Helicopters and Wildlife Disturbance in the Sonoran Desert

01 Research Question

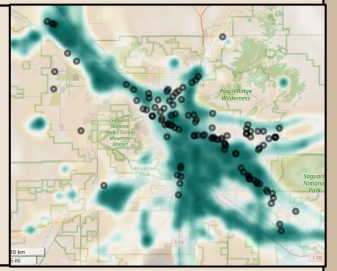
How does the presence of helicopters affect the behavior and presence of wildlife in the Tucson area?

02 Project Design

Use of camera traps across Tucson to determine wildlife response to helicopter presence.

03 Analysis

We aggregated species and helicopter data to measure the species' presence in relation to camera locations across 1-hour intervals.



04 Results

Only Rabbits and Javelina showed a response to helicopter activity. In which Rabbits were less present with helicopters and Javelina were more present.

Introduction

What is This Project?

- This project was designed to understand the effects helicopters have on the behavior of wildlife in the Sonoran Desert.

How Are Helicopters Disruptive?

- Helicopters in particular have been shown to be the most disruptive category of aircraft because of the noise they produce, their proximity to the ground, and their visual presence. Currently, the regulatory altitude limit for wilderness areas as specified by the Federal Aviation Administration is 2,000 ft (609.6 m) above ground level, even though aircraft can be heard and seen from far above that height.

Why is This Research Important?

- This research is important as a way to investigate the potentially harmful effects that helicopters could have on wildlife. Such as potentially causing unnatural changes in behavior, drawing animals away from natural resources, feeding grounds, or other territories.

Motivation

Aviation is and has been the largest part of my life the past 3 years, and having also developed an appreciation for the Sonoran Desert since moving here, I feel it's important to understand how the aviation industry may be harmful to it and how current practices may be altered for better coexistence.

Mt. Fagan pictured from a flight.

Problem and Predictions

Research Question:

- How does the presence of helicopters affect the presence and behavior of wildlife in the Tucson area?

Hypotheses:

- Helicopter presence will cause an absence in wildlife, more so if the helicopter's presence is closer and more intensely felt, such as when flying at lower altitudes.
- Helicopters will cause a greater reaction in prey animals such as rabbits due to the natural threat of airborne predators.

Images from camera traps: Coyote (Canis latrans, top) and Mule Deer (Odocoileus hemionus, bottom).

Methodology

Wildlife Images:

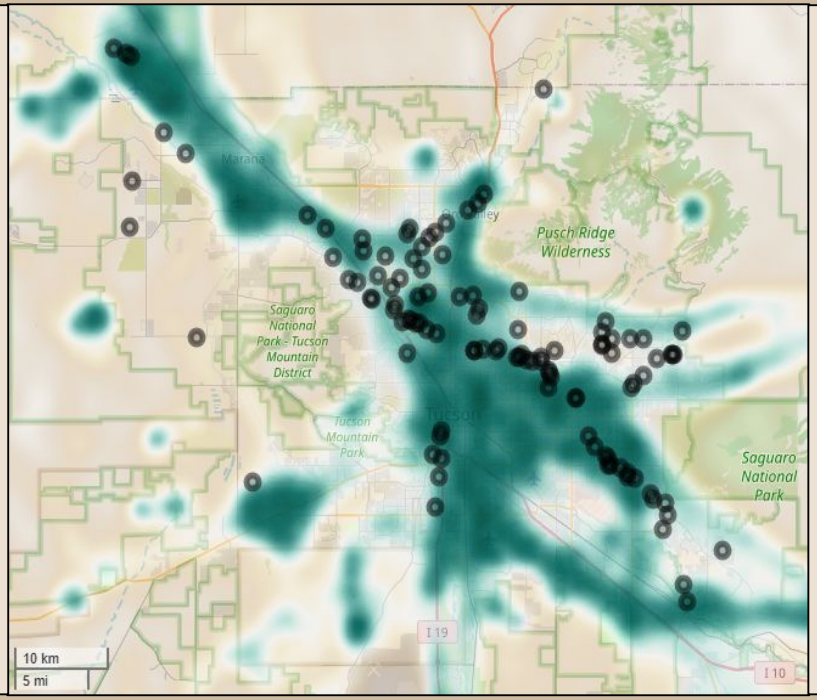
- Camera traps were deployed from November 17, 2024 - July 22nd, 2025 by the Alston Lab at the University of Arizona
- Cameras capture activity 24/7
- February 9th, 2025 - March 11th, 2025 timeline chosen for data collection (all cameras were deployed and active during this period).
- 3-shot rapid fire whenever a camera was triggered by motion activity
- Animals were identified to species by members of the Alston Lab using image processing software, Timelapse

Helicopter Data:

- Helicopter registrations were manually recorded from ADS-B exchange and downloaded KML files for each date they flew in or around Tucson in the chosen timeline.
- KML files provided latitude, longitude, and altitude data for each helicopter at a rate of ~13 positions per minute.
- Retained only helicopter locations $\leq$ 500 m from any active camera trap.

