

## Tucson – Tortolita Mountains Wildlife Linkage Monitoring Project

### 2025 Annual Report



*Figure 1. A white-nose coati was documented in November 2025 exploring the new wildlife ramp. Coatis, likely all males, have only been documented 4-5 times in the Tucson Mountains, most associated with the Santa Cruz River.*

#### Summary of Results to Date

**40 Camera Sites – Over 60 Species – 51,710 Traps Days  
110,140 Verified Wildlife Photos**

## **Executive Summary:**

The Tucson–Tortolita Mountains Wildlife Linkage Monitoring Project documents wildlife movement and species presence across a critically important but highly fragmented corridor in northwest Tucson, Arizona. Identified as a priority “missing linkage” in statewide conservation planning, this corridor is bisected by Interstate-10 and additional infrastructure that significantly constrains wildlife movement between the Tucson and Tortolita Mountains.

From 2017–2025, the Coalition for Sonoran Desert Protection deployed 40 remote wildlife cameras across nine stratified study areas, generating over 51,700 trap days and more than 110,000 verified wildlife photographs representing at least 60 species. Monitoring results confirm continued use of the linkage by a wide range of species, including mountain lion, kit fox, badger, bobcat, and mule deer, while highlighting differences in species distribution east and west of I-10. A few rare detections of white-nose coati provide new insight into dispersal behavior and the importance of riparian corridors such as the Santa Cruz River.

In 2025, a new wildlife ramp and expanded monitoring at the railroad underpass provided the first opportunity to evaluate existing crossing infrastructure within the linkage. Early results show regular use of these features by adaptable mid-sized mammals, demonstrating both the feasibility of wildlife passage across I-10 and the need for additional mitigation to support less adaptable and wide-ranging species.

This project establishes a robust baseline for evaluating future conservation and transportation mitigation efforts and reinforces the ecological importance of the Tucson–Tortolita Mountain Wildlife Linkage for regional biodiversity and long-term landscape connectivity.

## **Background:**

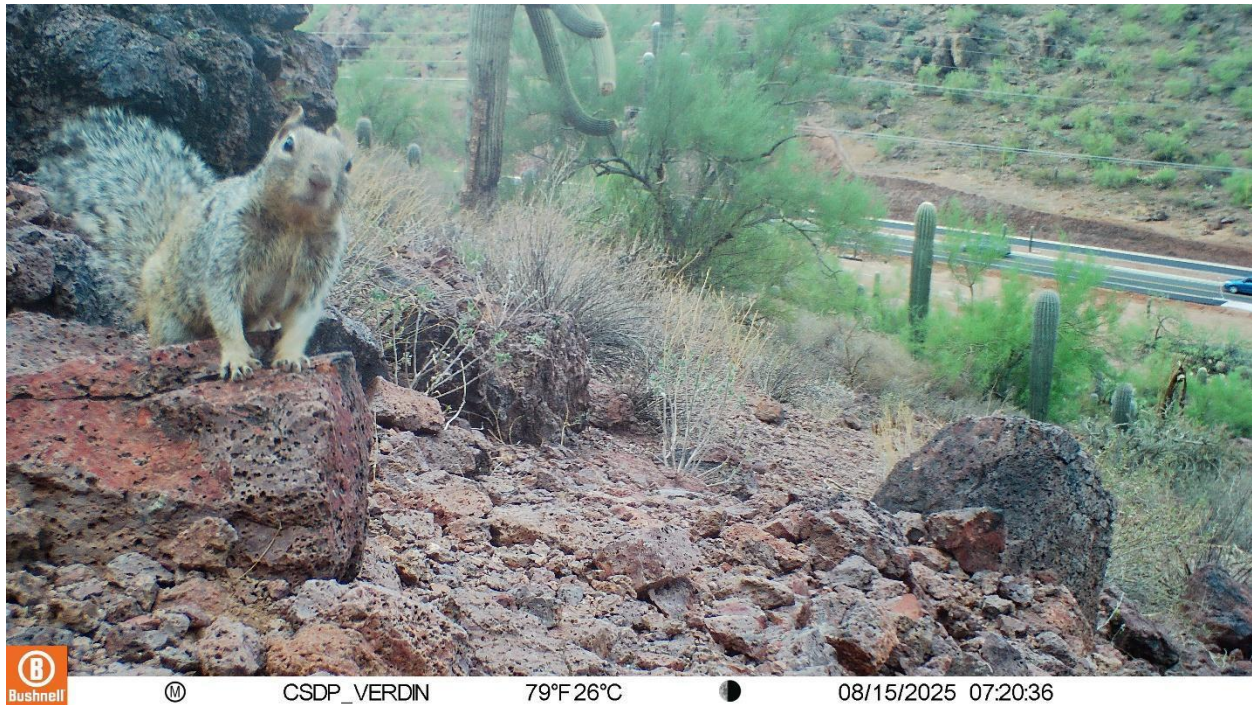
The Tucson-Tortolita-Santa Catalina Mountains Wildlife Linkage was identified as a critically important linkage in the [2006 Arizona Wildlife Linkages Assessment](#) and modeled in detail by Dr. Paul Beier in his [2008 Missing Linkages Report](#).

