BUILDING THE MINDS OF TOMORROW TODAY

CuriOdyssey AT COYOTE POINT

2017 Year End Reports for Conservation and Research Partnerships

This is a summary of the research and conservation efforts supported by CuriOdyssey's Conservation Fund in 2017

1. AZA S.A.F.E.
2. Bay Area Bobcat Study (*Felis rufus*)
3. Bay Area FrogWatch (Anurans)
4. CuriOdyssey Beach Cleanup
5. CuriOdyssey Conservation Crew
6. Marsh Research by Catherine Brett (LIRA)
7. Marsh Restoration Project
8. Northern Pacific Tree Frog Pond (*Psuedacris regilla*)
9. Ringtail Research Project (*Bassariscus astutus*)
10. River Otter Ecology Project (*Lontra canadensis*)
11. UC Berkeley Urban Bee Lab
12. Urban Wildlife Research Project (*Urocyon cinereoargenteus*)
13. Western Pond Turtle (*Emys marmorata, Emys pallida*) Ecology and Conservation

1. AZA S.A.F.E.

No funds requested

Summary written by Megan Hankins

CuriOdyssey continues to cooperate with other facilities for AZA's S.A.F.E. initiative- Saving Animals From Extinction. Western pond turtles were one of the first species unveiled by AZA to focus conservation efforts on. CuriOdyssey is home to seven western pond turtles- two adults that live in the walk through aviary and five juveniles that live in the Keeper Building area that are the offspring of the two adults. In the springtime of 2018 we are planning to collect blood samples on our two adults to determine if our turtles are the northern or southern subspecies. Knowing this will help us determine whether or not our turtles can be used for captive breeding purposes.

2. **Bay Area Bobcat Study (*Lynx rufus*) Felidae Conservation Fund**

Funds requested: $1000

Funds granted: $1000

Summary written by Courtney Coon, FCF

On behalf of Felidae Conservation Fund, I would like to thank CuriOdyssey for its support during the past year. In addition to our grant award, CuriOdyssey also hosted us for our informational "Living with Lions" lecture in May and CuriOdyssey's own Megan Hankins is an integral part of our camera trap research on the San Francisco peninsula. Below is a list of accomplishments that Felidae has completed this year.

- Felidae submitted its first academic publication entitled "Effects of land-use and prey abundance on the body condition of an obligate carnivore at the wildland-urban interface" to *Land-use and Urban Planning* journal.
- Our organization hosted 4 interns, including 2 masters (M.S.) students, who worked on a wide variety of research projects. Research topics ranged from developing methods to estimate bobcat density to vegetation surveys in habitats with and without pumas to examining human attitudes towards pumas and other large carnivores in the SF Bay Area.
- The Bay Area Puma and Bobcat Project is currently collecting image data from 121 motion-sensor trail cameras in San Mateo, Marin, Sonoma, Napa and Solano counties. Over three-quarters of these cameras are maintained by local citizen scientists.
- In addition to our general puma and bobcat monitoring program, we began a new project in October 2017 in order to monitor wildlife moving along I-280 – a very deadly freeway for animal movement. Data collection for this project will continue through

next year with data analysis beginning mid-2018, analyses completed by the end of next year and a manuscript prepared by year 2019.

- To date, our all-volunteer data entry team has categorized over 590,000 photographs.

3. **Bay Area FrogWatch**

Funds requested: $85.44
Funds granted: $85.44

Summary written by
Megan Hankins

The 2017 FrogWatch season saw 11 newly certified volunteers join our group. Volunteers are expected to go to wetland sites and listen for frog and toad calls and record that data in an online database. Between February and August, a total of 36 observations were made at nine different sites throughout the Peninsula. Of the six species that are found in the Bay Area, volunteers observed a total of three different species during the season- the Pacific tree frog (*Pseudacris regilla*), the western toad (*Anaxyrus boreas*), and the American bullfrog (*Rana catesbeiana*). The California red legged frog (*Rana aurora draytonii*), which is CA's state amphibian and a threatened species, was seen at one of the wetland sites, although we did not hear it calling. While not all volunteers were able to follow-through with their duties, we had more volunteers out in the field this year than we had in previous years. We are expecting that the 2018 season will see even more volunteers out in the field for FrogWatching!

