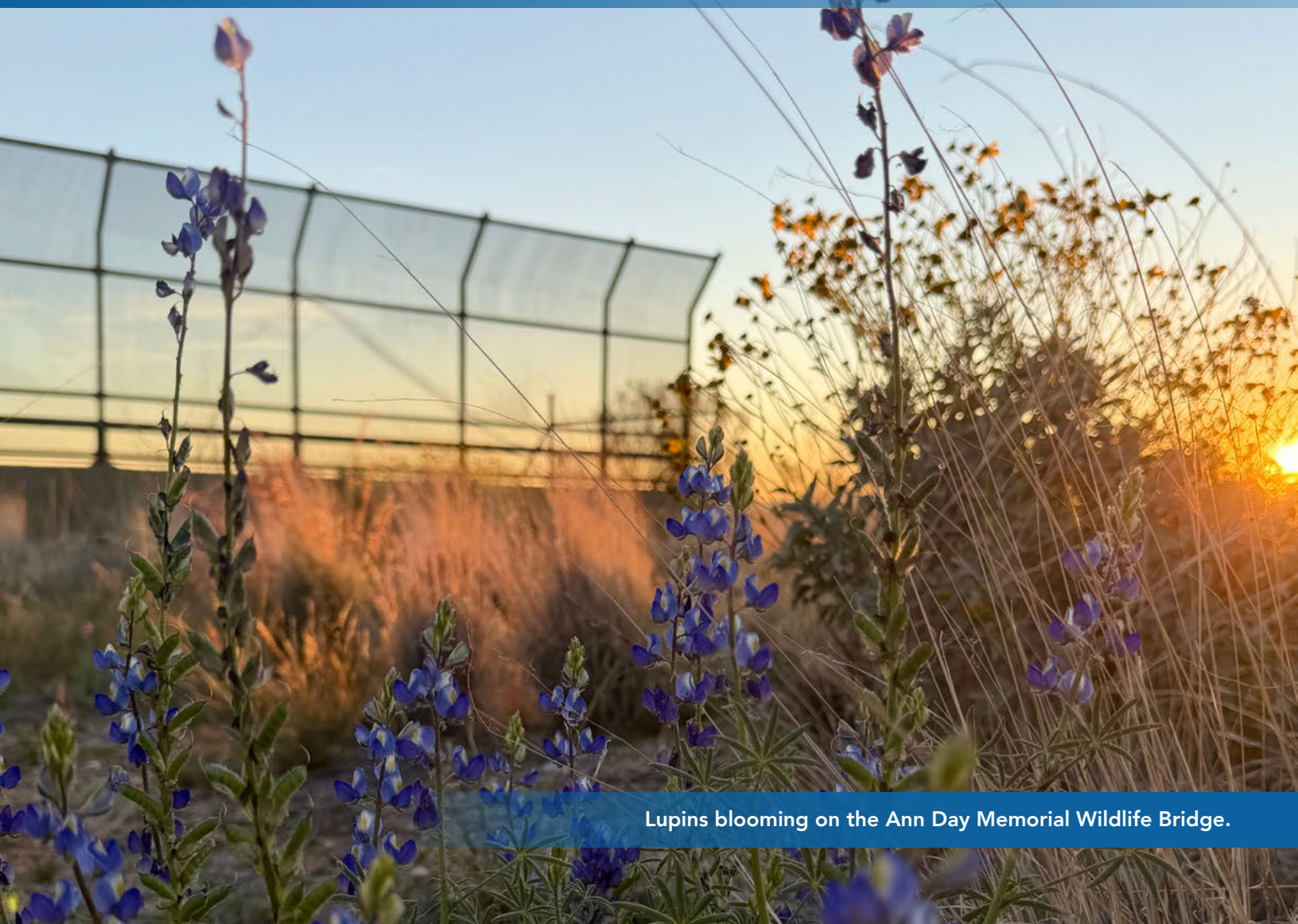


Desert wildlife crossings:

*A 13-year community science project
at the Oracle Road wildlife crossings*

Final report

Pima County, Arizona
2012–2025



Lupins blooming on the Ann Day Memorial Wildlife Bridge.



“Atop the crossing, I tried to conjure its future. Lives not on the road but over and beyond it, a road that animals would never meet, a road the land would never notice.”

– Ben Goldfarb, *Crossings: How Road Ecology is Shaping the Future of the Planet*

CSDP's Wildlife Camera Monitoring Project in Oro Valley is **the longest continuous community science project of its kind in the southwest.**

We hope that distinction will not stay ours for long.

In memory of Bob Cratty, Elizabeth Deupree, Josh Skattum, Pima County District 1 Supervisor Ann Day and dedicated to everyone who cares for the Sonoran Desert.

Contents

Overview 5

About CSDP’s Wildlife Camera Monitoring Project. . . . 6

Quick snapshot of results 8

The study area 10

 Our camera locations. 13

Initial findings from the crossings: Arizona Game and Fish Department data 14

Findings from the study area: CSDP data 16

 Species diversity 16

 Species distribution 18

 Special appearances 20

 Responses to the crossings 21

 Seasonal shifts 24

 Path of the puma 27

Other data we collect 28

Caring for the wildlife crossings 30

Conclusion 32

Overview

In 2016, the first wildlife bridge in the Sonoran Desert and its sister wildlife underpass were built across Oracle Road in Pima County.

Healthy wildlife populations need room to roam. Wildlife in Oro Valley was, and still is, struggling due to rapid development and roads that challenge their survival—from vehicle collisions, shrinking habitat, and other physical barriers that separate new mates from reaching each other.

The Oracle Road wildlife crossings gave an assist and wildlife immediately started to use them.

The first animal to approach the crossings was a desert tortoise, who attempted to cross through the new underpass while it was still under construction. Deer began using the crossings within the first week. By 2025, black bears and mountain lions had joined the list, along with 45 other species.¹

The crossings now see around 3,500 animals every year.

This comes from data from Arizona Game and Fish Department (AZGFD) cameras on the actual wildlife crossings, while CSDP’s Wildlife Camera Monitoring Project used a fleet of cameras in the surrounding linkage and study area.

Thirteen years later, our data validates that these wildlife crossings are used by wildlife and benefit the surrounding ecosystem. We also learned a lot about the maintenance and care of these structures.

¹ AZGFD wildlife crossing data is expected to be published by early 2027 and was shared with CSDP though a mutual data-sharing agreement.



The Oracle Road wildlife underpass.



Aerial view of the Ann Day Memorial Wildlife Bridge from NBC’s 1st Look episode featuring CSDP in 2019.

About CSDP's Wildlife Camera Monitoring Project

Humble beginnings

2012. Our first wildlife camera workshop in Oro Valley in 2012 was inspired by residents that wanted to monitor bobcats in their backyards.

This evolved into our Wildlife Camera Monitoring Project, which had a short list of goals:

- 1. Use the photos for education and outreach,
- 2. Use the data to inform land use decisions,
- 3. Engage people as local advocates and stewards of wildlife, and
- 4. Document wildlife species before, and after, wildlife crossing construction.

2025. With plenty of data, we wrapped up—nine years after the Oracle Road crossings became a reality, and three years after CSDP's Caring for Crossings re-vegetation project began.

Project stats at a glance

- **483,800** photos collected
- Around **285,100** photos where we could verify a species
- Around **141,400** individual wildlife detections
- **5,972** days of monitoring
- **4,884** volunteer hours²
- Over **100+** cameras used and countless batteries
- **65** species identified
- **65** camera locations
- **105** camera monitor volunteers, **16** wildlife identifier volunteers, and **8** wildlife data interns (see our acknowledgements for more!)

Plus countless muddy boots, seed-filled socks, lessons learned (use the same key for all locks!), untold numbers of spiders nesting in the camera boxes, and many new friends made.



CSDP staff and volunteers at the Oracle Road wildlife underpass for habitat restoration work.

Measuring success

Using our data, and complemented by Arizona Game and Fish Department's data, we set out to explore **whether the wildlife crossings work.**

Our conclusion: **Yes, they do.** Let's explore in more detail.

"One of the best stories for me was when a group of horses got onto the highway, interfering with traffic, and had to be shooed by drivers to the other side. We got video of them using the underpass to get back home minutes later. Otherwise, they would have tried crossing the highway again. That was a potential tragedy averted. These crossings help more than wildlife."

– Christine DeMatteo, *Desert Monitor* 2015-2026



² Volunteer hours pre-2019 were estimated using data from later years.