Located in the Town of Marana, northwest of Tucson, Arizona, Interstate 10 (I-10) is a six-lane divided transcontinental highway that splits “Stand A” of this regionally important wildlife corridor (see map on Pg. 4). Co-located with I-10 are additional barriers to wildlife movement, including the eastbound and westbound N. Casa Grande Hwy frontage roads, a Union Pacific double-track railroad, and the intermittent Santa Cruz River that is marked on the east by a steep soil cement embankment levee.

Combined, these make the area nearly impassable for terrestrial wildlife. The only available passage across the interstate is an abandoned railroad underpass, blocked with concrete vehicle barriers, near Avra Valley Rd.

In addition, the Linkage is jeopardized by a growing network of new roads and development, and the proposed Interstate-11 (I-11) bypass freeway, making this a critically threatened wildlife movement corridor and a priority “missing linkage” in Arizona (Beier et al 2006).

The Linkage acts as a lifeline to the ecological viability of Ironwood Forest National Monument, Tohono O’odham Nation lands, Avra Valley, Tucson Mountain Park, Saguaro National Park West, El Rio Preserve, Tortolita Preserve, and Tortolita Mountain Park, and informs Pima County open space conservation priorities through the nationally recognized Pima County Sonoran Desert Conservation Plan. Species of concern include bighorn sheep, mountain lion, kit fox, desert tortoise, Gila monster, and cactus ferruginous pygmy owls.



*Figure 2. A rock squirrel poses in front of Rattlesnake Pass.*

In February 2021, the Coalition for Sonoran Desert Protection (CSDP) began a study of wildlife movement and species presence between the Tortolita and Tucson Mountains, expanding from CSDP’s first monitoring efforts in the Scenic Drive and Los Morteros study areas initiated in 2017. Monitoring is conducted using remote wildlife cameras both east and west of Interstate-10. We have stratified cameras within the Tucson-Tortolita Mountains Wildlife Linkage into nine study areas for comparison (Figure 3), with 4 cameras sites assigned to each area, and placed a minimum of 200 meters apart. Our goal is to:

1. Identify and prioritize responses to the most critical barriers to wildlife movement in the wildlife linkage, including Interstate-10 at Avra Valley Rd and Rattlesnake Pass.
2. Justify the need for mitigation measures, including wildlife crossing infrastructure.
3. Document baseline conditions before and after mitigation to measure potential changes and impact of future conservation efforts.

In 2025, the wildlife ramp was constructed. It has been fenced off to provide only east to west passage via strategically placed jump outs and to avoid funneling wildlife onto the open highway. This same year, we successfully expanded the project to include the ramp, railroad underpass, and core habitat at either end of the Linkage, for a total of nine stratified study areas and 40 cameras. The ramp and underpass each have 6 cameras to collect accurate passage rate data, and the other strata each contain 4 cameras.

In 2026, Saguaro National Park plans to begin a camera study in the Tucson Mountains near Picture Rocks Rd and has offered to collaborate by comparing data between these projects. With a research agreement in place, CSDP deployed two camera sites within Saguaro National Park West to benefit both studies.

### **Project Timeline:**

This is a long-term monitoring study to document baseline conditions before mitigation and collect accurate data across seasonality. We will produce quarterly updates on project status, and annual summary reports for our permit issuers in January. The study design will be reviewed annually for effectiveness and the cost-benefit analysis of continuation for another year. Research permits must be renewed with the expiration of our liability insurance by March 1 of each year.