4. **CuriOdyssey Beach Cleanup**

Funds requested: $58.04

Funds granted: $58.04

Summary written by Megan Hankins

Once again, CuriOdyssey collaborated with Coyote Point Park Rangers to organize two beach cleanups at Coyote Point Park, one during Earth Day week in April and one on California Coastal Cleanup Day in September. Volunteer Manager Lee Cauble has taken the lead on organizing these events for several years, with the help of CuriOdyssey staff and park rangers. A total of 257 volunteers showed up to pick up trash and recycling on Earth Day, and Coastal Cleanup Day welcomed 229 volunteers to park for the cleanup! Funds were used to buy supplies for the cleanup as well as to provide snacks for volunteers that attended the events.

Coastal Cleanup Day, September 16, 2017

5. CuriOdyssey Conservation Crew

No funds requested

Summary written by Megan Hankins and Roisin Altreuter

2017 saw the creation of CuriOdyssey's Conservation Crew, a cross-departmental initiative started by educator Roisin Altreuter. The Conservation Crew, or CC, aims to weave conservation into our organizational habits and to help CuriOdyssey become a conservation leader in our community. Our initiatives have included expanding our compost collection program, bringing in conservation-themed speakers for our staff, increasing the amount of conservation-based education in our programming, and more. Future topics of interest for the CC include implementing more native plants in the garden and continuing to streamline composting and recycling for staff and visitors at CuriOdyssey.

6. **LIRA Research Project by Catherine Brett (*Limonium rasmosissimum*)**

Funds requested: $102.36

Funds granted: $102.36

Summary written by Catherine Brett

Experimental Strategy to Reduce *Limonium ramosissimum* at Coyote Point Marsh

Limonium ramosissimum, also known as Algerian sea lavender or LIRA, is a perennial herb native to the western Mediterranean. Introduced into the San Francisco Bay Area where it has proven invasive, LIRA has out-competed native plants including *Sarcocornia pacifica* (perennial pickleweed) and *Distichlis spicata* (coastal salt grass) in salt marshes (Barbour et al., 2007). LIRA forms dense, nearly monotypic mats and directly competes with native pickleweed (Archbald and Boyer, 2014a), which provides habitat for the endangered salt marsh harvest mouse, *Reithrodontonmys raviventris* (Sustaita et al., 2011).

Soon after dense patches of LIRA were discovered in the San Francisco Estuary in 2006, research began to map the extent of spread of LIRA and assess its invasion potential (Perlmutter et al, 2011). Recent research has revealed that a single large LIRA plant can yield as many as 17,000 seeds (Archbald and Boyer, 2014a). This species thrives in the higher marsh zones from MHW (mean high water) to MHHW (mean higher high water) zones in low salinity conditions (Archbald and Boyer, 2014b). Therefore, the seed bank under a mat of LIRA has the potential to provide an abundant supply for new recruitment despite diligent hand removal efforts.

In June 2016, funded by a grant from the National Fish and Wildlife Foundation (NFWF), the California Invasive Plant Council (Cal-IPC) treated the LIRA at Coyote Point with an herbicide application using a combination of imazapyr and glyphosate, two active ingredients that have shown previous success (Drew Kerr, personal communication, May 2016). In October 2016 following the herbicide application, observations of its effectiveness on LIRA revealed mixed results. Some LIRA was entirely dead, with both leaves and tap root brown. In contrast, some LIRA was entirely green, either seemingly unaffected by the chemical spray, or possibly overlooked and not sprayed. The remaining LIRA was yellow or red in places, but also included live, green tissues, and was perhaps only partially affected by the imazapyr application.

Many groups around the Bay Area have organized to manually remove LIRA. Hand removal of LIRA began at Coyote Point Marsh in 2013 largely through the efforts of volunteer groups

organized by Catherine Brett (Science Educator) and Lee Cauble (Volunteer Manager) from CuriOdyssey. The volunteer groups focused their efforts on two affected areas along Coyote Point Marsh, where they pulled LIRA seedlings a few times every year. Hand removal, however, is a costly and time-consuming effort.

Given Cal-IPC will apply herbicide again on March 17, 2017, we want to understand how best to maximize LIRA reduction with the combination of manual removal and herbicide treatments, while trying to minimize hand removal efforts. **The purpose of this proposed research is to determine whether manual removal in conjunction with herbicide treatment can shorten the time to local eradication.**

Since initial herbicide treatments in the Estuary showed variable efficacy, LIRA eradication may require combining methods in an Integrated Vegetation Management (IVM) strategy. The research will investigate the impacts of different levels of manual removal effort after an herbicide application to determine if the maximum LIRA reduction is achieved by manually removing all LIRA plants, or whether it is equally effective to remove only the large LIRA plants. The results of this experiment will serve to inform future management strategies and LIRA removal efforts, at Coyote Point and potentially the greater San Francisco Estuary.