Highlights
from the crossing cams and more across this project



Quick snapshot of results

Here's a quick summary of what we saw or learned over 13 years and from nearly half a million photos:

Species

- We documented over **65 species**, and the mix of species ("species diversity") was consistently high—which is good.
- That said, **we've seen most species far less often after 2020**—and numbers haven't bounced back much. We have some theories, but don't know why this is for sure.
- Coyotes were the **most commonly photographed animals**, followed by desert cottontail, mule deer, jackrabbits, javelina, bobcats, and Gambel's quail.
- People, coyotes, bobcats, and javelina were the **most widespread species**—showing up on more than 80% of our cameras.
- **Rare cameos** included Gila monster, desert tortoise, bighorn sheep, white-nosed coati, mountain lion, black bear, ringtail, spotted skunk, and striped skunk.
- We saw **very few mesocarnivores** (which are medium-sized omnivores like skunks)—a sign that development is affecting this ecosystem.
- We saw only three different individual **mountain lions**.
- **Coyotes** appear to be a keystone species and the top predator in the area.



Crossing impacts

- **Animal activity increased substantially** around when the wildlife crossing structures opened.
- Many animals became more active during construction, too—mule deer were an exception.
- After the crossings were built, **there was an increase in species observed west of the highway**.
- **Animals appeared to use the crossings to move to new areas**, and less so to travel back and forth.
- Javelina, bobcats and coyotes generally moved east, while mule deer shifted west.
- Wildlife favored the open space and limited development on the east side of Oracle Road. **Open space works!**



The study area

CSDP defined a rectangular study area along Oracle Road, and just west and east of it, to study the wildlife linkage and its intersection with the wildlife crossings (before, during and after construction, the roadway, development, and different habitats).

The wildlife linkage

The Tortolita – Santa Catalina Mountains Wildlife Linkage³ is an ecological lifeline between the two mountain ranges and for protected areas such as Tortolita Preserve and Tortolita Mountain Park (west of Oracle Road) and Catalina State Park and Coronado National Forest (east of Oracle Road). It's part of the broader Tucson – Tortolita – Santa Catalina Mountains linkage where most of CSDP's work takes place (Figure 1).

The linkage spans Pinal and Pima County and is a patchwork of protected, developed, and undeveloped areas that animals must navigate. Some of these areas have an uncertain future as Arizona State Trust lands.

Habitat within the linkage

Habitat includes **desert scrub**, **desert grasslands**, and **higher-elevation pine and oak woodlands** that even receive snow.

Honey Bee Canyon and Big Wash provide important **riparian habitat** to the west of Oracle Road, while Sutherland Wash and Cañada del Oro Wash connect Catalina State Park with Coronado National Forest to the east.

“Hazel looked down at the road in astonishment... ‘But that’s not natural,’ he said... ‘What is it? How did it come there?’”
– *Watership Down*

Oracle Road (SR-77) cuts right through the linkage

In 2006, academic experts, the Arizona Department of Transportation, and the Arizona Game and Fish Department all agreed: this is one of Arizona’s most critical wildlife corridors, and it’s **facing the most development pressure**.⁴

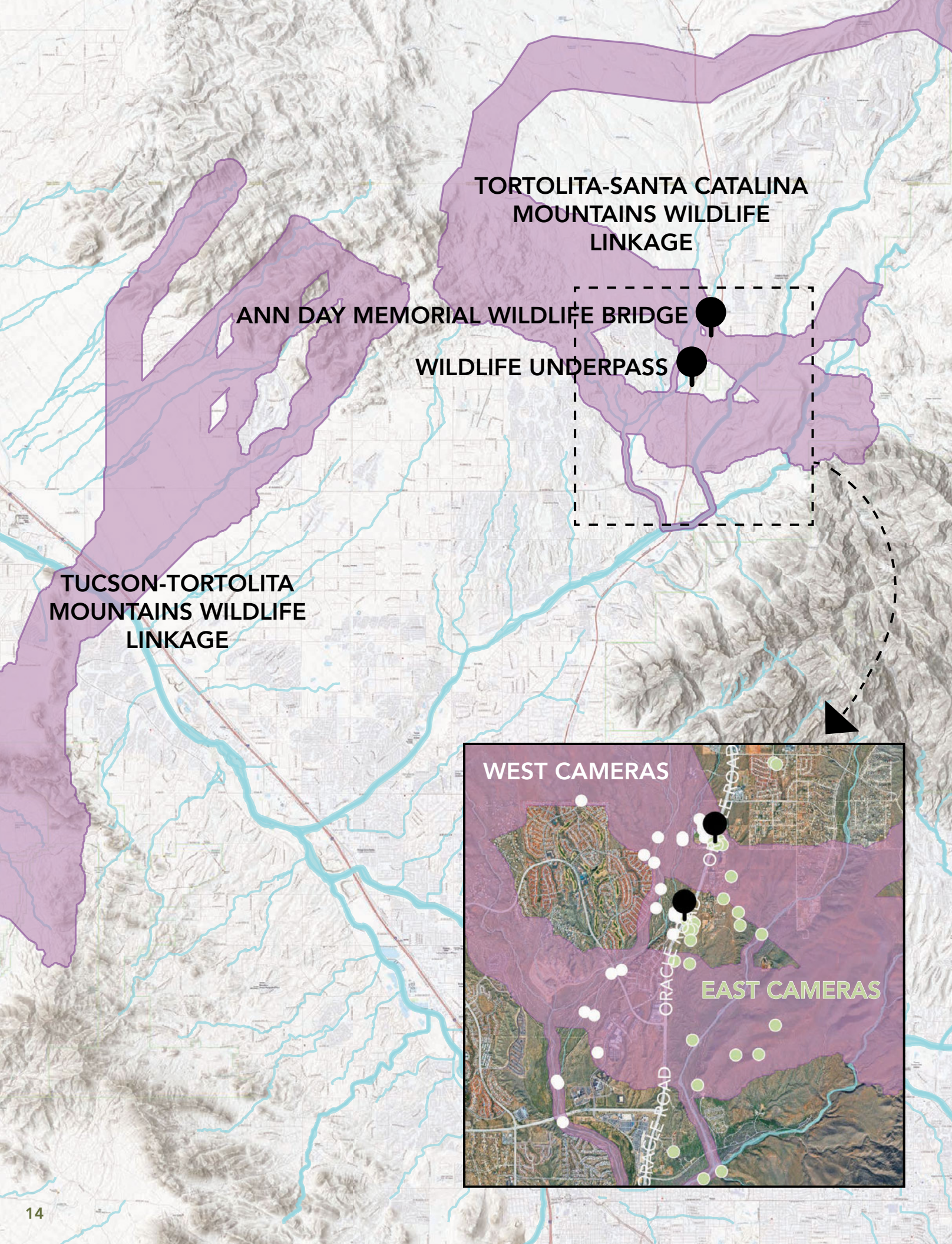
Along with the busy road, wildlife is also limited by development (including Rancho Vistoso and Sun City) and heavy recreational use of open space—including on and off-trail hiking, dog walking, mountain biking, and horseback riding. State Trust lands also include cattle and barbed wire fencing that is dangerous for wildlife.

Views from atop the Ann Day Memorial Wildlife Bridge in spring.



4 Arizona Wildlife Linkages Workgroup. 2006. Arizona Wildlife Linkages Assessment. Arizona Department of Transportation. <https://azdot.gov/business/environmental-planning/programs/wildlife-linkages>

3 Beier, P., E. Garding, and D. Majka. 2006. **Arizona Missing Linkages: Tucson – Tortolita – Santa Catalina Mountains Linkage Design**. Report to Arizona Game and Fish Department. School of Forestry, Northern Arizona University.



Our camera locations

CSDP monitored the wildlife linkage around the wildlife crossings, complementing AZGFD's cameras on the crossings.

At one point, we had 40 cameras⁵ operating at the same time. We finally settled on 24 cameras.

Over the life of the study, we tried **65 different camera locations**—we had to move some cameras because of the risk of theft, flooding, or too much human disturbance.

From May 2012 through May 2025, we had cameras on both sides of Oracle Road.

- As is best practice,⁶ most cameras were parallel to the ground at knee-height to detect medium to large-sized mammals.
- We picked locations in washes and near wildlife trails where animals were more likely to move near our cameras.
- This means our data isn't random—we saw a higher than average number of species, and biased towards species that use washes.

Since 2017, our final 24 camera locations have included 12 on each side of Oracle Road.

- All locations were in natural open space within 1.2 miles of Oracle Road. We split these into "East" and "West" of the road (Figure 1).
- We put cameras near the east and west approaches to both wildlife crossings.

◀ **Figure 1.** The wildlife linkage and our camera locations on both sides of Oracle Road.

⁵ We used Cuddeback models until replacing the fleet in 2019 with newer Bushnell Core DS 4K No Glow wildlife cameras.

