy Galloway
- Raingarden by Texas A&M AgriLife Extension Service

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