Removing LIRA is beneficial because it is invasive and outcompetes the native plants, displacing them without replacing the function. A native marsh habitat provides the structure and function for the most beneficial productivity to the marsh community. Native and endangered San Francisco bay marsh animals such as the California Ridgeway Rail and the Salt Marsh Harvest mouse depend on native, healthy marsh habitat for survival. Additionally, a highly functioning marsh accretes soil, absorbs wave action and acts as a biofilter.

The Marsh Research Project is being conducted in partnership with Drew Kerr, the Program Treatment Manager at the Invasive Spartina Project (ISP). The results of the experiment will inform future LIRA management practices in the greater San Francisco Estuary.

Site Selection

- Study area located with Kerstin Kalchmayr's LIRA mapping research at Coyote Point Marsh (Fig. 1).
- North side of Coyote Point Marsh within MHW to MHHW zones (Fig. 2)
- 10 replicate treatments at each site
- 30 plots randomly selected (3 treatments)
- Each plot is 1.0 m^2 quadrat

Methods

We will observe *Limonium ramosissimum* recruitment every 3 months for 2 years after the hand removal treatments and chemical treatments, and record the following measurements.

Record measurements at sites:

- Flower stage (rosette, bolting, flowering, senescence)

- Percent coverage of LIRA plants
- Percent coverage of other native and non-native plants

Treatments:

- Treatment 1: Remove all LIRA plants
- Treatment 2: Remove large LIRA plants only (large >15cm rosette D at widest point)
- Treatment 3: Control (no hand removal)

Condition of LIRA in plots (before and after herbicide application in Spring 2017):

- Record percent coverage of live LIRA in a plot before and after treatments
- Record percent coverage of dead LIRA in a plot before and after treatments
- Record percent coverage of mixed LIRA in a plot before and after treatments

Record percent coverage of other plants within the plot:

Native

- *Sarcocornia pacifica* - pickleweed
- *Distichlis spicata* – saltgrass
- *Jaumea carnosa*

Non-native, invasive

- *Salsola soda*
- *Carpobrotus edulis* – ice plant
- *Oxalis pes-caprae* or other Oxalis sp. – sour grass

Chemical Treatment

Cal-IPC will treat the experimental plots with herbicide on March, 17, 2017. Data collection will be completed May 2019. Data will be collected every 3 months after the herbicide is applied and hand removal treatments are completed.

Education Outreach

At the heart of CuriOdyssey's mission is public engagement with authentic science and creating opportunities to help protect our natural resources. This research exemplifies CuriOdyssey's role as a thought leader in environmental advocacy, supports the educational mission of the museum, and engages local communities in stewardship of the natural world. Teen Citizen Scientist volunteers will play an integral role in this project through hand removal and data collection. Data and results of the project will be shared and composed with Drew Kerr who will also serve as advisor to the project team.

Budget

PVC pipe: ¾ in X 10 ft length, Sch 40 PVC pipe $2.53 each (24) = $60.72
Bag of 25 PVC elbows: ¾ in, 90° Sch 40 PVC pipe elbows $6.75 each (3) = $20.25
PVC cement: 8oz PVC purple primer and solvent cement $8.39
Surveyors flagging tape: 2 rolls, $2.99 each (2) = $5.98
18 gauge wire: 1 roll = $3.15
Spray paint: 1 can = $3.87
Portable file storage container: $10.84
Total: $113.20

Fig 1 –Map of *Limonium ramosissimum* (LIRA) at Coyote Point (Kerstin Kalchmayr 2016, Map generated by Drew Kerr, ISP)

Fig 2 –
Proposed site for this experiment (Map generated by Drew Kerr, ISP)

Literature Cited:

1. Archbald G., Boyer K.E., (2014a). Distribution and invasion potential of *Limonium ramosissimum* subsp. *provinciale* in San Francisco Estuary salt marshes. San Francisco Estuary Watershed Sci 12(2):18824.