⁶ Kolowski JM, Forrester TD. 2017. Camera trap placement and the potential for bias due to trails and other features. PLOS ONE 12(10): e0186679. <https://doi.org/10.1371/journal.pone.0186679>



Initial findings from the crossings: Arizona Game and Fish Department data

The Arizona Game and Fish Department monitored the two wildlife crossings with cameras from 2016 to 2024⁷. A final technical report is expected in early 2027, but we are lucky to have a sneak preview.

These unpublished results⁸ showcase the success of the crossings:

Number of crossings

- In the first eight years there were a total of **27,401 successful animal crossings**.
- The structures average around **3,500 animal crossings per year**, total.

Species

- **45 different species** were documented at the crossings.
- Mule deer, coyotes, javelina, and bobcats are the most frequent documented users of the crossings.
- A single **opossum** was spotted by AZGFD. This was the only species confirmed to use the crossings that CSDP's cameras did not photograph during the study.

⁷ AZGFD unpublished data, 2026.

⁸ AZGFD unpublished data, 2026.

Which crossing did wildlife prefer?

- There was **generally equal use of the bridge and underpass** by year, with the first eight years of data showing 14,010 bridge crossings and 13,391 underpass crossings.
- Crossing use by bobcats, javelina, coyotes, and mule deer increased steadily, and fairly equally, at the underpass and overpass.
- **Mule deer like the bridge best.** Mule deer use the bridge four times more often than they do the underpass.
- **Bobcats, coyotes, and javelina prefer using the underpass.**

Animal behavior

- The time of day (by hour) that mule deer, coyote, bobcat, and javelina use the crossings is consistent with movement of these species in CSDP's data.

- Mule deer crossings generally peak during winter into spring, and again in fall.
- Coyote and bobcat crossings peak during the winter months, and javelina crossings peak in the spring. There is **year-round use** of the crossings by all four species.
- According to annual patterns, animals generally traveled in **both directions equally** at both the underpass and the overpass, except that coyotes appeared to use the bridge to cross from the east (n=688) more frequently than west (n=460).

AZGFD data⁹ also confirmed that **wildlife use of the crossings settled into a steady, consistent pattern three to five years after construction**, and after an initial increase, depending on the type of crossing structure and species using it. This is typical of results from other wildlife crossing projects in Arizona.

These results are an excellent example of wildlife crossings in action. Paired with our data, we can try to see how the crossings impacted the larger area.

⁹ AZGFD unpublished data, 2026.



A herd of mule deer crossing the Ann Day Memorial Wildlife Bridge.

Findings from the study area: CSDP data

Species diversity

Overall species diversity tells us that the study area is in pretty good shape.

The Sonoran Desert is home to at least 60 different species of mammals, including small rodents and bats.

- We saw at least **65 species** (Table 1).
- We saw every species we expected to see (all mammals larger than a desert cottontail that are known to live in the area), and some we didn't.
- Species diversity was consistent over time, except for an unexplained decrease in species—and number of detections—that began around 2020.
- **Mesocarnivore** presence is a sign of a healthy, balanced ecosystem—while we saw lots of diversity in mesocarnivores,¹⁰ **we wish we saw more of them.** They are particularly sensitive to habitat loss and development.¹¹
- Instead, we're mostly seeing a **large number of herbivores or prey** (around 80% of detections; see Table 1).

Total species diversity is difficult to measure using wildlife cameras because we miss most smaller animals, like rodents. Birds, reptiles, and insects are also not easily caught by our cameras, or later identified. We can assume there are way more than 65 species present in the area.

Biodiversity (also called biological diversity): the variety of all living things on Earth and the interconnected ecosystems they live in.

Species diversity (also called species richness): the number of species in an area. Higher species diversity helps natural systems remain resilient and adaptable.

Mesocarnivore An animal whose omnivore diet consists of 30% to 70% meat, supplemented with insects, fruit, plants, roots, seeds, and fungi. They are generally small-to-medium-sized mammals that are less than 35 pounds.

10 We mostly saw gray fox, raccoon, and hooded skunks, but also saw a few instances of badger, ringtail, hog-nosed skunk, striped skunk, spotted skunk, and white-nosed coati in the study area.
11 The low abundance of mesocarnivores we found is not a localized phenomenon. Saguaro National Park has been tracking a decline in mesocarnivores in the Rincon and Tucson Mountains since 2005 with its [Lost Carnivores Project](#).



TABLE 1. Species detections by trophic pyramid layer (carnivore, mesocarnivore and omnivore, and herbivores)			Before the crossings (pre-March 2016)		After the crossings (post-March 2016)	
Total trap days. This is the number of days that we were collecting data. CSDP initially had a lot more data from the east side of Oracle Road — once the crossings were completed, our study was more even across both sides of the road.			1,401	2,617	3,355	3,323
APEX PREDATORS (top carnivore, 0.01%)		Detections*	WEST	EAST	WEST	EAST
Mountain lion	<i>Puma concolor</i>	8		X	X	X
TERTIARY CONSUMERS (carnivores, 5%)		Detections*	WEST	EAST	WEST	EAST
Bobcat	<i>Lynx rufus</i>	2,833	X	X	X	X
Roadrunner	<i>Geococcyx californianus</i>	1,685	X	X	X	X
Domestic dog	<i>Canis lupus familiaris</i>	1,002	X	X	X	X
Owls**	Order: <i>Strigiformes</i>	44	X	X	X	X
Other raptors**	Order: <i>Accipitriformes</i>	13	X	X	X	X
Domestic cat	<i>Felis catus</i>	6			X	
Gila monster**	<i>Heloderma suspectum</i>	4	X	X	X	
Snakes**	Suborder: <i>Serpentes</i>	4	X		X	X
SECONDARY CONSUMERS (mesocarnivores and omnivores, 14%)		Detections*	WEST	EAST	WEST	EAST
Coyote	<i>Canis latrans</i>	15,097	X	X	X	X
Gray fox	<i>Urocyon cinereoargenteus</i>	479	X	X	X	X
Raccoon	<i>Procyon lotor</i>	184	X	X	X	X
Hooded skunk	<i>Mephitis macroura</i>	137	X	X	X	X
Other reptiles**	Class: <i>Reptilia</i>	71	X	X	X	X
Badger	<i>Taxidea taxus</i>	62	X	X	X	X
Striped skunk	<i>Mephitis mephitis</i>	61		X	X	X
Hognosed skunk	<i>Conepatus leuconotus</i>	31		X	X	X
Unknown skunk	Family: <i>Mephitidae</i>	29		X	X	X
Black bear	<i>Ursus americanus</i>	6				X
Spotted skunk	<i>Spilogale gracilis</i>	6		X		X
White-nosed coati	<i>Nasua narica</i>	4		X	X	X
Ringtail	<i>Bassariscus astutus</i>	2		X		X
PRIMARY CONSUMERS (herbivores, 81%)		Detections*	WEST	EAST	WEST	EAST
Other birds**	Class: <i>Aves</i>	46,730	X	X	X	X
Desert cottontail**	<i>Sylvilagus audubonii</i>	17,415	X	X	X	X
Javelina	<i>Dicotyles tajacu</i>	12,291	X	X	X	X
Mule deer	<i>Odocoileus hemionus</i>	5,988	X	X	X	X
Unknown jackrabbit	Genus: <i>Lepus</i>	4,241	X	X	X	X
Cow	<i>Bos taurus</i>	3,239	X	X	X	X
Other rodents**	Class: <i>Rodentia</i>	1,552	X	X	X	X
White-tailed deer	<i>Odocoileus virginianus couesi</i>	1,422	X	X	X	X
Harris's antelope ground squirrel**	<i>Ammospermophilus harrisi</i>	326	X	X	X	X
Other squirrels**	Family: <i>Sciuridae</i>	283	X	X	X	X
Horse	<i>Equus caballus</i>	215	X	X	X	X
Antelope jackrabbit	<i>Lepus alleni</i>	67	X	X	X	X
Black-tailed jackrabbit	<i>Lepus californicus</i>	38	X	X	X	X
Invertebrates**	Phylum: <i>Arthropods</i>	8			X	X
Sonoran Desert tortoise**	<i>Gopherus morafkai</i>	4	X	X	X	X
Bighorn sheep	<i>Ovis canadensis nelsoni</i>	1				X
Other categories		Detections*	WEST	EAST	WEST	EAST
Humans	<i>Homo sapiens</i>	18,251	X	X	X	X
Unknown vertebrate animal	Phylum: <i>Chordata</i>	7,466	X	X	X	X
Unknown mammal	Class: <i>Mammalia</i>	67	X	X	X	X

* Our detection numbers attempt to discount duplicates by only counting each photographed species once per minute (and so not counting several photos taken while the species moves past a camera).

** Likely undercounted: these species are difficult for our cameras to capture.



Species distribution

Native occupancy How evenly distributed species are throughout the area, calculated by the proportion of camera sites where a species is detected.