Continuous monitoring allows for cumulative impact analysis and tracking wildlife response to other mitigation measures or adverse impacts that may occur in the intervening timeframe. We recommended the study be paused and later duplicated or resumed after mitigation measures are completed for comparative analysis after construction of any wildlife crossing structures, such as a wildlife bridge over I-10. Alternatively, the study could be reduced to just a few cameras to maintain our presence for outreach and advocacy purposes.

In the future, we recommend at least 1 year of post-construction data be collected using these same protocols for comparison.

✔️ *Preparation phase completed* > ✔️ *Cameras deployed* > ✔️ *Monitoring in progress* > ✔️ *Data Processing in progress* > *Analysis* > *Reporting*

- **2017-2020** - Pre-study monitoring begins in the Scenic Drive and Los Morteros study areas in response to bighorn sheep sightings.
- **2021-2022** - The study expands effort both east and west of I-10, adding El Rio Preserve, Santa Cruz River, Cascada, and Tortolita Preserve study areas to the project. El Rio Preserve receives permanent water to maintain the lake year-round.
- **2024** - Levee and floodplain maintenance construction and habitat restoration begins in El Rio Preserve and the Santa Cruz River, resulting in wildlife disturbance and tree removal. Some cameras were removed in these study areas until trees were replaced or confirmed to remain, which decreased monitoring effort for a period. Also, this year,

solar panels were added to camera stations thanks to a grant from TEP.

- **2025** - Pima County's wildlife ramp is completed and cameras are added to the ramp and railroad underpass to monitor wildlife use and passage rates at these chokepoints, and in Saguaro National Park for comparison of core habitat with the linkage.

**Sampling Method:**

We used a stratified random sampling design and have divided the Linkage into nine "strata," or sub-areas of interest. Four unbaited cameras were assigned to each study area and placed using a random point generator. An optimal location for camera deployment was selected within 10 meters of this random point. Historical camera sites placed prior to 2021 remained in place as some of these assigned camera sites, but only if they were located off trail. All camera sites are located a minimum of 200 meters apart, except for the two crossing locations at the I-10 railroad underpass and wildlife ramp. In these sites, cameras were clustered to help provide passage rate data. The nine study areas within the linkage are listed here from north to south:

1. **Tortolita Mountains Wildland Block** (Private Property) – not currently included in this study. However, potential camera data collected from private landowner(s) may be available to add to future analysis.
2. **Tortolita Preserve** (Town of Marana)
3. **Cascada** conservation area (Pima County)
4. **I-10 Railroad underpass** at Avra Valley Rd (ADOT)
5. **Wildlife Ramp** (Pima County)
6. **The Santa Cruz River** between Avra Valley Rd and Twin Peaks Rd (Pima County)
7. **El Rio Preserve** (Town of Marana)