2. Archbald G., Boyer K.E., (2014b). Potential for Spread of Algerian Sea Lavender (*Limonium ramosissimum* subsp. provinciale) in Tidal Marshes. Invasive Plant Science and Management, 7(3):454-463.

3. Barbour M., Keeler-Wolf T., Schoenherr A.A., (2007). Terrestrial vegetation of California, third edition. Berkeley (CA): University of California Press.

4. Sustaita D., Quickert P.F., Patterson L., Barthman-Thompson L., Estrella S., (2011). Salt marsh harvest mouse demography and habitat use in the Suisun Marsh, California. J Wild Manage 75: 1498–1507.

5. Perlmutter, M., Archbald, G., Boyer, K.E., (2011). Eradicating invasive sea lavenders from San Francisco Bay wetlands Bay Area Early Detection Network (BAEDN), Berkeley, CA (Poster presentation).

5. Drew Kerr, Treatment Program Manager at the San Francisco Estuary Invasive Spartina Project.

7. **Marsh Restoration Project**

No funding requested

Summary written by Megan Hankins

In addition to cleaning up the beaches in Coyote Point Park, CuriOdyssey also organizes marsh restoration projects, coordinated by Sr. Educator and Science Research Manager Catherine Brett and Volunteer Manager Lee Cauble. Bay Area saltmarshes are threatened by the presence of invasive plants such as *Limonium ramosissimum,* or LIRA for short, which outcompete native plants such as pickleweed. In 2017, CuriOdyssey hosted 3 restoration project days that brought in 60 volunteers from groups such as Wells-Fargo, Oracle, the Moore Foundation and Blue Bottle Coffee, as well as students from various high schools and colleges. We estimate that over 900 gallons of LIRA was removed from our marsh in 2017! We will continue these projects throughout 2018 and continue to get our local community involved in these essential habitat restoration efforts.

Marsh Restoration Project Data

Year	Date	Participants	Hours (Individual)	Hours (Project)	LIRA removed (gallons)	Organization(s)	Total Amt removed
2018	24-Feb		2.5				
	31-Mar		2.5				
2017	18-Feb	23	2.5	57.5	606	Blue Bottle, Oracle, Wells Fargo	
	16-Mar	15	1.5	22.5	112	Moore Foundation	
	18-Mar	22	2.5	55	187	Oracle, Wells Fargo	905 gallons
2016	30-Jan	32	2.5	80	606	Oracle, SolarCity	
	2-Mar	11	1.5	16.5	202	HGC	
	30-Apr	11	2.5	27.5	135	SolarCity	942 gallons
2015	18-Apr	6	2.5	15	202	Oracle	
	7-Feb	10	2.5	25	187		464 gallons
2014	25-Jan	10	2.5	25	553	Oracle	
	22-Feb	11	2.5	27.5	606	Oracle	1159 gallons
		151	28	351.5	3396		

8. **Northern Pacific Tree Frog Pond (*Psuedacris regilla*)**

No funds requested

Summary written by

Megan Hankins

In 2016 the tree frog pond experienced some water quality issues that prevented the wild frogs from successfully breeding in the pond. We made it our mission in 2017 to address these issues by application of a water conditioner that is meant to prevent the harmful algae buildup we were experiencing in the past. This process has seemed to work well and has improved the water quality of the pond, hopefully making it an ideal place once again for frogs to lay their eggs. While this past winter did not give us much rain yet, we have heard frogs calling in the gardens and are expecting that the pond will soon be filled with frogs and frog eggs.

9. **Ringtail Research Project**

Funds requested: $1000

Funds received: $750

Summary written by Dr. David Wyatt, Sacramento City College

(Wild ringtail in Sutter Buttes, CA)

Project: Development of a Citizen-science Project for Reporting Ringtail Sightings in California.

Background

The ringtail (*Bassariscus astutus*) is listed as a Fully-Protected Mammal in the California Fish and Game Code (Section 4700) and is therefore protected as a special-status species. This status was conveyed by legislative action in 1967 and was subsequently re-enacted without revision in 1992. A total of nine mammal species are identified under this statute: Morro Bay kangaroo rat, bighorn sheep (except Nelson bighorn sheep), Northern elephant seal, Guadalupe fur seal, Pacific right-whale, salt-marsh harvest mouse, Southern sea otter, wolverine, and ringtails (written as “ring-tailed cat”).