Low native occupancy means a species was documented at a low percentage of camera locations, and 100% native occupancy means they were documented at all camera locations.

Coyotes, bobcats, and javelina were the most abundant and evenly widespread wildlife species.

- Humans had close to 100% native occupancy—we were seen pretty much everywhere (Figure 2).
- Coyotes, bobcats, and javelina were also widespread. These species are highly adaptable generalists, so this is expected.
- Specialist species such as ringtail, skunks, jackrabbits, and badgers were seen at fewer locations, and on the east side of the highway more often than the west.

More open space on the east side means more wildlife.

Species tended towards the open space and public lands on the east side of Oracle Road, an area with limited development that includes Catalina State Park and the Catalina Mountains.

- Javelina and mesocarnivores were found to be more abundant within Catalina State Park than elsewhere in the study area. This was especially true after the crossings were finished (Figure 5)—the local javelina herds began spending more time to the east of Oracle Road.
- During COVID-19, we saw humans increase in Catalina State Park, especially.
- Overall, human activity decreased on both sides of the road since 2020—a surprising trend. The creation of the official Big Wash Multi-Use Trail may have helped to keep humans out of more natural areas.
- There were more domestic animals—dogs and cows—on the west side of the highway.

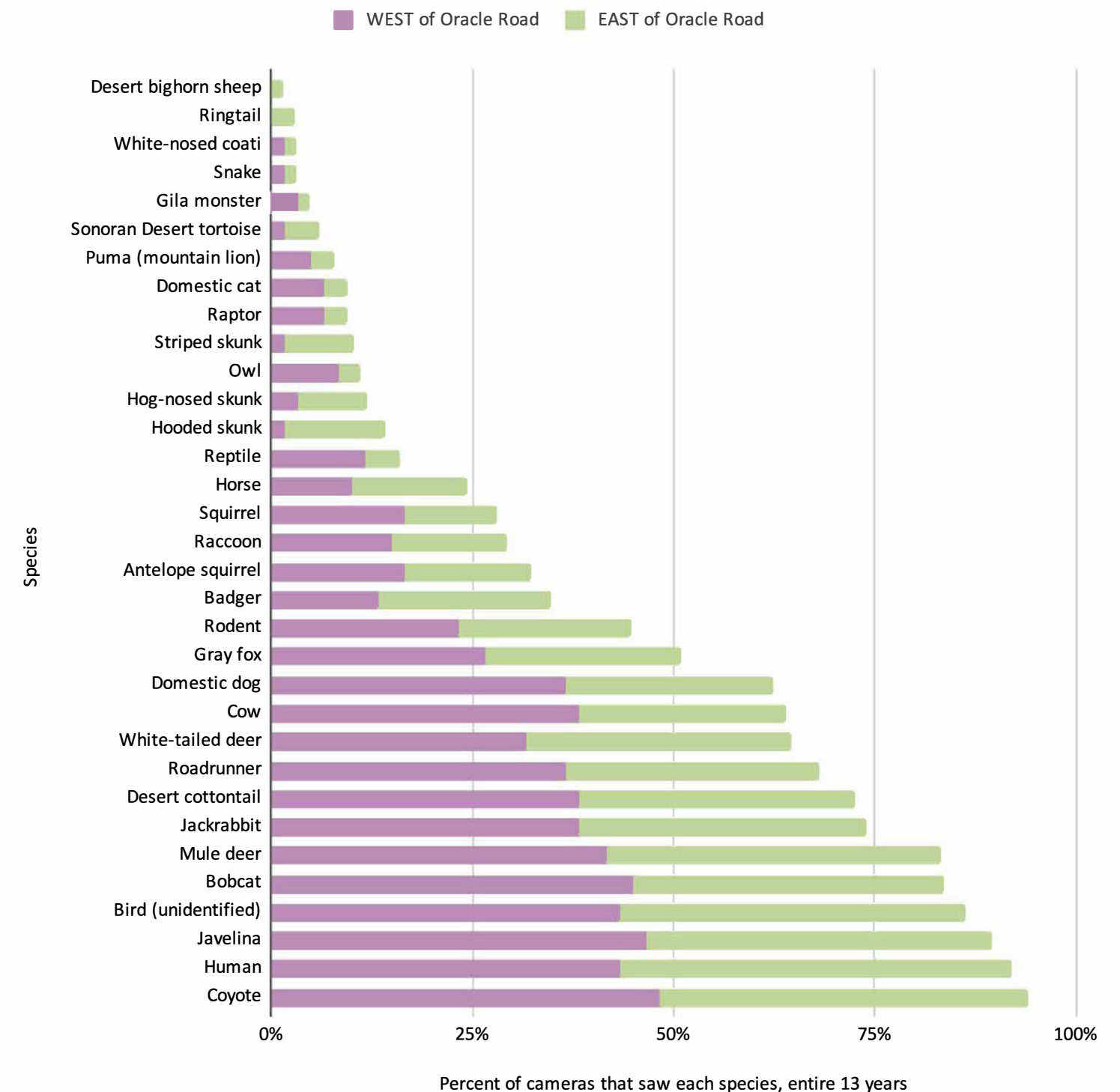


Figure 2. Native occupancy of, or how widespread each species was, on cameras west and east of Oracle Road. Notice that specialist species were more common on the east side, where there's more open space.



Special appearances

Some species were only seen once or twice:

- Gila monster, desert tortoise, bighorn sheep, white-nosed coati, mountain lion, black bear, ringtail, spotted skunk, and striped skunk.

Excitingly, AZGFD also once photographed an opossum crossing the wildlife underpass.¹² In 13 years, we never saw opossum on any of our cameras in the surrounding area!

Why so few sightings of certain species?

- Easy to miss with a wildlife camera: Cameras frequently don't trigger for animals like tortoises and other reptiles because of their small size, low height, or cold-blooded nature.
- Rare visitor to the area: Some species typically live in higher elevations and are moving from one place to another less frequently than animals that make daily, local commutes.
- Black bears come down to lower elevations to eat cactus fruit and the larvae of cicadas in the summer. They wouldn't usually be in the study area unless they are dispersing to new territory or exploring new food sources in lean years.
- Another example is the photo of a single bighorn sheep (ear tag #14) that passed near the underpass crossing. This was when the newly introduced bighorn sheep in the Catalina Mountains were still exploring before settling into the Pusch Ridge area.
- **Small populations:** Species such as opossum and mountain lions are simply low in numbers in the study area.



Bobcat eating a rattlesnake.

Responses to the crossings

The crossings appear to allow animals to react to their environment and move as they need.

- Around a year **before the crossings were finished, mule deer and coyotes became more prevalent.** Were they responding to weather conditions (there was more rainfall in 2015), the two years of construction on Oracle Road and disruption to their normal routes, or were they using the crossings before they were finished? We don't know!
- After the crossings opened, the east side of the road saw more coyotes (Figure 3), javelina (Figure 4), and bobcat. We think this is largely because of the amount of open space on the east side of Oracle Road.
- **Mesocarnivores also increased to the east of the highway** (Figure 5)—and we think most stayed east.
- **We saw a notable drop in javelina and mesocarnivores in the study area after the crossings opened.** We don't know why—they may have simply migrated and moved on, or disease is another possibility.

