



**Guadalupe-Coyote
Resource Conservation District (GCRCD)**
An independent special district of the State of California

888 N. 1st Street, Suite 204, San Jose, CA 95112
408-288-5888 gcrcd@gcrcd.org www.rcdsantaclara.org

Community Grant Application

This document has been provided in Microsoft Word format to facilitate applicant use, but may be converted to a .pdf document for submittal purposes. Please complete all lines; if something doesn't apply, enter "N/A". Handwritten applications are acceptable. In compliance with the Americans with Disabilities Act (ADA), please contact the District at gcrcd@gcrcd.org if you would like to request assistance or accommodations to complete the application.

Section A: Application Information

Project Name: Gray Fox Collaring and Tracking

Applicant (Legal Name of Organization): Urban Wildlife Research Project

Website: <https://urbanwildliferesearchproject.com/> Federal EIN: 472341365

Street Address: 4318 Collins Court, #9, Mountain View, CA 94040

Mailing Address: 4318 Collins Court, #9, Mountain View, CA 94040

Grant Contact:

Name/Preferred Pronouns: Ms. Robin Kline

Title: Grants Director

Email: robinjk@hotmail.com Phone: 202-486-4555

Purpose of Grant: This grant will assist UWRP with GPS collaring of gray fox pups to track their movement through urban corridors in the Palo Alto Baylands area. The collaring project will provide critical GPS data that enables tracking of the fox pups born during the 2021-22 season. Tracking the pups will allow UWRP to pinpoint the location and number of adequate, as well as inadequate, habitat regions along the western edge of the San Francisco Bay. Given this data, it will then be possible to plan for restoration and/or establishment of riparian linkages between distinct habitat regions.

Beginning and Ending Project Dates: August 2021-August 2022

Grant Amount Requested: \$ 5000

Total Project Cost: \$ 30,000 (3 Yrs)

Section B: Project Description

Please enter answers under each question. For purposes of this application, the term “project” refers to either a program or project. These answers will help inform reviewer assessment of the application. The Community Grant Policy and the Community Grant Application Review scoring sheet are available for viewing on the [Community Grant Program](#) page.

1. Describe the proposed project, including goals, proposed methods and implementation strategies, and list measurable outcomes.

UWRP requests \$5000 to assist with collaring activities for one year (2021-2022) of a three-year collaring project. The mission of UWRP is to document gray fox behavior in the San Francisco Baylands region in order to establish healthy habitats and develop the biodiverse wildlife corridors necessary for their survival. The specific goals of this project are to successfully fit five (5) fox pups with GPS collars and track their movements over the course of one year in order to document behavior, birth and death rates, and patterns of dispersal. UWRP has already established 13 trail cameras in the Palo Alto area which volunteer field staff monitor on a daily basis. Using these trail cameras, personal observation, GPS tracking information, and local veterinary services, UWRP will obtain and analyze data on the gray fox to share with other wildlife organizations and government agencies for the purpose of creating wildlife corridors that protect the biodiversity of the Bay area.

The funds requested will provide partial support for equipment and veterinary costs for one year of the three-year collaring project which will run from 2021-2024. Total project budget across three years is \$30,000 (\$10,000 x 3 years). UWRP anticipates raising funds to support the remainder of the collaring project, including modest but dedicated annual funding from the National Wildlife Federation (NWF). All collaring activities are conducted by volunteers, including UWRP Founder Bill Leikam (“the Fox Guy”) and UWRP field assistants who are experienced with wildlife tracking and collaring activities. This project is aligned with the typical mating season of the gray foxes, and is predicated upon estimates based on field experience.

The predicted timeline is:

August-September 2021: Obtain permits for GPS study

September-October 2021: Purchase annual tracking equipment

November 2021: Begin live trapping of up to 5 gray foxes

November-December 2021: Fit 5 gray foxes with GPS collars and begin tracking

December 2021-August 2022: Collect and analyze tracking data

Each fox cohort is tracked throughout the three-year project, so although this particular activity has an “end date” of August 2022, all foxes in this cohort will be tracked for the duration of the total tracking project which concludes in 2024. Additional funding will be raised and utilized to ensure completion of the three-year project.

Measurable Outcomes:

UWRP anticipates successful collaring of five pups over the course of one year, depending upon the foxes' birth rate. Performance metrics include: 1) the number of pups collared; 2) GPS data gathered over the course of one year showing survival success/failure rates; 3) patterns of dispersal; 4) analyses of survival rates and dispersal patterns which will show exactly where habitat needs to be enhanced; and 5) updates on UWRP's partnership with NWF and other organizations.

Data will be collected weekly throughout the project once the pups are collared. The collaring project will yield substantial data that will be helpful in the establishment of wildlife habitat, corridors and linkages to those corridors in the Baylands area.

2. Is this project a portion of a larger project? If so, please include a description of the larger project and how this component fits into it.

Yes. UWRP conducts a multi-year collaring project to document gray fox movement through urban corridors in the San Francisco Baylands area over the course of three years. Using trail cameras, personal observation and GPS tracking information, UWRP obtains and analyzes data on the gray fox to share with other wildlife organizations and government agencies for the purpose of creating wildlife corridors that protect the biodiversity of the Bay area.

Attached to this proposal is the *URBAN GRAY FOX COLLARING PROJECT RESEARCH PROPOSAL AND OUTLINE* which provides detailed information on the collaring project activities, methods and value.

In addition, UWRP Founder Bill Leikam provides regular education and outreach (by invitation) to the public, including local schools and homeowners associations, regarding his work with the gray foxes and how their welfare correlates to UWRP's mission of establishing healthy habitats and developing biodiverse wildlife corridors in the Bay area.

3. Will this grant be used to leverage funding for another grant or funding request? If yes, please explain. No.

4. Are there other organizations and/or partners participating in the project? If yes, please describe their role and level of participation.