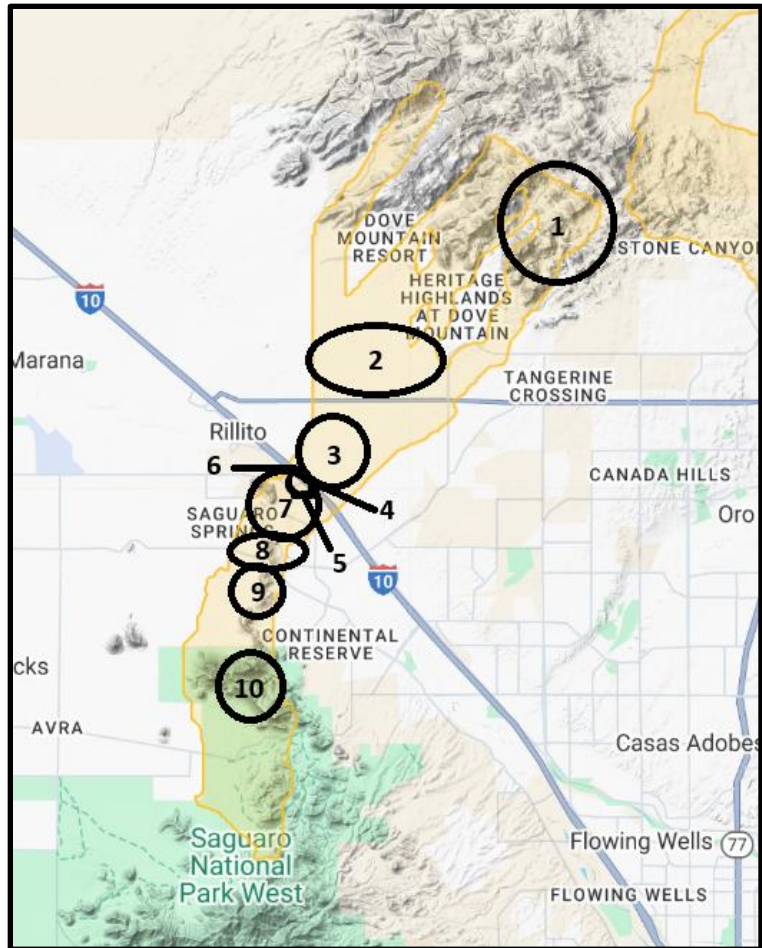


Figure 3: Map of the wildlife linkage and study areas.

8. **Los Morteros** conservation area (Pima County)
9. **Scenic Drive** (Private Property) south of Twin Peaks Rd
10. **Tucson Mountains Wildlands Block** (Sanctuary Cove & Saguaro National Park West)

**Methods:**

Field operation – This project involved the placement and once-monthly maintenance of wildlife camera traps to collect species richness data and activity patterns. Cameras use “low glow” infrared light for night images to avoid animal or human disturbance. We use Bushnell Core DS 4K camera models protected by a steel security box and padlock. Camera traps were set to ‘normal’ sensitivity and attached to trees so that the passive infrared (PIR) sensor was approximately at knee-height above ground level and parallel to the ground. The camera was programmed to take one image per trigger event with a 10 second delay before the camera was armed again. We were able to attach solar panels to power most of the fleet. Equipment is clearly labeled with contact information. Baits or lures are not permitted as a part of this project. For safety, staff and volunteers do not visit camera sites during upstream rain events or flash flood conditions, or during a heat advisory, and are not permitted to bring dogs with them to service the cameras.

Cameras were serviced with new AA alkaline batteries when needed at every maintenance check, the date and time settings corrected if needed, and the camera re-deployed with a fresh 32GB memory card.

Data management – After a field check, Desert Monitors uploaded the photos from the cameras to a designated Google Drive folder, or by handing over the physical SD card to CSDP project staff. These photos were imported into the project’s CPW Photo Warehouse Access database by site visit, and a module (a set of photos with a linked database .accdr file) is then sent to two different Desert Identifier volunteers for identifying the number of animals and the species in each image. CPW Photo Warehouse is a freely available software based in Microsoft Access that has been customized specifically for wildlife camera monitoring by Colorado Parks and Wildlife.

Desert Identifiers tag blank/false positive photos for removal and identify animals in the images to species, count the number of individuals, and note details such as evidence of predation. Photos documenting people were labeled as one of the following: Pedestrian, Vehicle, Bicycle, Horseback, or CSDP Volunteer. Birds were categorized only as “Greater roadrunner” or “Bird” or “Raptor.” Animals that could not be identified to species were labeled as “Unknown” and were tagged for the staff biologist to confirm, if possible. These results, saved in the .accdr file, were then imported back into the database, where discrepancies or disagreements could be addressed by the staff biologist or other subject expert.

In reporting, we distinguish between “number of photos processed,” which can include false positives, “number of verified wildlife photos,” and “number of detections.” For our purposes, a detection is the number of independent pictures after a one-minute interval. If there are six photos of one cow that occurs within a one-minute period, that is one detection.

Data sharing – Outreach photos are pulled from the Google Drive folder, watermarked with CSDP’s logo, and saved on CSDP’s Google Drive photo albums for sharing with project partners and on CSDP’s website and social media. All project data is shared with Pima County and our permittees. It is our protocol that if/when any sensitive species are photographed, the permitting agency or landowner be notified promptly first, followed by the appropriate management agency contact, preferably by phone. Camera locations are considered sensitive information and are not shared publicly until after the project is complete. Upon agreement with all parties, if endangered species photos are released to the public, location information is scrubbed from the meta data of the image, and the location should be as broadly vague as possible, as in “southern Arizona,” the mountain range, linkage, or county. Listed species include jaguar, ocelot, Mexican long-nosed bat, Mexican gray wolf, bighorn sheep, Cactus ferruginous pygmy owl, and Sonoran pronghorn. Species in danger of poaching or collection, like most reptiles, Gila monster, desert tortoise, and mountain lion, are generally protected by not sharing specific camera locations.