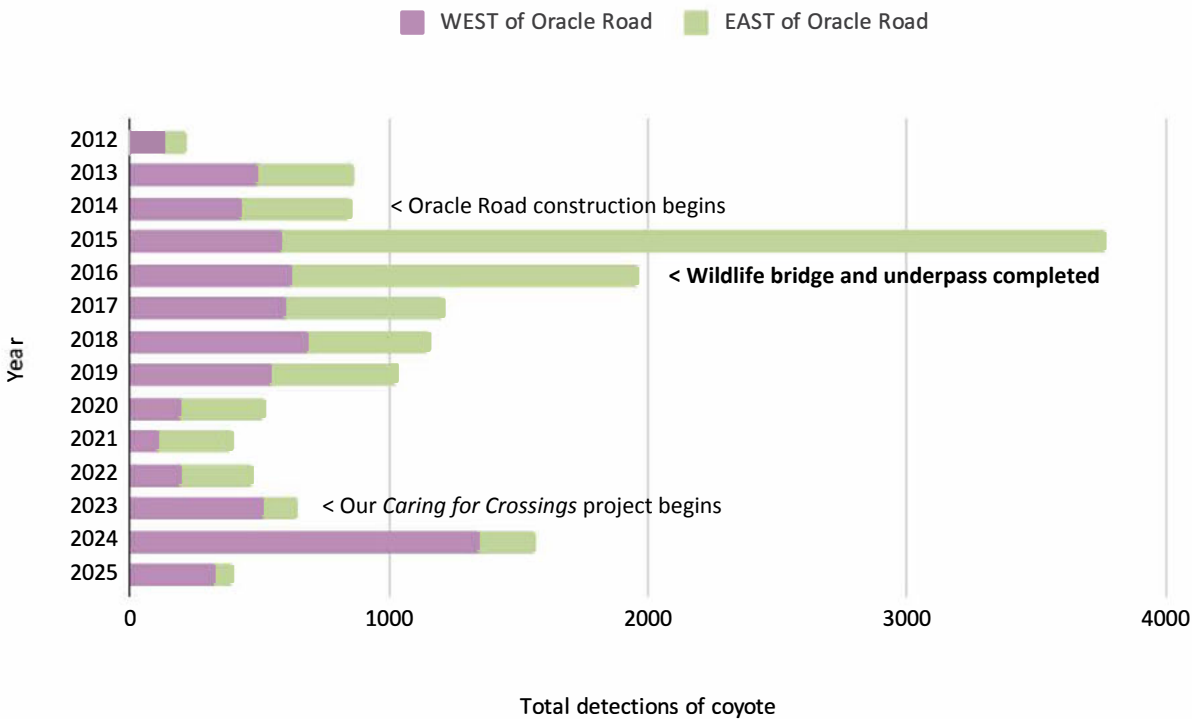


Figure 3. Total detections of coyote.

¹² AZGFD unpublished data, 2026.



Did you know? A desert tortoise tried to use the underpass before construction was complete, bringing the work crews to a halt.

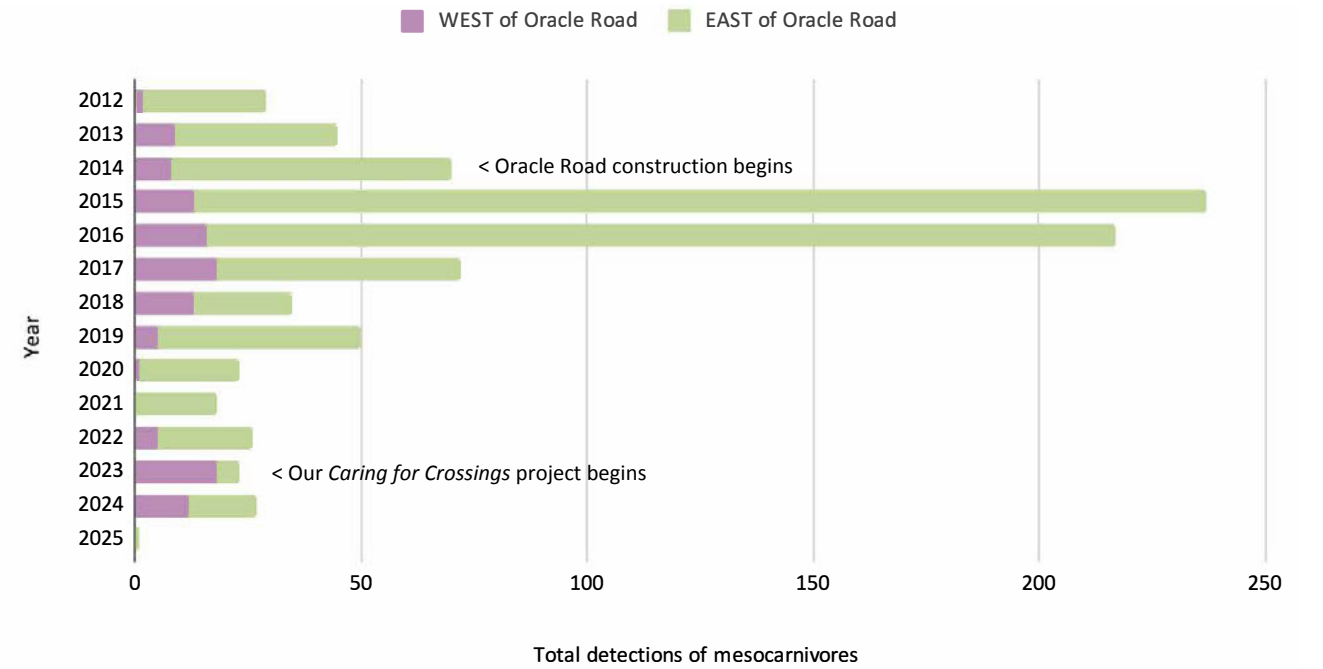


Figure 5. Total detections of mesocarnivores. As with javelina, we saw a significant decline in numbers.

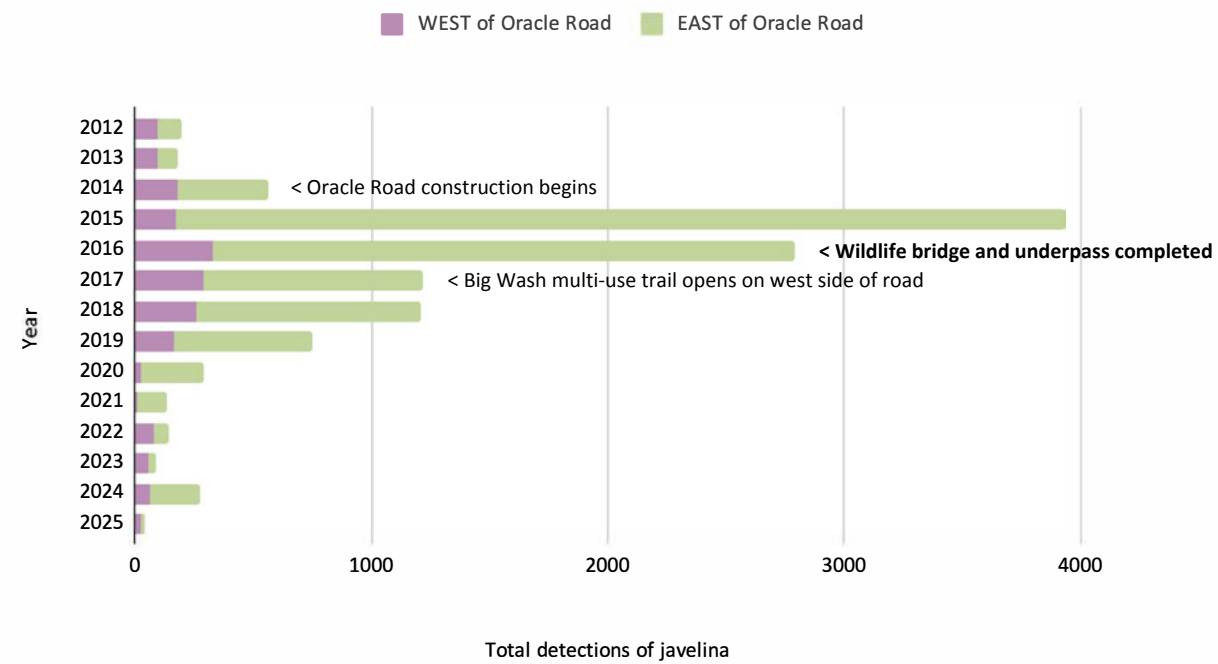


Figure 4. Total detections of javelina, with a notable decline in activity and abundance within the study area.



Hooded skunk.