Yes. The National Wildlife Federation (NWF) sought out a partnership with UWRP in 2013 which continues through today. Each year NWF provides a minimum of \$5,000 (cash) to UWRP.

5. What is the need, problem, and/or opportunity to be addressed? Who else is addressing it?

Biodiversity is important for the well-being of the ecosystem of the South San Francisco Bay that is interconnected to the larger Bay Area. Each species in an ecosystem has a specific role. Gray foxes are important predators that help control the rodent popu-

lation. As development increases, barriers for gray foxes to naturally intermingle and disperse are created. This leads to a depressed genetic pool, poor health, increased disease, and eventually to population collapse. UWRP has witnessed this first hand: in 2016, an outbreak of canine distemper obliterated the entire gray fox population between Matadero Creek and San Francisquito Creek. This resulted in an explosion in the jack rabbit population as well as other rodents, in addition to killing off the foxes. Previous studies of gray foxes in Southern California suggested the occurrence of gray foxes declines with both proximity and intensity of urbanization. The UWRP collaring project will provide crucial data needed to restore habitat and create corridors for the species to survive in the Baylands area, and also will also be shared with local and state wildlife organizations to support development of wildlife corridors in the region.

UWRP is the only organization in the Bay area, and in the U.S., that is focused on the long term study of the gray fox.

6. How will the project provide a natural resource conservation benefit to the District and/or its constituents?

The collaring project is an important step in protecting the gray fox and its habitat which has much larger implications for the Baylands area. Through ensuring the success of the gray fox population locally, biodiversity on a larger scale is safeguarded, as is maintaining ecosystem balance in the Baylands, preserving important habitats for other wildlife, building resilience to climate change, conserving natural resources, and curbing the spread of diseases and pests, all of which benefit the people of the Baylands and the state of California.

7. Which Area(s) of Strategic Focus in GCRCD's Long Range Plan will be served by this project?

This project addresses the following Strategic Focus Areas of the GCRCD's Long Range Plan:

B. Biodiversity, specifically:

- Provide education and technical assistance to watershed stakeholders to maintain healthy and sustainable native plant and wildlife populations.
- Collaborate with regional partners to develop or improve wildlife linkages and corridors.

<and>

E. Climate Change, specifically:

- Provide public outreach and education on the potential impact of climate change on local wildlife.

<and>

F. Public Engagement, specifically:

- Ensure the public is aware of the role watersheds play in maintaining a healthy and resilient community, and the personal importance of preserving agricultural lands and healthy ecosystems.
- Expand existing outreach and education programs to homeowner associations, community organizations, and educational institutions.
- Make presentations regarding the District’s mission, goals and programs to other government entities and regional organizations.
- Produce outreach materials that can be distributed at events and workshops.

8. How will the project help the District meet its goals for the indicated Areas of Strategic Focus?

Founder Bill Leikam, well known in the San Francisco Bay Area as “the Fox Guy,” has documented hundreds of hours of observation, and has written thousands of pages of research over the past decade. The collaring project provides crucial data needed to help restore habitat and create corridors for the gray fox and other species to survive in this area. This data is also shared with local and state wildlife organizations to support development of wildlife corridors in the region. The National Wildlife Federation, for example, offered to partner with UWRP in 2013 after becoming aware of Bill’s research, and that partnership continues to the present day.

Bill provides regular education and outreach to the public, including local schools and homeowners associations, regarding his work with the gray fox and how their welfare correlates with UWRP’s mission of establishing healthy habitats and developing biodiverse wildlife corridors in the Bay area. In addition to educational outreach to students and the general public, Bill and UWRP are recognized by companies such as Facebook and Intuit, which have invited Bill to speak at their corporate events about his work in order to educate employees about the gray fox population living on their campuses.

UWRP has been invited by the BBC this year to assist them with creating a profile of the gray fox as part of the BBC series Nature, focused on urban wildlife. Bill has also been invited to represent the United States at a large international immersive wildlife video installation in the Museum fur Gestaltung in Zurich, Switzerland.

Bill is a contributing researcher to the field guide Canids of the World by Dr. Jose Castello, published by the Princeton University Press, and is featured in Beth Pratt's book When Mountain Lions are Neighbors, wherein the author calls Bill “the Jane Goodall of the gray foxes.”

UWRP’s research has also been featured in many local and national journals and news media – all of which approached Bill after learning of his monumental work with the gray fox population in the Baylands.

9. What are the anticipated challenges to the successful completion of the project?

Potential anticipated challenges include:

- Lower than normal birthrate for the gray fox, which would result in fewer pups collared;
- Theft of trail cameras;
- COVID-related restrictions limiting in-person education and outreach (which are currently being done virtually);
- Illness/disease in fox population
- Denial of access (for reasons of security) to study gray fox populations that have been sighted in Shoreline in Mountain View and the Google Campus.

10. How will this project incorporate the principles of environmental justice, which call for “fairness, regardless of race, color, national origin or income, in the development of laws and regulations that affect every community’s natural surroundings, and the places people live, work, play and learn”? (Cal EPA).

The UWRP team consists of a majority of women, and UWRP welcomes volunteers from all ethnicities, backgrounds and belief systems. Anyone with a passion for wildlife and the environment with experience that can be helpful to the gray fox is encouraged to join UWRP as a volunteer. Additionally, the educational and community outreach that Bill regularly engages in includes people of all races, creeds, colors, beliefs and income levels, as curiosity about the foxes is all-encompassing.

11. Does this project have a data-driven component to address impacts from climate change? If so, please describe.

The data from the collaring project may indicate that the pups being tracked are being driven increasingly into the urban environment as the sea level rises within the San Francisco Bay. This potentially impacts Bay area citizens as well as other wildlife of the Bay area in ways that are not yet known but that must be measured in order to plan environmental mitigation strategies.