#### **Biases and Data Limitations:**

Wildlife camera traps are designed to detect wildlife using heat and motion sensing technology. They can provide data on species location, population sizes, and how species interact with each other and their environment including recruitment and predation. They cannot provide data on species absence, only presence. This technology is a fast-growing field, and models and brands differ in capability, including trigger speeds, delay settings, rapid fire or video recording ability, PIR sensor sensitivity settings, and detection distance and detection zone as it relates to the camera’s field of view. Some cameras can record temperature and moon phase as well as the date and time. The trigger speed of the camera model can affect detection probability, especially making it difficult to detect animals moving at speed. PIR sensitivity can affect the detection of cold-blooded reptiles, and ambient environmental heat (or shade) can also cause false negatives particularly during the hot summer months.

To help address some of these biases, we used the same model camera for all our sites. Placement also can create bias unless differing features are considered as part of the study design (Kolowski and Forrester 2017), including but not limited to distance to water, distance to roads, human activity, trails, washes, and height and angle of the camera, vegetation cover, etc. Small animals, reptiles, and birds will not have the same detectability as larger mammals. Additionally, some animals may avoid the camera if startled by a white flash or the sound of the camera engaging, or simply because of the regular presence of people coming to check the cameras.

## Limiting Occurrences and Data Gaps:

Santa Cruz River and El Rio Preserve Site Disturbance – In October 2024, Pima County initiated their Santa Cruz River Cortaro Narrows Project and Wildlife Ramp construction. Tree and vegetation removal has taken place, and construction is expected to continue until May 2027, including post-construction habitat restoration. In addition, the Town of Marana is beginning a habitat restoration project of El Rio Preserve which involves the removal and replacement of Tamarisk trees with native tree species. Tree removal for both projects impacted several of the study's camera locations, so these cameras were safely pulled in October 2024 and will be replaced post-construction or moved to a nearby location. Wildlife disturbance/avoidance is expected to be significant during this phase. One of our historical camera sites from 2017, called Jersey, was located at the current wildlife ramp site, so we have some pre-construction data for both the El Rio Preserve bank protection and the wildlife ramp.