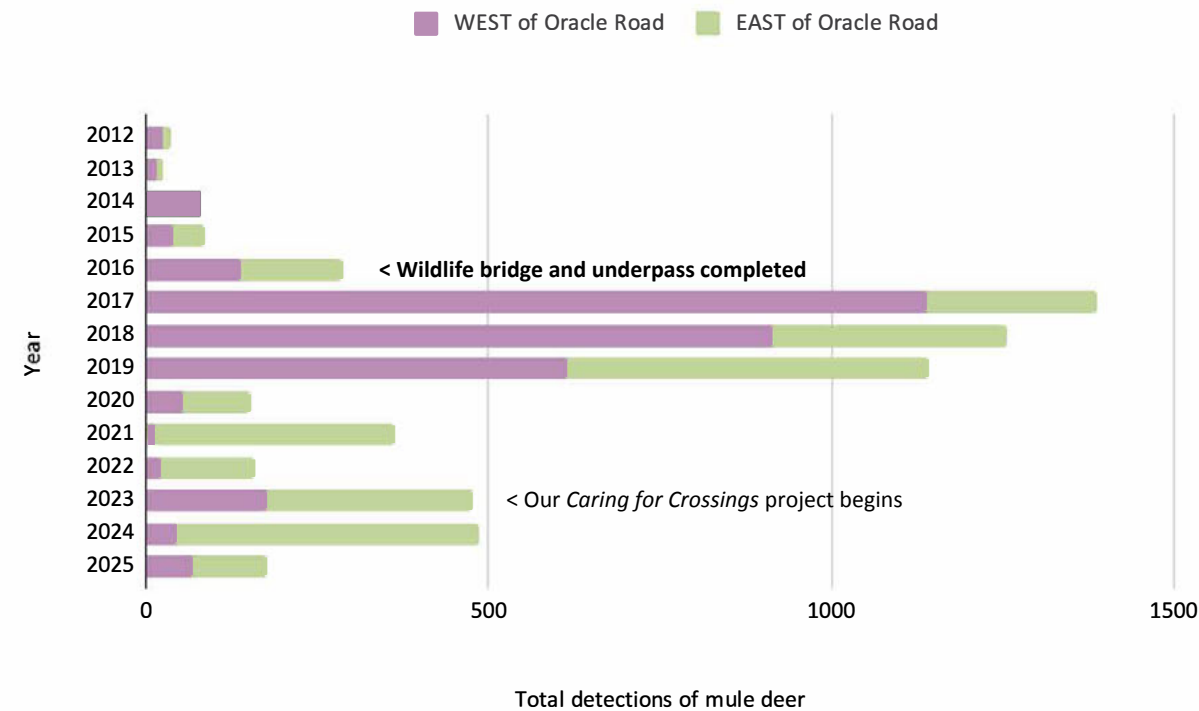


Figure 6. Total detections of mule deer. Notice the initial shift west, which we didn't see with other species.

- Mule deer became more active on the west side (Figure 6). This also correlates with data from AZGFD on collared mule deer.¹³ We think many deer moved and stayed west but some also continued with regular commutes across the crossings.

Some species were only spotted west of the highway post-crossings.

- Specialist mesocarnivores such as **hog-nosed skunks**, **striped skunks**, and **white-nosed coati** first appeared west of the highway in 2016, after the crossings opened.
- **Mountain lions** did not appear on our cameras on the west side of the highway until after 2018.
- AZGFD documented a **black bear** moving west on the bridge for the first time in 2023.¹⁴ Days later, the same bear was photographed by a resident (and volunteer Desert Monitor) near Big Wash.



¹³ AZGFD unpublished data, 2026.
¹⁴ AZGFD unpublished data, 2026.

The first black bear to use the Ann Day Memorial Wildlife Bridge. Photo credit: AZGFD, 2023.



Seasonal shifts

The photos captured by our camera tell a story of the Sonoran Desert's seasons.

There are five seasons in the Sonoran Desert: we divide summer into the hot, dry start of summer and the later wet monsoon months.

We saw predictable peaks in activity throughout the year that coincide with species-specific mating seasons or the birth of young (Figure 7).

- Mule deer activity spikes around April and the September breeding season.
- Cottontail detections explode in the spring with the birth of new litters.
- Javelina activity peaks in the fall, when herds shift to more daytime activity with the cooler temperatures and move around foraging for seasonal fruit and seeds.
- Gray foxes are more active in winter, the start of their mating season, and a time when prey are harder to find and hunting takes them further afield. They are also seen foraging for food at night in the hot summer months.
- Coyote activity spikes in spring during pupping season. We saw healthy numbers of coyote pups. Coyote activity spikes again in fall and dispersal season, when young adults leave to find their own new territories.
- Many desert species become less active during the dry months of May-June, and then more active during the July-August monsoon season when water is more available.

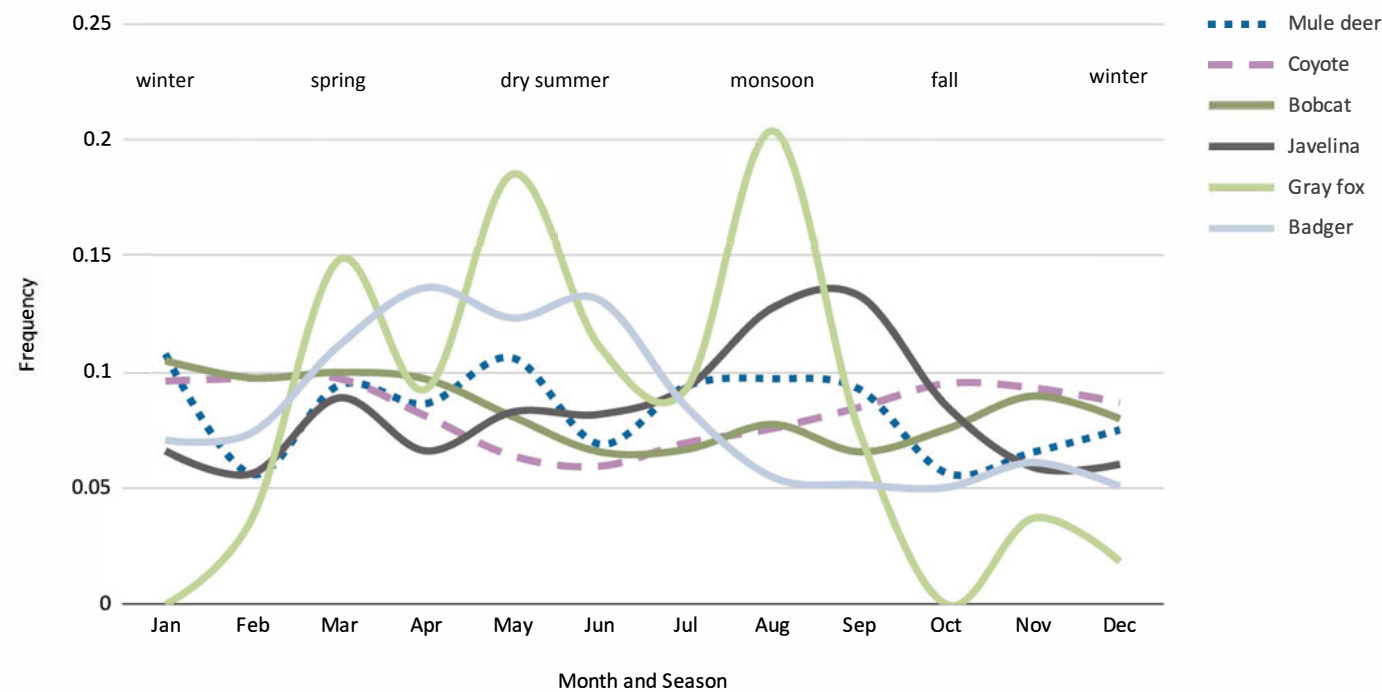


Figure 7. Species activity by month and season.

It's hard to tell how humans impacted daily, seasonal, and longer-term trends.

- Most desert species were crepuscular (active at dawn and dusk), or purely nocturnal (Figure 8).
- This is in contrast to humans, which were most active in the late morning (Figure 9).

From 2020 onward, there have been different patterns documented for species diversity and presence observed by CSDP and AZGFD. CSDP data shows a general decline, while AZGFD data shows similar or increasing use of the structures during this period.

We know from AZGFD studies that crossing activity can settle into a steady pattern around three to five years after construction—that would be around 2019 to 2021. Other potential reasons for these behavioral shifts include:

- **Impacts of COVID-19:** We know there was an increase in outdoor recreation, although we didn't see more humans on our cameras except in Catalina State Park.
- **Changes to our own study:** we upgraded our camera fleet in early 2019. After some initial disruption in the field, though, we would have expected to photograph more wildlife with the better cameras.
- **Climate impacts:** 2020 was a drought year, and also the year of the Bighorn Fire (which drew a lot of human activity to the area). We then saw heavy precipitation in 2021, and even lost nearly half of our cameras to flooding. Both of these things would typically mean more wildlife movement, but maybe not in the areas we had come to expect.
- **Better habitat elsewhere:** With more freedom to roam, animals may have simply passed through rather than moving back-and-forth from less optimal habitats on either side of the highway.



We are seeing a slight upwards recovery for most species, perhaps indicating that we're getting closer to a baseline for the area. **We continue to hope for more mesocarnivores**, though, which are not recovering (Figure 5).