12. How will the project be sustained after the grant has concluded? Will the results provide a basis for additional projects or programs?

UWRP anticipates continued and additional fundraising for the collaring project and educational outreach, and has seen an increase in recurrent individual donations over the past year due to a renewed focus on strengthening the organization’s social media footprint. The National Wildlife Federation has also dedicated a small but significant amount of funding annually to UWRP. These funds combined enable UWRP’s all-volunteer staff to continue collaring and educational outreach activities. Once the data is gathered from the gray fox’s dispersal patterns, the next phase of this project will be to restore and enhance habitat, corridor and linkages conducive to the health of all wildlife living along the San Francisco Bay. (Zoom) discussions between Bill and Lindsay Vivian, Office Chief, Office of Environmental Analysis, Caltrans District 4 (Bay Area) and Lauren Ross, M.S. Associate Biologist, Office of Biological Sciences & Permits, California Department of Transportation are ongoing regarding how the results of the collaring project will inform decisions moving forward on establishing riparian linkages for wildlife corridors.

13. How will project results be made available to the public?

UWRP has increased its social media presence, including posting the monthly Gray Fox Report on Facebook. A brochure and information card have also been developed for educational and outreach events. As stated previously, in addition to educational outreach to students and the general public, Bill is invited by various organizations such as Facebook and Intuit to speak at their corporate events about his work in order to educate employees about the gray fox population living on their campuses. Also, the BBC invited UWRP to assist them with creating a profile of the gray fox as part of the BBC series Nature, focused on urban wildlife. Bill has also been invited to represent the United States at a large international immersive wildlife video installation in the Museum fur Gestaltung in Zurich, Switzerland.

Bill is a contributing researcher to the field guide Canids of the World by Dr. Jose Castello, published by the Princeton University Press, and is featured in Beth Pratt's book When Mountain Lions are Neighbors.

UWRP's research has also been featured in many local and national journals and news media – all of which approached Bill after learning of his monumental work with the gray fox population in the Baylands. Bill has granted approximately 15 interviews to various media outlets (press and online), with two scheduled for this year thus far: Environmental Volunteers, July 3, 2021; and Point Reyes Bird and Nature Festival April 23, 2021.

14. Add or attach any supplemental information you believe is important for the reviewers and/or approving authority to be aware of in assessing your application.

- UWRP's Facebook page, including links to the monthly Gray Fox Report, information on our enthusiastic Board of Directors and volunteers, and other interesting tidbits, may be found here: <https://www.facebook.com/UrbanWildlifeResearchProject>.

- Attached is a research proposal produced by UWRP volunteer and Board Director Patrick Ryan who is completing a Masters degree at Texas Christian University Fort Worth, Texas. Patrick will be working with Bill on the collaring project, including trapping and collaring the gray fox pups. The proposal lays out in detail what is involved with this critical activity.

Section C: Project Budget

Please enter project budget information in the following table. If including indirect costs, please only apply the percentage to the "Personnel" and "Operating Expenses" line items. The total in the "Grant Funding" column should be \$5,000.00 or less. Add additional lines as needed.

Line Item Description	Grant Funding	Matching Funds *	Project Totals
Personnel Costs (list position/hours/hourly wage):		\$14,116.50 (in kind)*	\$14,116.50
*In-kind salary match for Bill Leikam for 2 months of the 12-month collaring project (Yr 1). In-kind match supports collaring and tracking during Nov-Dec 2021 as described in Timeline (8 weeks, 7 days per week, 8 hrs per day). Salary calculated per the allowed CA volunteer hourly rate of \$31.51 (IndependentSector.org)			
Operating Costs (list general categories):			
Equipment: Tellus Micro GPS collar @ \$1700 each (x 5 = \$8,500)	\$4,250	\$4,250 (NWF funding)	\$8,500
RX-98 receiver, Y-4FL antenna plus cable (x 1 = \$1,500)	\$750	\$750 (NWF funding)	\$1,500
Personnel and Operating Expenses Subtotal:			
Indirect Costs (list percentage)	0	0	
Contractual Costs: (list firm name, if known)	0	0	
	Requested	Match	Total
Total	\$5,000	19,116.50	\$24,116.50

* Match is not required but may make the project more competitive.

Section E: Project Deliverables and Due Dates

Please complete the following task table. Add or subtract task lines as needed.

Task #	Task Description	Task Deliverables	Estimated Completion Dates
1	Obtain permits for GPS study	Permits obtained from state nlt September 30	August-September 2021
2	Purchase annual tracking equipment	All tracking equipment purchased and verified in working order nlt October 31	September-October 2021
3	Begin live trapping of gray foxes	Up to 5 gray foxes humanely trapped nlt November 30	November 2021
	Gray foxes fitted with GPS collars and begin tracking	Up to 5 gray foxes fitted with GPS tracking collars nlt December 15	November-December 2021
	Collect and analyze tracking data	GPS data from collars downloaded and analyzed. Results provided to state and local governments/orgs as requested	December 2021 - August 2022
	On-going: Outreach and educational events conducted by Bill Leikam to public	It is anticipated that the number of in-person outreach events will increase, depending upon status of COVID-related closures. Virtual events will continue per invitations to Bill to present to the public, homeowners associations and Bay area companies.	Ongoing

Section D: Additional Attachments

Indicate those attachments included as part of your application.

- xx__ Copy of a current IRS determination letter indicating 501(c)3 tax-exempt status or letter from a fiscal sponsor accepting responsibility (required)
- xx__ Letters of support (optional) - Letter from Beth Pratt, NWF
- xx__ Additional information for Question 14 (optional):

URBAN GRAY FOX COLLARING PROJECT RESEARCH PROPOSAL AND OUTLINE

Section E: Application Signature

I certify that the information contained within this application is true and correct to the best of my knowledge, and that I am authorized to sign on behalf of the applicant.