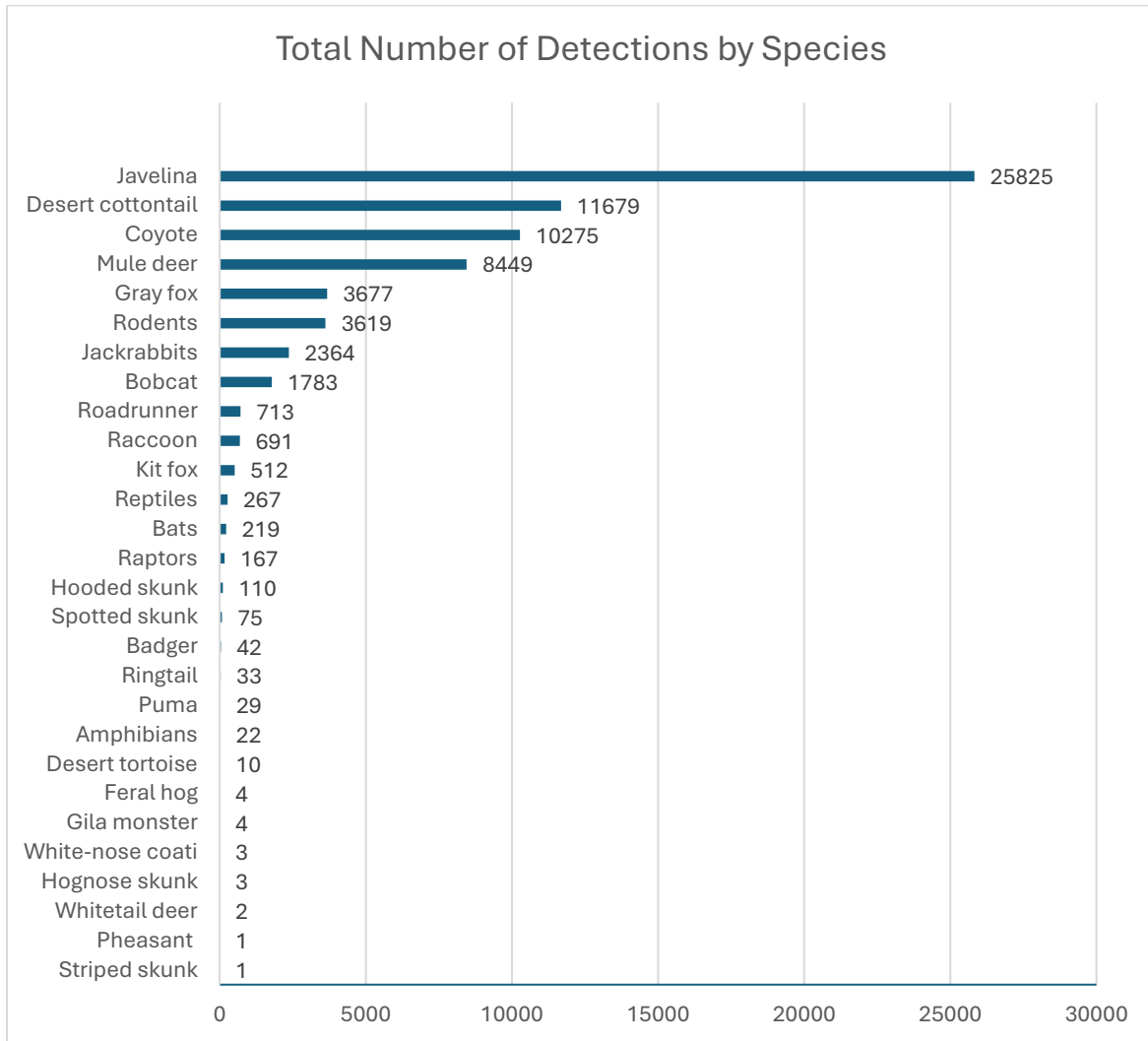
*Figure 4. The newly completed wildlife ramp, with the 1-10 railroad underpass and Tortolita Mountains visible in the upper right corner. Photo by Nanda Srinivasamurthy.*

Rattlesnake Pass/Twin Peaks Rd interchange construction – Beginning in July 2024, construction to widen Twin Peaks Road occurred at Rattlesnake Pass, creating changed traffic flows, evening disturbance, and noise. The Twin Peaks Road widening project at Rattlesnake Pass is a four-phase project that began in July 2024 and is scheduled to finish in August 2026. The project will widen Twin Peaks Road from two lanes to four lanes, add a median, improve drainage, install new traffic signals, and construct a multi-use path.

Phased camera deployment – This project grew over time. Some cameras have been active since 2015, while others were set as late as 2025. Analysis of data will delineate timelines and clearly define the number of camera sites and number of trap days used for each period. Some camera sites stopped being monitored because of development of the open space they were placed on.

## Results 2017 – 2025

**This project has gathered a total of 110,140 verified wildlife photos, and more than 60 species in the study area including mountain lion, white-nose coati, kit fox, and badger.**



*Figure 5. There were a total of 175,324 photos processed resulting in 110,140 verified wildlife photos and 45,902 species detections across all study areas combined. Birds, making the majority of photo records, and some other species including humans, were removed from this figure for clarity.*

### **Key Highlights:**

The photo of a coati at the wildlife ramp was surprising to see due to the rarity of coatis in this area, since coatis prefer higher elevation habitat found in the Tortolita and Catalina mountains, and wooded riparian corridors. Five days before this photo was taken, one of our Desert

Monitor volunteers photographed what we think is the same individual male at his house in the Tucson Mountain foothills south of Rattlesnake Pass, approximately 3km southwest of the wildlife ramp. We also photographed a solitary Coati In El Rio Preserve in February 2024. The Santa Cruz River is clearly a movement corridor for dispersing solitary male coatis, and they do explore the Tucson Mountains despite its lower elevation.