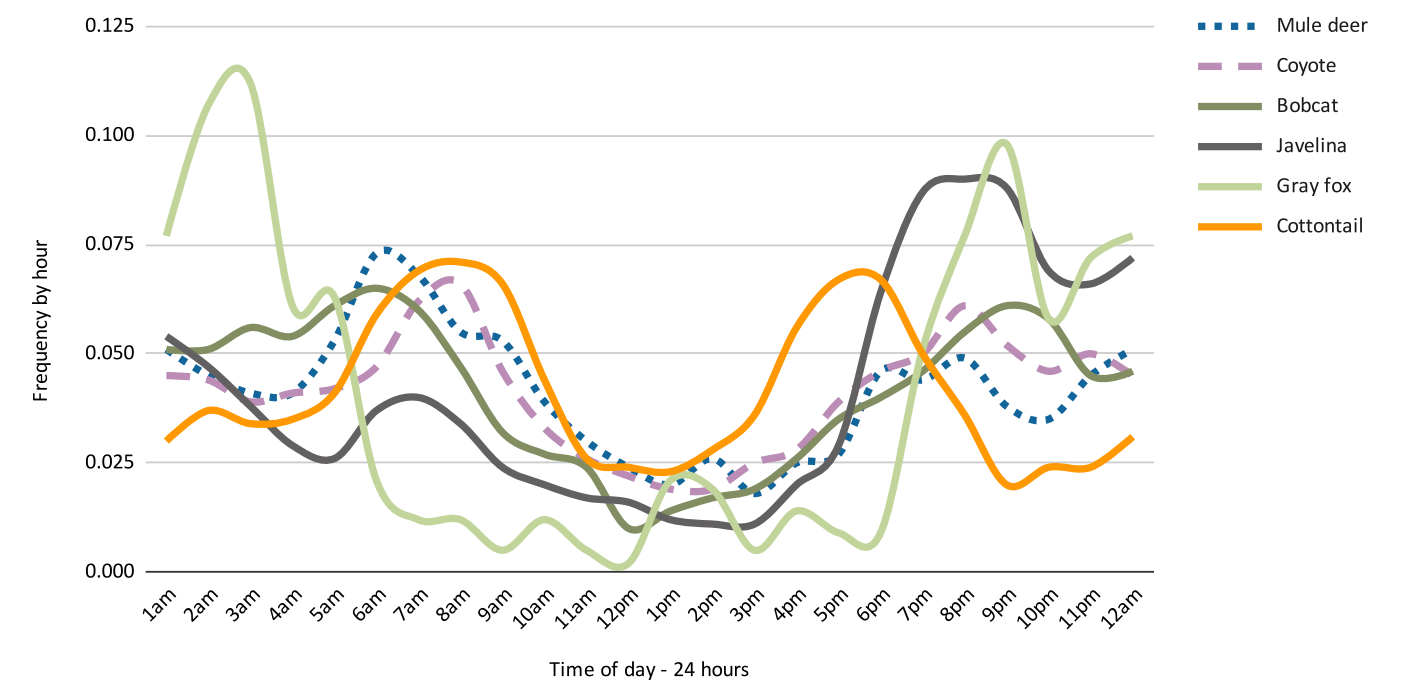


Figure 8. Wildlife activity by time of day. Note the morning and evening pattern, vs. the daytime pattern of humans (Figure 9).

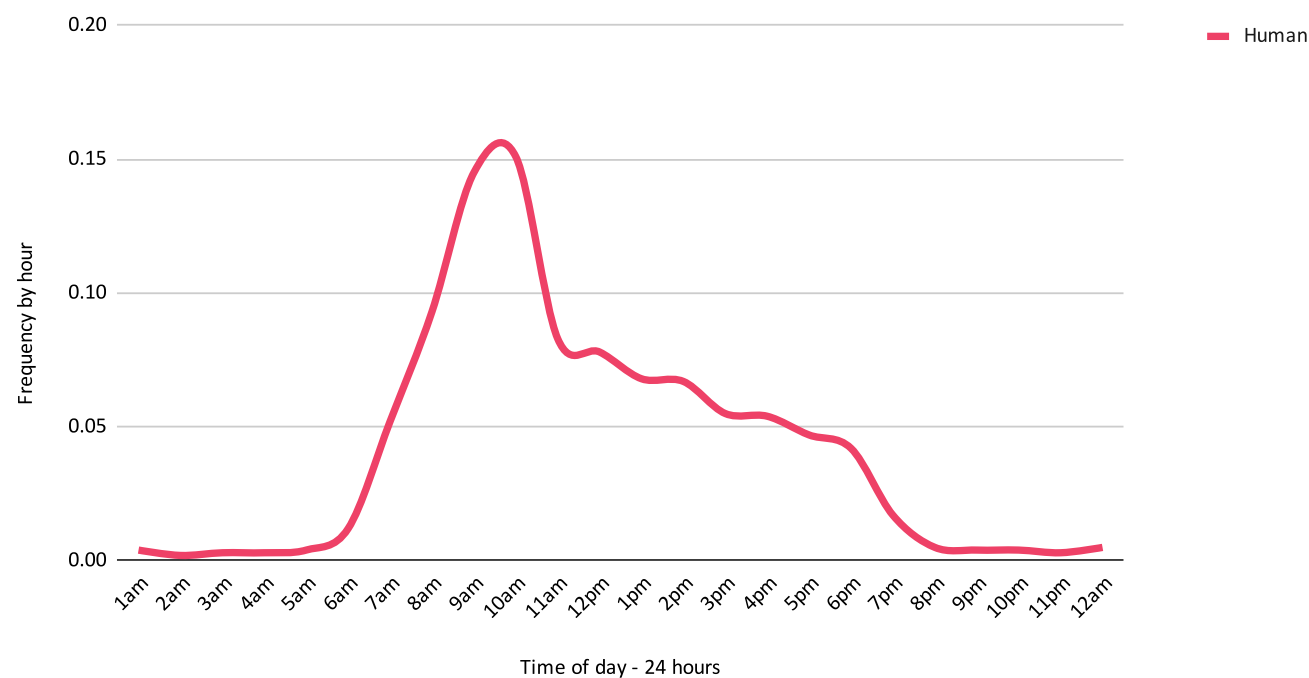


Figure 9. Human activity by time of day.



Path of the puma

At least three mountain lions were in the area during the study.

Predators are an important part of a diverse ecosystem. **We photographed mountain lions only eight times** during the study¹⁵ and we think we saw **three different individuals**:

- Two different cats appeared separately in 2015—an adult female (“Puma 1” or P1) and a young subadult of unknown gender (P2).
- The last photo taken in October 2023 appears to be an older adult male (P3).
- The other photos all look to be of the same adult female—we can’t tell if she is P4 (a new cat to our study) or if she is P2 all grown up!

The first mountain lion to use the crossings

- In June 2021, the first mountain lion to use the wildlife crossings was photographed by AZGFD traveling east through the underpass. It appeared to be an adult female.
- That same night, the same cat was photographed on one of our cameras around half a mile east of the underpass. She would have navigated around a local horse boarding stable in between the two locations.

Mountain lions in the Sonoran Desert

Mountain lions are solitary and need large areas to roam—for females, 50 to 80 square miles, and more for males—so the wildlife linkage is only a small part of their range.

Given this, we didn’t expect to see more than one adult female in the area at a time. And perhaps the occasional visiting male in the area or a youngster in tow!

¹⁵ In 2012, 2015, 2018, 2019, 2021, and 2023.



▲ An adult female (P1) photographed east of the highway in 2015.



▲ A subadult mountain lion (P2) at the same camera location, five months later.



▲ An adult female is photographed using the underpass in 2021 (Photo credit: AZGFD).



▲ Take a look at her left front inner leg markings—they helped us match AZGFD’s photo to a cat seen by one of CSDP’s cameras in Catalina State Park later that night.



CSDP volunteer on a funnel fence survey.



Javelina bones.



Other data we collect

Roadkill surveys

A reduction in roadkill is a strong indicator of crossing success.

- AZGFD roadkill surveys¹⁶ from after the crossings were built found **roadkill hotspots near gaps in the wildlife funnel fencing.**
- That means the system worked, except for where there were gaps in the fence that let wildlife back onto the road!

Crash data

A reduction in wildlife-vehicle collisions is another indicator of success. Unfortunately, crash data is only collected when a police report is filed—so collisions are under-reported.

Each year, around 200 wildlife-vehicle collisions are known to happen in Pima County.¹⁷ From 2012 to 2021, ADOT reported 321 people injured and 588 totaled vehicles from wildlife-vehicle crashes. And this is just what is reported.

After the crossings were built, known crashes on Oracle Road were mostly south of Rancho Vistoso Blvd where there is no wildlife funnel fencing.

“I live next to the wildlife underpass and have noticed less roadkill after the crossings went in. Roadkill has practically disappeared!”

– Jean Lewis, Desert Monitor, 2018-2026



¹⁶ AZGFD unpublished data, 2026.

¹⁷ ADOT crash records, 2012-2021.

Success depends on the wildlife funnel fencing

Wildlife funnel fencing, or wildlife exclusion fencing, helps to steer wildlife towards crossings and away from the road. The fence needs regular maintenance, though, to be effective.

AZGFD’s roadkill surveys found **six roadkilled tortoises** near fencing gaps, breaks, and end points.

After **the largest gaps were fixed** in 2023, we found **zero roadkilled animals** in an entire week of surveying (we did find the bones of a javelina, not captured by earlier surveys).