Authorized Signature

Robin J. Kline, UWRP Grants Director

Print Name/Title

March 22, 2021
Application Date

Submit the application and attachments electronically to gcrd@gcrd.org by 11:59 p.m. on March 22, 2021. Please contact Executive Director Stephanie Moreno at the same email address if you have any questions.



URBAN GRAY FOX COLLARING PROJECT RESEARCH PROPOSAL AND OUTLINE

Published: February, 2021

ABSTRACT

The Urban Wildlife Research Project (UWRP) has been focused on doing research that helps them move towards their goal of maintaining California's natural biodiversity. In order to expand on this research and to take another important step towards their goal, UWRP is developing a project that will use GPS radio-collars to track gray foxes in Palo Alto, California. GPS radio-collars are often used to identify dispersal events/corridors along with preferred habitat and this project will seek to do just that. Using the location data from these collars, a variety of methods using statistical analyses will be employed to identify habitat preferences, home-range characteristics, dispersal events, and current/potential dispersal corridors. The results of this study will be used to inform government officials, land/wildlife managers, and community members on the needs of urban wildlife and what steps can be taken to make maintain healthy urban wildlife populations.

Patrick Ryan

UWRP Board Director and Science/Research Advisor
Research/Teaching Assistant Graduate Student in
Conservation Biology
Department of Biology, Texas Christian University
Fort Worth, Texas

Background:

The gray fox (*Urocyon cinereoargenteus*) is a mesocarnivore and along with its congener, the island fox (*Urocyon littoralis*), makes up the genus *Urocyon* (Collins, 1993). This genus is considered to be the most basal of all living canids (Goddard et al., 2015). Since 2013 the Urban Wildlife Research Project (UWRP) has been doing research on the wildlife of the San Francisco Bay Area (SFBA), with a special focus on the gray fox. UWRP has been studying the gray fox to understand how they are adapting to areas of increasing urbanization in the SFBA such as Silicon Valley. To date, the research has primarily utilized camera traps and direct observation to monitor urban wildlife and the gray fox. These methods have documented fascinating aspects of gray fox behavior such as the utilization of their tree climbing capabilities for hunting as well as their social and pup-rearing interactions (Leikam & Kerekez, 2020).

The research efforts of UWRP have allowed them to not just document the behavior of the gray foxes, but to begin mapping areas of gray fox use around Silicon Valley. Using direct observation, documentation of gray fox signs such as tracks and scat (feces), camera traps, and photos/reports from community science efforts, UWRP has been able to map potential high use areas for the gray fox and other urban wildlife. These areas consist of marshes, mountainous terrain, and creeks in and around the SFBA. This information allows UWRP to help maintain California's natural genetic diversity by mapping, protecting, and enhancing the corridors that wildlife use (Leikam, 2020).

The Problem:

After years of observing the gray foxes, UWRP researchers began to notice signs of decline in both the genetic and population health of the gray foxes in Palo Alto, California. These signs include documented instances of incest (Leikam, 2016), disease/die-offs (Leikam, Gray Fox Report: May 2020), and overpopulation (Roemer et al., 2001; Harestad & Bunnell, 1979; Rogers & Leikam, 2015). These observations resulted in questions being asked about the connectivity and relatedness of these gray foxes to other populations in Silicon Valley (Leikam, 2020). Could a lack of connective habitat be causing problems for the gray fox population in Palo Alto?

Study Goal(s):

UWRP plans to use the data from their radio-collaring project to identify the habitat types that makes up the corridors that the gray foxes use and where they are located. They also hope to better understand the ability of these gray foxes to disperse and move around their urban landscape, and to identify any potential barriers to movement. The collars can also tell us the home range size of these urban gray foxes allowing us to compare them to rural counter parts. The results of this study will hopefully be published in a peer reviewed scientific journal. Some of the potential journals for submission include: The Journal of Urban Ecology, the Western North American Naturalist, the Southwestern Naturalist, and the Proceedings of the California Academy of Science.

Hypothesis:

UWRP hypothesizes that the gray foxes residing in the Baylands Nature Preserve (Baylands) in Palo Alto, California have limited access to corridors to facilitate dispersal and resource allocation due to anthropogenic landscape features and lack of preferred corridor habitat. It is expected that dispersal events and distances will be lower than rural and better-connected populations of gray foxes. If these gray foxes are unable to disperse, we may also expect to see smaller home ranges than rural gray foxes. This is consistent with density inflation seen in island fox populations. However, urban home-ranges are often smaller than rural ones due to resources existing at a higher density. Further study may be required to confirm the likely cause of smaller territories (Roemer et al., 2001; Rountree, 2004). When individuals do disperse, we would expect them to use habitats dominated by hardwood and shrubs along with edge habitats (Deuel et al., 2017).

Rationale:

With the rapid expansion of urban environments around the world over recent decades, it was only a matter of time before wildlife experts began to be curious about the impacts that these developed landscapes have on wildlife populations. To date, urban wildlife research projects exist across the country with long term studies going on in major urban centers such as New York City, Chicago, Los Angeles, Denver, and Austin (TX) (Magle et al., 2019). Of particular

interest for study is how these urban landscapes potentially inhibit instances of dispersal, gene flow, and resource selection which are critical for allowing healthy wildlife population to persist in an urban landscape (FitzGibbon et al., 2007). Gray foxes could provide interesting information on the urban landscape's ability to facilitate important wildlife behaviors such as dispersal and resource selection. This is because while gray foxes are often seen in urban areas, they are not as well adapted to these environments as other urban canids, meaning the impacts of poor urban habitat connectivity could be more observable in the gray fox (Miller & Adams, 1995). Gray foxes also compete for resources and prefer similar habitats to many other animals in these urban environments such as coyotes (*Canis latrans*), raccoons (*Procyon lotor*), skunks (*Mephitis mephitis* and *Spilogale gracilis*), bobcats (*Lynx rufus*), and red foxes (*Vulpes vulpes*) (Chamberlain & Leopold, 2005; Crooks & Van Vuren, 1995; Fedriani et al., 2000). This overlap in resource use means that challenges of living in an urban environment for gray foxes, such as increased disease exposure, may be similar across species occupying similar habitat (Riley et al., 2004). This would seem to suggest that if the gray foxes residing in the Baylands of Palo Alto, California are having difficulty dispersing among other things, other wildlife species in that area might have issues as well.