Surprisingly, among these species the ringtail is not tracked by the California Natural Diversity Database and much of the distribution records for this species are reliant on the findings from Sue Orloff’s 1986 California Department of Fish and Game report on the status of the ringtail in California. This report included distributional data submitted by fur-trader reports, incidental observations, and distributional data from prior mammal surveys (in particular Joseph Grinnell’s data from the 1930’s). No other distributional studies have been conducted in California since that 1986 report.

In fall 2016, a status review of ringtail was requested by the California Department of Fish and Wildlife, however, this review was made difficult by the lack of recent distributional data because this species is not tracked by the Department. In response, ringtail researcher David Wyatt (principle investigator for this project) developed a reporting email address (reportringtails@gmail.com) to report ringtail sightings. The email site was introduced during the 2017 Western Section of The Wildlife Society annual meeting and numerous sighting reports have been submitted by agencies, biological consultants, academics, and the general public. The sighting information is being stored in a tracking database maintained by the principle investigator. This data will be periodically provided to the BIOS program at the California Department of Fish and Wildlife for mapping into their GIS system.

While ringtails are better known among professional biologists, the general public are typically not aware that this species occurs in California...in fact, they are often amazed that such an animal is found in North America. To develop an outreach program that incorporates the general public in ringtail reporting efforts, this ignorance about ringtails must be addressed. Thus, an awareness program using posters and flyers was developed for distribution in locations that are popular with segments of the general public. In particular, that segment was/is concentrated on outdoors oriented people...such as campers and hikers. Additionally, such “Have You Seen Me?”-style posters and flyers can also target individuals who work in close proximity to the outdoors.

Results

This project received $750.00 in funding from CuriOdyssey to cover the costs of printing color posters and color flyers to help with ringtail identification and reporting. Two hundred color flyers were printed and distributed at The Wildlife Society meeting in 2017. Another fifty color flyers printed on thick cardstock were also distributed at the conference for posting by participants. One hundred color flyers were taken by professional biologists attending a wildlife workshop in spring 2017 for distribution at their respective agencies, businesses, and public utilities (e.g. PG&E, SoCal Edison).

A Canon archival quality, pigment-ink printer was used to make fifty 13”x19” color posters and the fifty thick cardstock color flyers. Distribution of posters also occurred at the wildlife workshop as well as at The Wildlife Society meeting. In addition, posters and approximately 100 additional color flyers were distributed in multiple locations in the Mojave National Preserve (San Bernardino County), Tecopa and Shoshone areas (Inyo County), Death Valley National Park (Inyo County), Panamint Springs (Inyo County), Lone Pine area (Mono County), Bishop area (Mono County), Lee Vining area (Mono County), and Bridgeport area (Mono County). Color flyers were also distributed to several National Wildlife Refuges in the Central Valley (Sacramento, Sutter, and Glenn Counties).

For 2018, posters and flyers will be printed and distributed at the next Wildlife Society conference in Santa Rosa, California and at a wildlife workshop being conducted in March 2018. During June 2018, posters and card-stock flyers will be posted and/or distributed at U.S. Forest Service locations and Southern California Edison public-use facilities in the southern Sierra Nevada. Continued coordination will occur with U.S. Forest Service personnel and with California Department of Fish and Wildlife personnel in the distribution of flyers and of any requests by these agencies for posters or flyers. Targeted placement would occur at information kiosks at public lands facilities operated by these two agencies and by other entities.

The effort remains on-going and reports of ringtail sightings have been received from entities that were not clients of the outreach effort but in their work or travels did encounter those printed flyers or posters (or heard about them). Recently a report of a ringtail sighting on a wildlife camera was received from a Napa Land Trust preserve manager who was able to document a ringtail for the first time on one of their land preserves. Another example is from a private landowner in the Nevada City/Grass Valley area who reported and sent in several photographs of ringtails from a wildlife camera she recently installed behind her house. These are all encouraging signs that more awareness and knowledge of ringtails is occurring. Further targeted distribution of posters and flyers is scheduled for this spring to continue with the distribution schedule originally envisioned in the project proposal.

10. River Otter Ecology Project

Funds requested: $1000

Funds granted: $841

Summary written by Megan Isadore, ROEP

(Young otter. Photo by Doris Sharrock)

Many thanks for Curiodyssey's support of our genetics project!

The funding provided was used for primer pairs for amplification for the microsatellite analysis and sexing assay on river otter scat collected in 2013 from four sampling locations in Marin County, based on techniques from previous molecular otter studies. Results were mixed, as sometimes happens with molecular research, but we're delighted to report that the results we have will enable and inform continuing studies.