Helicopter Activity

Current heat map of helicopter activity (n=93) across the Tucson area. Camera traps are displayed as black circles.



Most of the KML files in this map were collected from helicopters in central Tucson, where Tucson International and Davis-Monthan Air Force base are located.

Methodology (cont.)

Analysis

- We selected species that were present across the majority of camera sites: coyotes (*Canis latrans*), bobcats (*Lynx rufus*), desert cottontail rabbits (*Sylvilagus audubonii*), and javelina (*Dicotyles tajacu*).
- We aggregated species observations and helicopter data to their presence/absence in relation to camera locations over one-hour intervals.
- Altitudes from each present helicopter across this timespan were averaged to a single value.
- Using the R package glmmTMB, we fit binomial generalized linear models to determine if helicopter presence and altitude influences the presence of these species.

Results

- Coyotes and bobcats did not exhibit a response to helicopter presence.
- Desert cottontail rabbits and javelina both showed a positive relationship with helicopter presence. Desert cottontails were 0.6 times as likely to be observed on our cameras within the hour when at least one helicopter passed within 500m. Javelina were 0.7 times as likely to be observed on our cameras within the hour when at least one helicopter passed within 500m.
- Helicopter altitude did not have an impact on presence/absence of either of these species.

Results A (Helicopter Presence / Absence)

Rabbit

	Estimate	Std. Error	z value	Pr(>|z|)	
(Intercept)	-2.7989788	0.6858783	-4.081	4.49e-05	***
Alt_avg	-0.0005522	0.0005869	-0.941	0.34681	
Zhfi	-0.1955484	0.0905815	-2.159	0.03086	*
Zdem	-0.3259993	0.1240816	-2.627	0.00861	**
Shrub	0.3498531	0.2492750	1.403	0.16047	

Results A (cont.)

Javelina

	Estimate	Std. Error	z value	Pr(>|z|)	
(Intercept)	-6.6183	0.2000	-33.087	< 2e-16	***
helicopter	0.7571	0.3920	1.931	0.05342	.
Zhfi	0.4028	0.1641	2.455	0.01410	*
Zdem	0.0849	0.1298	0.654	0.51297	
Shrub	0.7124	0.2231	3.193	0.00141	**

Results B (Response to Altitude)

Rabbit

	Estimate	Std. Error	z value	Pr(>|z|)	
(Intercept)	-2.7989788	0.6858783	-4.081	4.49e-05	***
Alt_avg	-0.0005522	0.0005869	-0.941	0.34681	
Zhfi	-0.1955484	0.0905815	-2.159	0.03086	*
Zdem	-0.3259993	0.1240816	-2.627	0.00861	**
Shrub	0.3498531	0.2492750	1.403	0.16047	

Results B (cont.)

Javelina

	Estimate	Std. Error	z value	Pr(>|z|)
(Intercept)	-3.801336	2.298165	-1.654	0.0981
Alt_avg	-0.001609	0.002089	-0.770	0.4412
Zhfi	0.803104	0.844328	0.951	0.3415
Zdem	0.896833	0.558254	1.606	0.1082
Shrub	0.005323	0.785231	0.007	0.9946

Interpretations

With coyotes and bobcats not exhibiting any visible response, it can be inferred that they've grown accustomed to the stimuli of the urban areas of Tucson in which they were captured. Rabbits were less likely to be present at the same time as a helicopter, which could be an instinctual response as a prey animal. And peculiarly, Javelina were more present at the same time as a helicopter, which is potentially a result of the human shield effect in which animals will use human-inhabitted areas to avoid their natural predators.

Continuing Work

Future work would benefit from comparing reactions in urban populations to those in rural and remote (wild area) populations of each of these species. Additionally, we had to assess observations within the hour due to processing power limitations for analyses, but this would be better observed at 1-minute intervals to better capture acute response to helicopter presence. Our results could be skewed by our selection of wildlife and helicopter presence at 1-hour intervals. Additionally, rather than gathering from locations across an entire city, it could be more sensible to choose one location for observation, because different areas of a city will possess different stimuli or at least different magnitudes of a stimuli, which can muddy up the final results.

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