The challenges that an urban environment present to wildlife dispersal and resource selection have been said to be similar to that of island ecosystems (Adams, 2005). This is because in both scenarios, there is a lack of dispersal options/routes and dispersal distances are reduced while home range overlap remains small (Roemer et al., 2001; Trewhella et al., 1988; Zimmermann et al., 2005). If a smaller than expected home range size, or one comparable to the island fox is observed, this could be suggestive of density inflation of these urban gray foxes due to a lack of dispersal options. (Roemer et al., 2001). As mentioned in the "Hypothesis" section, these smaller home-ranges would also be consistent with what is seen when home-range sizes are compared between rural and urban populations, due to increased resource density in urban settings (Rountree, 2004). A further study may be required to identify what is contributing to smaller home range size. Increasing corridor and dispersal options are important to reduce inbreeding and resource overuse in wildlife populations, while lowering

their densities reducing disease transmission (Christie & Knowles, 2015; Gortázar et al., 2006; Krausman et al., 2014).

In an effort to alleviate the challenges and restrictions that an urban environment can present to wildlife, research has been done on corridors and their habitat characteristics (McClure et al., 2016). To study corridor use of animals, there is a diversity of methods that are used by researchers and wildlife managers. Many of these methods utilize GPS and/or VHF radio-collars in order to establish the location of wildlife corridors and this data provides information on the preferred corridor habitat of a particular species (Leoniak et al., 2012; Pereboom et al., 2008). When studying wildlife corridors, especially in urban habitats, it is important to understand how roads, along with other anthropogenic structures, impede dispersal, if they do at all. Researchers studying urban wildlife look to see if animals avoid roads and where other barriers to movement are, along with identifying preferred locations to cross roadways also by using GPS and/or VHF radio-collar data (Harrison, 1997).

Methods:

Study Site:

The UWRP study will take place primarily at the Baylands Nature Preserve (Baylands) in Palo Alto, California. The Baylands consists of wetland, marshland, and upland ecosystems that play an ecologically critical role for threatened species such as the salt marsh harvest mouse (*Reithrodontomys raviventris*), Ridgway's rail (*Rallus obsoletus*), and western burrowing owl (*Athene cunicularia*). Five vegetation/habitat types are common throughout the Baylands: tidal salt marsh, tidal brackish marsh, diked/muted wetlands, nonnative annual grassland, and riparian forest. The total area of the Baylands is ~ 1,940 acres but the primary area of the study will be in a ~ 3.0 km² area of the preserve between the Palo Alto Airport and Shoreline Lake Park (Edwards & Unger, 2017)(See Figure 1).

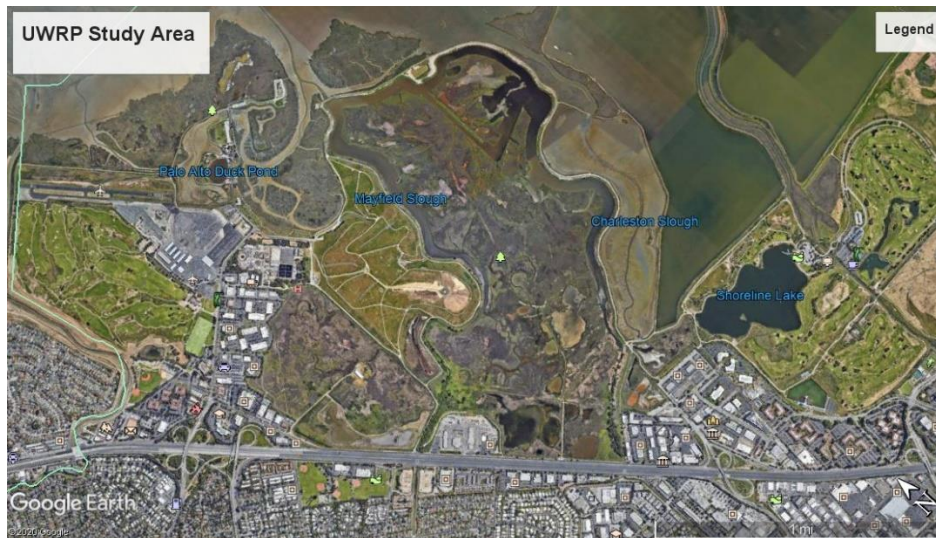


Figure 1: Image of the study area for the UWRP Collaring Project. By “study area” we mean where the trapping of gray fox kits will take place. (Note: Map is oriented where the top of the map is northeast.)