The effort to retrieve consistent and reliable PCR tests for microsatellite and sexing analysis on river otter scat were unsuccessful, as is sometimes the case. Jordan Arce is now focusing on statistical analysis of mitochondrial data that was successfully derived from the samples.

The data is in the form of DNA sequences, each around 300 base pairs long, derived from river otters from the four sampling locations. After each sequence is organized into groups based on their sampling location, statistical analysis is used to derive population information. These include metrics for conventional population genetics parameters which assess how different populations are from each other.

We will also look at what are referred to as tests for neutrality for each population. The analysis test show how neutral, or static, the migration rates and population sizes are based

only on the diversity of genes in that population . We might also rerun these tests after redefining the populations based on geographical significance. Grouping certain populations together based on the landscape (rivers, mountains and other barriers) may yield interesting information on the behavior of these populations (migration rate or population expansion).

Jordan Arce working in the genomics lab. Photo by Jaymi Heimbuch

11. UC Berkeley Urban Bee Lab

Funds requested: $1000

Funds granted: $500

Summary written by Alexis Hidalgo, UC Berkeley

Project Abstract:

Over the years, there has been a drastic decline in honey bee populations, threatening agriculture that relies on their pollination. With honey bees declining, there has been an increased need for native bees to supplement their pollination and it has become more apparent that native bees will be critical for long-term agriculture sustainability. The Urban Bee Lab has developed a training program for a Pollinator Habitat Advisors (PHA) position to advise and assist in the management of these native bee habitats. Farmers need trained professionals, to help them design, install, and monitor these habitats since they don't have expertise in native bee populations or the time to learn it.

I was selected to participate in this PHA pilot program in order to develop and test the training program in Fall of 2016. I am working alongside the UC Berkeley Urban Bee Lab and am being mentored and trained by Gordon Frankie, Sara Leon Guerrero, and Chris Jadallah. The training involves readings and tutorials, hands-on field training, and supervised communications with stakeholders and farmers. I will specifically be working on the Lab's *Farming for Native Bees* project to construct native bee habitats on farm sites in the most cost-effective and sustainable way.

Once I learned all the information needed to create a habitat, I designed, implemented, and monitored two habitats in a real-life farm setting. The funding I have received from this grant will be used specifically for implementing and monitoring the second habitat. After that, I

will synthesize and develop all the information and steps into a complete plan that will be presented and possibly used by other farmers to help them construct and maintain bee habitats of their own. My experience and input about the PHA Pilot Project will be used to help train other people who want to become PHAs.

Site:

For this project, I have been working with Frog Hollow Farm in Brentwood, California, which is a family-owned organic farm managed and owned by Al Courchesne. This farm is located on over 200 acres of land and has over 100 varieties of fruits. The Urban Bee Lab has been installing native bee habitats here since 2009, and as a result there are currently 55 species of native bees located on the farm.

First Pollinator Habitat:

Methods

In Fall of 2016, I selected a site at Frog Hollow Farm in Brentwood, CA, with guidance from the Urban Bee Lab, taking into consideration nearby crops, conditions, and Farmer Al Courchesne's preferences. After observing the habitat, I calculated that around 62 plants would fit here. I outlined and mapped out which plants would be used in order to maximize the number of native bee pollinators. I then developed a budget of all the items I would need such as the plants and tools. After having figured out all the logistics, I, along with other members of the Lab and farm staff, went out to this site to plant the habitat. This installation took a full day where we removed dying plants as well as planted and watered new seeds throughout the habitat.

From March until August 2017, I monitored this habitat using a standardized methodology used by the Urban Bee Lab. In this methodology, I visited the sites every three weeks, observed progress of the crop and bee habitat plant growth, and communicated with farmers about their observations and comments. Next the bees were collected through either aerial netting or pan trapping, and taken them back to the lab where there species could be identified. Through this process, I assessed the habitat's attractiveness by analyzing how many of each bee species were found on each plant.

Picture 1: Attached is a photo with the curated bee specimens from 2017. They have yet to be identified on a species level. Many of the collection came from my site.

Lessons Learned

I have gained a lot of knowledge about developing habitats by working with Farmer Al on his farm. Farmer Al is very supportive of the Urban Bee Lab's work and very open to new ideas. Working with Al has taught me just how important it is to have regular communication with the people you work with so that they remain aware of your work and can be further supportive down the line. This was evident by the fact that when more hands were needed to help out when installing the habitat, he was more than willing to send some workers to help out.