CSDP surveyed all seven miles of the fence in 2025¹⁸ and found:

- **59 gaps or holes in the fence** large enough for wildlife. Most were caused by digging animals (54%), erosion (32%), and structural gaps (6%), but some were due to vehicle collisions (3%) or deliberate vandalism (3%).
- Breaks occurred most often and more severely where drainage pipes opened inside the right of way, rather than outside of the fence; a lesson learned for future projects.
- 35% of the gaps showed obvious signs of recent animal use, including tracks, trails, or scrapes.

As we have told ADOT, these fences require regular maintenance to be effective!

¹⁸ CSDP. 2025. Nearly a decade later: Assessing the condition of the Oracle Road wildlife funnel fence. <https://www.sonorandesert.org/archives/publications/>

Caring for the wildlife crossings

When built, the crossings were treated with construction backfill dirt, spread with native seeds, and then largely left to nature.

Over time, we realized that some maintenance was needed—especially to address erosion and invasive species. While these crossings are technically maintained by ADOT, we got permission to do work that wasn't otherwise going to happen.

Volunteer-led maintenance

In 2023, we launched the Caring for Crossings project and began invasive plant removal, re-seeding, erosion control, and native plant establishment on the crossing structures.

We wrapped up this project in 2026, which resulted in:

- **10** tons of rock used for erosion control structures, such as one-rock dams and Zuni bowls.
- **115** yard bags of buffelgrass removed.
- **Over 100** trees and shrubs planted, including ironwood, blue palo verde, mesquite, and ocotillo.
- **Over 60** native Palmer's agaves planted.
- Hundreds of seedballs made with 21 different native plants, and spread at both crossings.
- **3 years** of hand watering newly established plants.
- **150 - 250** volunteers each year.
- **1,529** volunteer hours.

This work helped to attract pollinators, created frog and toad habitats, and made space for smaller animals to safely travel with shelter—we added “windrows” or corridors on the bridge (a living path of prickly pear) and in the underpass (two 200-foot long, 3 foot-wide brush piles).

Lizard and rodent tracks appeared in the windrows the next day, and cameras captured bobcats, skunks, and raccoons exploring the new attraction.

This project was funded by the Santa Cruz Valley National Heritage Area, and supported by Carianne Funicelli of Strategic Habitat Enhancements, who designed the original native seed-mix for the bridge, selected the best plants for habitat restoration and helped us lead volunteers.



Palmer's agave. Photo credit: John Ashley.



Volunteers learning planting tips from Carianne Funicelli. Photo credit: John Ashley.



Conclusion

Wildlife crossings influence an ecosystem beyond their physical footprint.

Resilience is the best defense wildlife have against the challenges they face today, and **resiliency requires the freedom to roam**. That’s what these crossings set out to do.

There’s always more to learn (scientific studies love to tell us that “more research is needed”), but this 13-year study gave us something important: **animals are using the crossings, and in record numbers**.

In *Crossings*, author Ben Goldfarb writes, “One of the road’s quirks is that it brings us into contact with the animals it destroys. Many conservation problems are distant in space and time, their causes displaced from their effects.”

One of the best things about this project has been bringing people closer to the wildlife around us. Seeing bobcats, mountain lions, javelinas, and other animals using these crossings has made the value of connectivity real—and helped build support for doing more.

Moving forward

Crossings are a solution, but not the solution—they can’t solve every challenge that wildlife face, which is why we work to conserve open space in the first place.

We’ve learned a lot that can make future crossings even better. We now feel that crossings need:

1. A lot of ongoing maintenance and monitoring. We think it’s best if local governments or agencies are responsible for this work, and not small non-profits such as ours.
2. Nature-friendly features designed into the project from the start: pollinator plants, water basins, erosion control features, windrows, and more.
3. A campaign to help the public learn about the value of crossings—the photos from our cameras helped with that, a lot.
4. Public investment, including public funding and artwork.



Acknowledgements

We couldn't have done this work without the following people. Our interns and volunteers braved heat, snakes, floods, cacti, spiders living in camera cases, and gigantic amounts of camera data—yet never lost enthusiasm for the work.

CSDP's principal investigators made significant contributions while managing this project:

- 2012-2013** Gabe Wigtil
- 2013-2016** Hannah Oden
- 2016-2018** Sarah Whelan
- 2018-2025** Jessica Moreno

Other CSDP staff also contributed to this project:

Carolyn Campbell, Kate Hotten, Kathleen Kennedy, Nick Maya, and Jonni Zeman.

Eight CSDP interns contributed to this project:

Josh Skattum, Andrew Grusenmeyer, Jeremiah Powers, Aster Schaefer, Lilly Ramirez, Woods Nystedt, Mireya Ballesteros, and Zoey Feldman (who helped to create this report).

Over 120 Desert Monitor and Desert Identifier volunteers contributed to this project:

Lori Andel, Cindi Azuogu, Mickey Baumrind, Russ Beatson, Zoe Benson, Bill and Meagan Bethel, Genevieve Bock, **Carl Boswell**, Don Broomall, Gary and Lenora Brown, Carol Bull, Barbara Cain, Lisa Caprina, Dean Chapman, Ellen Coleman, Laura Couchman, Harriet Cowper, Bob and Jan Cratty, Alan and Karen Dahl, Jeena Davidson, Michael DeConcini, Christine DeMatteo, Caleb and Elizabeth Deupree, Joanne Devereaux, Christopher Dobrzenski, Juliette Duncan, Diana Elbirt, Harry Epler, Patty Estes, Vicki Ettleman, Izetta Feeny, Patricia Frannea, Melissa Fratello, Mike Froehner, Cheyenne Garcia, Petra Gee, Chuck and Mary Graf, Joan Hall, Jane "Middy" Henke, Margarita and Parker Henslee, **Diana Holmes, Peggy Hughes**, Susan Husband, Liam Kennedy, Craig Lecroy, Lainie Levick, Jan Johnson, Jean Lewis, Kristi Lewis, Abby and Don Marier, Craig Marken, Andres and Ruben Martinez, Gene McCormick, Caleb Milford, Mike Miller, Pat and Henry Miller, Kerry Milligan, **Terry Minks**, Eduardo and Sofia Moreno, Tania Morris, Robert Morse, Kathy Myers, Ireland O'Connell, **Margie O'Hare**, Peggy Ollerhead, Sharon Otstot, D'angelo Padilla, Art Petty, Vicki and Frank Pitts, Margaret Pitts, Caleb and Megan Pocock, Renee Powers, **Clive Probert**, Kathy Renno, Joel Rhymer, Evelyn Richards, Amy Rule, Lois Richardson, Gay Russell, John and Cherry Sand, **Richard Sauer**, Mai Schaefer, **Kathie Schroeder**, Ivy Schwartz, Susan Screven, Billy Sedlmayer, Brian Shear, Jacob Simon, Josh Skattum, Ricardo Small, Millie Sparling, Jefferson Stensrud, Patty Stern, Virgil Swadley, Wienke Tax, Barbara Tellman, Stephanie Theodore, Bill Thornton, Marcy Tigerman, Raynor Vandeven, Doug Vollgraff, Jim Wagner, Yessica Wheeler, Samantha Wilber, Robert Wisler, Harold Wood, middle school students of the Catalina Foothills School District, and volunteer docents of the Reid Park Zoo.

Bold: These eight extraordinary volunteers were involved for the entire 13-year study!

A lasting legacy

The wildlife bridge was officially named the **Ann Day Memorial Wildlife Bridge** in honor of Pima County Supervisor Ann Day, a strong supporter of the wildlife crossings and the Sonoran Desert Conservation Plan. She died tragically just months before the bridge was complete.

Bob Cratty, Elizabeth Deupree, and Josh Skattum were especially instrumental in the project's formation and growth, and also left us too soon. This project is part of the legacy they leave behind.



Project Funders

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Project Partners

This work could not have been possible without the collaboration and partnership of: Arizona Department of Transportation, Arizona Game and Fish Department, Arizona State Land Department, Bat Conservation International, Catalina Foothills School District, Catalina State Park, the Pima Association of Governments Regional Transportation Authority (PAG/RTA), Pima County Conservation Lands & Resources, Pima County Regional Flood Control District, Rancho Vistoso Homeowner's Association, Reid Park Zoo, Santa Catalina Catholic Church, Strategic Habitat Enhancements, the Sun City Bobcat Project, Sun City Homeowner's Association, and the Town of Oro Valley.

Thank you!



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SR77 OP3



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Coalition for Sonoran Desert Protection

The Coalition's mission is to protect the biodiversity of the Sonoran Desert in Southern Arizona through science-based advocacy, education, and collaboration.

We envision a community in the Sonoran Desert where ecosystems are healthy, valued, and protected, with benefits for current and future generations.

Funded in part by



SANTA CRUZ VALLEY
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