Capture and handling:

Trapping of gray fox kits ($n = 10-20$), with the potential collaring of some adults, will occur in the fall from mid-August to the beginning of November beginning in 2021 and will occur over a ~ 3-year period (Koopman et al., 2000; Nicholson et al., 1985). This is to ensure both that the kits are large enough to be fitted with the 180 g GPS radio-collar (GPS Logger W500, Advanced Telemetry Systems, Isanti, MN) and that they are collared before they disperse from their natal range. Kits will be trapped using cage traps with a spring door activated by a treadle (Tomahawk, USA). The dimensions of the traps will be ~ 32 x 10 x 12 3/4 inches and traps will be placed near den sites and areas of known use by the kits (Best Management Practices for Trapping Gray Foxes in the United States, 2014; Nicholson et al., 1985). Traps will be checked once a day in to prevent kits from being in a trap for too long. For both the safety of the researchers and the foxes, kits will be restrained using a catch-pole and secured by placing electrical tape around the muzzle, rostrum, and legs while using a blindfold to reduce animal stress (Deuel et al., 2017). If deemed necessary, an intramuscular injection of a 1:1.2 mixture of Ketamine 7.0- 10.0 mg/lbs and xylazine 0.5 - 1.0 mg/lbs will be administered (Taylor, 2021; Harrison, 1997). Kits will be given ear tags in each ear for easier identification and a DNA (hair) sample will be collected. GPS radio-collars will be programmed to record a location every 2

hours (12 locations/day) until cessation of data collection (Fall of 2022). After data collection is complete the collars will be programmed to fall off. If this mechanism fails (~10% of the time), it has been shown that GPS radio-collars generally have little to no long-term impacts on the animals (Stabach et al., 2020). Thankfully, the uncommon occurrence of the drop-off mechanism failing now happens at an ever-decreasing rate with improvements in drop-off mechanism technology (Buil et al., 2019). Foxes will be monitored once every week with a 3-element Yagi antenna and hand-held radio telemetry receiver in order to obtain a remote download using the ATS downloading software/antenna on a laptop to generate a KML file. During dispersal season, daily attempts may be made to find the foxes.

Data Analysis:

Home-ranges and habitat selection will be calculated and analyzed using the function package “adehabitatHR” in Program R v.4.0.0 (Calenge, 2006). Home-ranges will be calculated using both 95% minimum convex polygons (MCPs) and 95% kernel density estimates (KDEs). Home ranges will be calculated for individuals with at least ~80 location fixes (Roemer et al., 2001). Habitat selection will be analyzed using both “adehabitatHR” function in Program R v.4.0.0 and Arc GIS by overlaying home-ranges on a GIS shape file of the study area showing habitat types classified by vegetation and land use. This will allow us to analyze what habitat types the foxes are utilizing at each location and what proportion of these locations are in each habitat type (Davis et al., 1994). The size of the home-ranges in our study will be compared to the size of home-ranges from other studies on gray foxes in more rural environments and on island fox (*Urocyon littoralis*) populations (dispersal distances will be compared as well). This will allow us to see if there is a significant statistical difference between gray foxes in an urban landscape and those that live in more connected rural or isolated island ecosystems. This comparison will be done using an unpaired t-test on the mean home-range sizes from our study and the studies done on island and rural populations (Guillet et al., 1996). This test, along with all statistical tests in this study, will be done in the statistical program R v.4.0.0.

To analyze dispersal, dispersal distance will be defined as the distance separating the arithmetic centers of pre- and post-dispersal home-ranges. If accurate home-range estimates

cannot be made after dispersal, the distance between the arithmetic center of the pre-dispersal home range and the farthest post-dispersal location will be used as the dispersal distance (Roemer et al., 2001). If pre-dispersal home-ranges cannot be estimated, the capture location or natal den site will be used as the arithmetic center of the pre-dispersal home-range (Koopman et al., 2000; Zimmermann et al., 2005). Dispersal events will be defined as movements/locations between the first date of dispersal (the median between last location date within natal range and first location date > 1km from the natal range) and the first movement/location within its post dispersal home-range (Koopman et al., 2000). Locations within these dispersal events will be used to map corridors and an analysis on habitat selection will be done using those locations using similar methodologies outlined earlier for habitat selection within the home-ranges. Survival of fox kits post collaring will be monitored, especially during dispersal, in order to see mortality as a potential cause of low dispersal and if dispersal events put the foxes at increased risk of mortality.

To further analyze habitat connectivity, potential corridors will be identified using a GIS-generated Least Cost Path Analysis (LCP) (Leoniak et al., 2012). This will allow us to better understand not just where corridors may be located, but what potential barriers to movement may be.

Conservation Implications:

As a result of this research, this data can be used to inform government officials, land/wildlife managers, and community members on the needs of urban wildlife and what steps can be taken to maintain healthy urban wildlife populations. This study will allow these decisions to be made efficiently by allowing areas of critical conservation interest to be more readily identified. Furthermore, the variety of published data for this project will be useful for future research by UWRP and other organizations as well.

Literature Cited:

- Adams, L. W. (2005). Urban wildlife ecology and conservation: A brief history of the discipline. *Urban Ecosystems*. <https://doi.org/10.1007/s11252-005-4377-7>
- Best Management Practices for Trapping Gray Foxes in the United States. (2014). Retrieved January 06, 2021, from https://www.dec.ny.gov/docs/wildlife_pdf/trapbmpsgrayfox.pdf
- Buil, J. M., Peckre, L. R., Dörge, M., Fichtel, C., Kappeler, P. M., & Scherberger, H. (2019). Remotely releasable collar mechanism for medium-sized mammals: An affordable technology to avoid multiple captures. *Wildlife Biology*, 2019(1). doi:10.2981/wlb.00581
- Calenge, C. (2006). The package “adehabitat” for the R software: A tool for the analysis of space and habitat use by animals. *Ecological Modelling*. <https://doi.org/10.1016/j.ecolmodel.2006.03.017>
- Chamberlain, M. J., & Leopold, B. D. (2005). Overlap in space use among bobcats (*Lynx rufus*), coyotes (*Canis latrans*) and gray foxes (*Urocyon cinereoargenteus*). *American Midland Naturalist*. [https://doi.org/10.1674/0003-0031\(2005\)153\[0171:OISUAB\]2.0.CO;2](https://doi.org/10.1674/0003-0031(2005)153[0171:OISUAB]2.0.CO;2)
- Christie, M. R., & Knowles, L. L. (2015). Habitat corridors facilitate genetic resilience irrespective of species dispersal abilities or population sizes. *Evolutionary Applications*. <https://doi.org/10.1111/eva.12255>
- Collins, P. W. (1993). Taxonomic and Biogeographic Relationships of the Island Fox (*Urocyon littoralis*) and Gray Fox (*U. cinereoargenteus*) from Western North America. *Third California Islands Symposium: Recent Advances in Research on the California Islands*.
- Crooks, K. R., & Van Vuren, D. (1995). Resource utilization by two insular endemic mammalian carnivores, the island fox and island spotted skunk. *Oecologia*. <https://doi.org/10.1007/BF00328365>
- Davis, A. J., Manly, B. F. J., McDonald, L. L., & Thomas, D. L. (1994). Resource Selection by Animals: Statistical Design and Analysis for Field Studies. *The Journal of Animal Ecology*. <https://doi.org/10.2307/5247>