However, Farmer Al has difficulty following through with regular watering and maintenance of pollinator habitats. I learned this because several months after installing and monitoring the habitat, more than half the plants have died. This has showed me regular communication is not always enough and should be supplemented with further individual monitoring and in-person contact. Therefore, when I planted the second habitat, I not only selected the best plants for native bees but also for Farmer Al's capabilities.

Second Pollinator Habitat

Plan and Design

In fall of 2017, I selected my second site for installing a pollinator habitat at Frog Hollow Farm in Brentwood, CA, also taking into consideration nearby crops, conditions, and Farmer Al Courchesne's preferences. I chose a site called *Ceanothus Row*, which is a hedgerow habitat located next to different varieties of peaches, apples, grapes, and pears. A couple of years ago the Urban Bee Lab had installed this habitat, however because it was not regularly watered and maintained by the Farmer Al, around half of the original plants have died, much like with the case of my previous habitat.

Picture 2: Attached is an aerial view of part of Frog Hollow Farm. The yellow line represents the bee habitat I just installed called Ceanothus Row.

With the help of Farmer Al's workers who weeded the site, I was able to better observe the state of the habitat. There were 20 plants that remained alive and room for 23 new plants. I then outlined and mapped out which plants would be used to maximize the number of native bee pollinators, since each plant attracts a different set of native bees. I also made sure to select plants that were already established, larger, and more drought-resistant as to minimize

their vulnerability. After creating a Pollinator Habitat Plan for Ceanothus Row, I made sure that Al Courchesne and Gordon Frankie both approved of it.

Implementation

I then developed a list of all the items I would need such as the plants and tools I would purchase to help install this habitat. After I made sure I had everything that I would need, I went out to the site a couple weeks in a row and planted, watered, and fertilized the habitat.

Expenses	Cost
Tools from Ace Hardware	$31
Plants from Nurseries	$410
Total:	$441

Picture 3: Attached are my expenses. This is what I have spent so far from the grant.

A couple months before I started this second pollinator habitat on Frog Hollow Farm, Al had hired a new operations manager, Rachel Sullivan. After learning about the projects that the Urban Bee Lab is doing with Frog Hollow Farm to increase native pollinators, she has been extremely helpful in carrying out its implementation. She has not only offered me rides to the farm, but she has also been an extra set of hands to help with installing the habitat, and has been more consistent in watering and maintaining the plants when I am not there.

Next Steps

From March until August 2018, I will be monitoring this habitat using the standardized methodology used by the Urban Bee Lab. This methodology involves visiting the sites every three weeks, observing progress of the crop and bee habitat plant growth, and communicating with farmers about their observations and comments about what works. I will make sure to especially keep in contact with both Al and Rachel. I will also be collecting bees by using bee nets, trapping them in soap water bowls, and taking them back to the lab, where they can be identified by Jaime Pawelek, the project taxonomist. I can assess the habitat's attractiveness by analyzing how many of each bee species were found on each plant. The data that I have collected will then be synthesized and developed to showcase research results. I will deliver a final report to the farmers and PI, which will be used for outreach, presented to a general audience, and distributed in the Lab's final report and newsletter.

12. **Urban Wildlife Research Project**

Funds requested: $1000

Funds granted: $950

Summary written by Bill Leikam, the Fox Guy

During the year 2017, none of our plans laid down in 2016 came to fruition due to the large die-out of 100% of all the gray foxes in the Palo Alto Baylands Nature Preserve during the months of November and December 2016. Our intent was to use your donation as part of a larger whole; to collect gray fox scat for DNA analysis.

These circumstances led to a modification in our goals for the year. With the extensive die-out ranging from Adobe Creek in the south and San Francisquito Creek to the north, there occurred a surge in the rodent and the black-tailed jackrabbit (*Lepus californicus*), population at the baylands. Witnessing that alteration in the ecosystem, it became obvious that the keystone predator- the gray fox- had played a significant role in managing the general population of rabbits and rodents. As such, and with no scat available, we were forced to shift our goals to measuring the impact of the gray foxes on the environment when they repopulated the region.