Notable records included two instances of white-nose coati, and four separate detections of the same feral hog (which was eventually recaptured and is no longer in the study area). Similar to previous years, javelina, cottontail, coyote, and mule deer remain the most frequently detected species in the linkage.

There is some indication emerging of the barriers presented along the I-10 route, although these may be explained by variances in habitat within the linkage. The data shows some differences in species richness and species distribution across the different study areas. Thus far, antelope jackrabbits have only been identified within the Santa Cruz River study area. Kit foxes have only been documented on sites east of Interstate-10, and mountain lions have only been documented west of Interstate-10.

In 2015, we began monitoring the railroad underpass and documented use by coyote, bobcat, and badger, despite the presence of vehicle barriers and the remains of several animal carcasses (deer, javelina and coyote primarily) dumped at the west entrance. We also documented sign of javelina using a canal culvert directly south of the railroad underpass to cross the highway. It is encouraging to see that some wildlife passage across I-10 is regularly occurring, although mostly by species that are most adaptable to the human-urban interface.



*Figure 6. A bobcat using the railroad underpass, headed west.*

	Saguaro National Park West & Sanctuary Cove	Scenic Drive Properties	Los Morteros Ridgeline	El Rio Preserve	Santa Cruz River	Wildlife Ramp	Railroad Underpass	Cascada Property	Tortolita Preserve	TOTAL
Number of Camera Sites	4	4	4	4	4	6	6	4	4	40
Number of Species (Species Richness)	23	38	27	31	42	7	4	27	27	63
Number of Species Detections	1199	18479	1455	7042	10884	140	42	2777	3884	45902
Number of Trap Days (Effort)	4975	9513	5934	7095	6023	445	79	5384	3362	42810
Year of first camera deployment	2018	2018	2021	2021	2022	2025	2025	2022	2022	

Table 1. A summary of wildlife camera monitoring effort and results between 2017-2025.

This project was presented in May 2025 at the Santa Cruz River Research Days in Tucson, AZ, and at the October 2025 International Conference on Ecology and Transportation (ICOET) in Denver, CO. These talks can be viewed on CSDP’s website and YouTube channel.



Figure 7. Wildlife camera photo results showing a small selection of the diversity of animals and habitats in the wildlife linkage.

## Avra Valley Wildlife Corridor



*Figure 8. A bobcat crosses a CAP canal wildlife siphon.*

CSDP also has three active cameras monitoring a critical CAP canal wildlife crossing feature west of the Tucson Mountains near Sinagua Rd. This data has been separated from the Tucson – Tortolita Mountain study, and we can report that to date these cameras have collected **2,274 verified wildlife photos over the course of 1,417 traps days, of over 23 species**. The most abundant have been ground birds, coyote, javelina, mule deer, bobcat, and domestic dog. In addition, a local resident has contributed over 5 years of wildlife camera data from her property, located adjacent to this CAP crossing, and we will be processing and incorporating this data as well in the coming year.

**Acknowledgements:**

Thank you to our Desert Wildlife Interns Aster Schaefer and Mireya Ballesteros, our Volunteer Database Manager Virgil Swadley, and our Desert Monitor and Desert Identifier volunteers for helping make this community science program possible. This project was supported by Tucson Electric Company, who provided funds for the addition of solar panels to power our cameras in 2024.

**Project Volunteers:**

Virgil Swadley, Keith Kleber, Kyle Rohlfing, Don Brommall, Chuck Graf, Josh Skattum, Andrew Gourevitch, Zig Fang, Jane Hunter, Tania Morris, Genevieve Bock, Kayla Baker, Jean Boris, Roger Carpenter, Skylar Mitchell, Elizabeth Dupree, Curt Campbell.

**Project Partners:**

Sanctuary Cove, Bean Tree Farms, Town of Marana Parks and Recreation, Pima County Regional Floodplain Control District, Pima County Conservation Lands and Resources, Saguaro National Park, private landowners.

**Principal CSDP Staff Contact:**

Jessica A. Moreno, Wildlife Biologist  
Coalition for Sonoran Desert Protection  
Email: [jessica.moreno@sonorandesert.org](mailto:jessica.moreno@sonorandesert.org)  
Mail: 738 N. 5th Ave. Suite 205, Tucson, AZ 85705  
Web: [www.sonorandesert.org](http://www.sonorandesert.org)  
Office: 520-388-9925