- Deuel, N. R., Conner, L. M., Miller, K. V., Chamberlain, M. J., Cherry, M. J., & Tannenbaum, L. V. (2017). Habitat selection and diurnal refugia of gray foxes in southwestern Georgia, USA. *PLoS ONE*. <https://doi.org/10.1371/journal.pone.0186402>
- Fedriani, J. M., Fuller, T. K., Sauvajot, R. M., & York, E. C. (2000). Competition and intraguild predation among three sympatric carnivores. *Oecologia*. <https://doi.org/10.1007/s004420000448>
- FitzGibbon, S. I., Putland, D. A., & Goldizen, A. W. (2007). The importance of functional connectivity in the conservation of a ground-dwelling mammal in an urban Australian landscape. *Landscape Ecology*. <https://doi.org/10.1007/s10980-007-9139-x>
- Goddard, N. S., Statham, M. J., & Sacks, B. N. (2015). Mitochondrial analysis of the most basal canid reveals deep divergence between eastern and western North American gray foxes (*Urocyon* spp.) and ancient roots in Pleistocene California. *PLoS ONE*. <https://doi.org/10.1371/journal.pone.0136329>
- Gortázar, C., Acevedo, P., Ruiz-Fons, F., & Vicente, J. (2006). Disease risks and overabundance of game species. In *European Journal of Wildlife Research*. <https://doi.org/10.1007/s10344-005-0022-2>
- Guillet, C., Bergström, R., & Cederlund, G. (1996). Size of winter home range of roe deer *Capreolus capreolus* in two forest areas with artificial feeding in Sweden. *Wildlife Biology*. <https://doi.org/10.2981/wlb.1996.039>
- Harestad, A. S., & Bunnell, F. L. (1979). Home Range and Body Weight--A Reevaluation. *Ecology*. <https://doi.org/10.2307/1937667>
- Harrison, R. L. (1997). A Comparison of Gray Fox Ecology between Residential and Undeveloped Rural Landscapes. *The Journal of Wildlife Management*. <https://doi.org/10.2307/3802420>
- Koopman, M. E., Cypher, B. L., & Scrivner, J. H. (2000). Dispersal patterns of San Joaquin kit foxes (*Vulpes macrotis mutica*). *Journal of Mammalogy*. [https://doi.org/10.1644/1545-1542\(2000\)081<0213:DPOSJK>2.0.CO;2](https://doi.org/10.1644/1545-1542(2000)081<0213:DPOSJK>2.0.CO;2)

- Krausman, P. R., Christensen, S. A., McDonald, J. E., & Leopold, B. D. (2014). Dynamics and social issues of overpopulated deer ranges in the United States: A long term assessment. *California Fish and Game*.
- Leikam, W. (2016). Incest at the Baylands. Retrieved December 09, 2020, from <https://urbanwildliferesearchproject.com/2016/03/05/456/>
- Leikam, W. (2020, June 04). Gray Fox Report: May 2020. Retrieved December 09, 2020, from <https://urbanwildliferesearchproject.com/gray-fox-report-may-2020/>
- Leikam, W. (2020, November 03). SF Bay Area Wildlife Corridor. Retrieved December 08, 2020, from <https://urbanwildliferesearchproject.com/our-vision-bay-area-ridge-wildlife-corridor/>
- Leikam, W., & Kerekez, G. (2020, October 15). Gray Foxes of Silicon Valley. Retrieved December 08, 2020, from <https://urbanwildliferesearchproject.com/documentary/>
- Leoniak, G., Barnum, S., Atwood, J. L., Rinehart, K., & Elbroch, M. (2012). Testing GIS-generated least-cost path predictions for *martes pennanti* (Fisher) and its Application for Identifying Mammalian Road-crossings in Northern New Hampshire. In *Northeastern Naturalist*. <https://doi.org/10.1656/045.019.0201>
- Magle, S. B., Fidino, M., Lehrer, E. W., Gallo, T., Mulligan, M. P., Ríos, M. J., Ahlers, A. A., Angstmann, J., Belaire, A., Dugelby, B., Gramza, A., Hartley, L., MacDougall, B., Ryan, T., Salisbury, C., Sander, H., Schell, C., Simon, K., St Onge, S., & Drake, D. (2019). Advancing urban wildlife research through a multi-city collaboration. *Frontiers in Ecology and the Environment*. <https://doi.org/10.1002/fee.2030>
- McClure, M. L., Hansen, A. J., & Inman, R. M. (2016). Connecting models to movements: testing connectivity model predictions against empirical migration and dispersal data. *Landscape Ecology*. <https://doi.org/10.1007/s10980-016-0347-0>
- Miller, E. J., & Adams, L. W. (1995). Urban Wildlife Habitats: A Landscape Perspective. *The Journal of Wildlife Management*. <https://doi.org/10.2307/3809137>