However, even as of this writing, the expected repopulation has yet to occur. As such, we cannot proceed until there is, at a minimum, a stable pair that has made an area of the baylands their home range. Only then will we be in a position to collect their scat and discover the linkages between those foxes and others that live in regions somewhat distant from the Palo Alto Baylands Nature Preserve.

Meanwhile, as the bulk of CuriOdyssey's generous donation of last year remained in our bank account. A portion of it, $229, went for a trail camera, the Exodus Lift II, from the Exodus

Outdoor Gear, LLC. We are in the process of gradually shifting trail camera brands as the Bushnell cameras have not been performing as needed. For instance, the Bushnell trigger speed is slow in comparison to the Exodus cameras, the recovery is upwards of two seconds which is enough time for a gray fox to pass by the camera without being captured on video, and there are far too many false positives.

Down the Road - 2018

As such, we will continue to replace the Bushnell trail cameras with either the Exodus and/or the Browning Dark-Op cameras. DNA analysis is costly. We are depositing not only CuriOdyssey's donation into our bank account in order to reach the dollar figure of seven to ten thousand dollars, but we are also contributing to the fund by being paid for public speaking engagements and that money is deposited in our account as well. Presently, we have nearly $6,000 in our account; nearly enough to begin to conduct the DNA work as soon as we have scat out in the field.

During the first three months of 2018, we will be on high alert looking for at least a pair of yearlings who will establish their home range at the baylands. When this takes place, then the pair is likely to have pups born in April. Once this happens, there will be enough scat marking the pair's active territory for us to begin collecting scat and receiving DNA reports. If this does not occur, then we will go for another year of monitoring the region.

13. Western Pond Turtle Ecology Project

Funds requested: $923.90

Funds granted: $923.90

Summary written by Maria Wojakowski, PhD

(Western Pond Turtle at CuriOdyssey)

Summary of Field Work

A single blood sample was taken from 111 western pond turtles. From each of these single blood samples, a small amount was preserved on FTA cards and will be used for genetic analysis. The remainder was used for diagnostic tests as described in Chapter 5 of the attached doctoral thesis. All CuriOdyssey funds from 2016 and 2017 were used to perform diagnostic tests as described in the funding proposals. Because completion of the genetic analysis was not possible given our budget, it was postponed until additional funds can be collected. The original 2015 funding provided by CuriOdyssey is currently being retained by M. Wojakowski until the remainder of the funds can be gathered and samples submitted for genetic analysis.

Future Research

The author is currently in the process of forming a small statistical consulting company that serves researchers and workers in the fields of ecology, conservation, environment, and natural resources. One division of this company will be a research-only branch dedicated to innovation in ecological statistics and informatics and the development and application of robust environmental monitoring systems. The first/foundational priority of this research will be to continue studying western pond turtles in the San Francisco Bay Area and to bring awareness to the quality of conservation-relevant science that can be generated by harnessing the power of data collected in local ecosystems. In this capacity, the future goals for research of western pond turtles are the following:

- Raise funds to complete genetics research (this work is already partially funded by CuriOdyssey - 2015 funding). As part of the blood collection procedures, 100 blood samples have been collected on FTA cards and are stored and awaiting analysis. Publication in a peer-reviewed journal will follow analysis and write-up of results.

- Raise funds to complete stable isotope research. As part of the general methodology, shell shavings from western pond turtles were collected into small glass vials and are stored and awaiting analysis. Publication in a peer-reviewed journal will follow analysis and write-up of results.
- Implement a long-term western pond turtle demographic study and monitoring program. As explained in the attached doctoral thesis, long-term studies of freshwater turtles are rare and very valuable for understanding turtle life history, biology, and conservation. This dissertation research has laid the foundation for a long-term monitoring study, with over 550 western pond turtles individually marked over 6 populations (La Honda, Sausal Pond, Fish Pond, Felt Lake, Mammoth Lake, Dinosaur Lake). The specific goals of this study are:
    - Seek state and local permits to perform a multi-year simple capture-mark-recapture study. This study would consist of ecosystem monitoring and a single capture-mark-recapture session per year in the late spring.
    - Retain as many of the original six populations as possible in the study and gradually add new ones.
    - Develop an educational online platform/app about the project. One possibility could be a website/app where citizens could view photos and information about turtles and track the basic progress of populations (a `live' or `real-time' demography/population dynamics experience designed for the general public as an interactive educational tool).
    - Publish a demography/life history paper in a peer-reviewed journal every 3-5 years.