- Nicholson, W. S., Hill, E. P., & Briggs, D. (1985). Denning, Pup-Rearing, and Dispersal in the Gray Fox in East-Central Alabama. *The Journal of Wildlife Management*.
<https://doi.org/10.2307/3801836>
- Pereboom, V., Mergey, M., Villerette, N., Helder, R., Gerard, J. F., & Lode, T. (2008). Movement patterns, habitat selection, and corridor use of a typical woodland-dweller species, the European pine marten (*Martes martes*), in fragmented landscape. *Canadian Journal of Zoology*. <https://doi.org/10.1139/Z08-076>
- Riley, S. P. D., Foley, J., & Chomel, B. (2004). Exposure to feline and canine pathogens in bobcats and gray foxes in urban and rural zones of a national park in California. *Journal of Wildlife Diseases*. <https://doi.org/10.7589/0090-3558-40.1.11>
- Roemer, G. W., Smith, D. A., Garcelon, D. K., & Wayne, R. K. (2001). The behavioural ecology of the island fox (*Urocyon littoralis*). *Journal of Zoology*.
<https://doi.org/10.1017/S0952836901001066>
- Rogers, E., & Leikam, W. (2015). On The Trail of the Surprisingly Mysterious Gray Fox -. Retrieved December 09, 2020, from <https://baynature.org/article/on-the-trail-of-the-surprisingly-mysterious-gray-fox/>
- Rountree, G. H. I. (2004). Comparative study of the home range and habitat usage of red foxes and gray foxes in an urban setting: a preliminary report. *Proceedings 4th International Urban Wildlife Symposium*.
- Stabach, J. A., Cunningham, S. A., Connette, G., Mota, J. L., Reed, D., Byron, M., Songer, M., Wachter, T., Mertes, K., Brown, J. L., Comizzoli, P., Newby, J., Monfort, S., & Leimgruber, P. (2020). Short-term effects of GPS collars on the activity, behavior, and adrenal response of scimitar-horned oryx (*Oryx dammah*). *PLoS ONE*.
<https://doi.org/10.1371/journal.pone.0221843>
- Trewhella, W. J., Harris, S., & McAllister, F. E. (1988). Dispersal Distance, Home-Range Size and Population Density in the Red Fox (*Vulpes vulpes*): A Quantitative Analysis. *The Journal of Applied Ecology*. <https://doi.org/10.2307/2403834>

Zimmermann, F., Breitenmoser-Würsten, C., & Breitenmoser, U. (2005). Natal dispersal of Eurasian lynx (*Lynx lynx*) in Switzerland. *Journal of Zoology*.
<https://doi.org/10.1017/S0952836905007545>



March 21, 2021

RE: Recommendation for Bill Leikam and the Urban Wildlife Research Project

To Whom It May Concern,

I am writing to you on behalf of the National Wildlife Federation to express our support for Bill Leikam and his important work with the Urban Wildlife Research Project (UWRP). Operating for over 80 years, the Federation is one of the United States' largest and oldest non-profit wildlife conservation organizations with more than 6 million members and supporters across the country.

In California, the Federation works on a number of conservation projects, and our work throughout the state focuses on restoring habitat, connectivity and corridors for wildlife. As the California Regional Executive Director for National Wildlife Federation and a leading proponent of connecting wildlife corridors, I have been fascinated by the observational research Bill Leikam and the Urban Wildlife Research Project have undertaken since I first interviewed him for my book, *When Mountain Lions Are Neighbors*, in 2013. I was so impressed with his work, I offered to support their project through the National Wildlife Federation, and we have been an official partner for over eight years.

UWRP, which Bill founded, is the only organization in the Bay Area, and in the country, which is focused on the long-term study of the gray fox. These ancient canids represent a touchstone for the importance of genetic diversity in the Baylands, throughout California and the United States, and also serve as an indicator for overall environmental health. Bill's work with UWRP provides critical data necessary for developing a San Francisco Bay Area Wildlife Corridor, and his work has provided data that can be used to map, protect, and enhance the corridors that wildlife use to travel from one region to another. For example, it was Bill who discovered, through the UWRP collaring project, that an outbreak of canine distemper wiped out the entire gray fox population between Matadero Creek and San Francisquito Creek in 2016. This one event resulted in an explosion of the rodent population in addition to killing off the foxes. The current collaring project that UWRP will undertake this year will provide data and analyses that are critical for restoring habitat and creating corridors for the gray fox and other species to survive in the Baylands area, and will also be shared with local and state wildlife organizations to support development of larger wildlife corridors throughout the region.

The passion and diligence that Bill and his team apply to studying urban gray foxes speaks to the impact citizen scientists and educators can have on wildlife and habitat conservation efforts. With volumes of information gathered on *Urocyon cinereoargenteus* in the Palo Alto Baylands area by Bill already that has provided invaluable insight into urban gray fox behavior, the National Wildlife Federation is proud to support the next level of research needed to ensure that gray foxes and other wildlife species can disperse and thrive in the Silicon Valley region.

In short, I highly recommend Bill Leikam, and the organization he founded, UWRP, for this grant award. I believe his work directly supports California's efforts to mitigate habitat loss, fragmentation and isolation of wildlife

populations due to urban encroachment -- all which are major factors in the decline of wildlife populations and environmental degradation worldwide.

Please do not hesitate to contact me if you need additional information. If you have any questions, I can be reached at prattb@nwf.org or (209) 620-6271.

Sincerely,

A handwritten signature in cursive script that reads "Beth Pratt".

Beth Pratt
California Regional Executive Director, National Wildlife Federation
prattb@nwf.org (209) 620-6271