Abstract
The Cuyamaca College Nature Preserve
Sabbatical Work by Kim Dudzik

During the Spring semester of 2016, sabbatical work was conducted in the Cuyamaca College Nature Preserve. The purpose of this sabbatical project was to collect baseline data on the identification and distribution of species occurring in the nature preserve. The Science department has had a desire to design curriculum and special projects around the preserve, but this is difficult to do when there is no basic knowledge of species occurrence and distribution. The main focus was on bird species using the preserve, but information was also collected on reptiles, arthropods (insects, etc.), and mammals. A large number of bird species were identified during a short period of time. This information, coupled with observations made on the distribution of plants draws the conclusion that, aside from the former bike park area, the preserve is in a healthy state. Further, this study is now the basis for activities designed within the preserve for students to implement scientific principles and techniques, while gathering useable data to store in a long term database for continued tracking of the health of the preserve. This database can be beneficial to the District in demonstrating to California Fish and Wildlife our continued stewardship of the preserve. Also, plans can now be implemented intelligently, to turn our preserve area into a community access recreational area, furthering Cuyamaca College's role within the local community.

The Cuyamaca College Nature Preserve

The campus at Cuyamaca College occupies about 165 acres within the El Cajon community of Rancho San Diego. Within these 165 acres, campus facilities are surrounded by gently rolling hills of open space, of which approximately 47.5 acres has been designated a preserve since 1994. This open space preserve provides for almost limitless possibilities for student learning, and health and well-being opportunities for Cuyamaca students, employees, and individuals from the surrounding community.

History of Preserve

The Cuyamaca College Nature Preserve was established in 1994 as part of the conditions for a Habitat Loss Permit needed for the construction of new buildings. In April of 1993, Cuyamaca began the construction of the Physical Education complex, which had been approved in the 1975 Facilities Master Plan with no environmental constraints. Unbeknownst to the District, a bird known as the California gnatcatcher (*Polioptila californica californica*), a small gray songbird, was listed as a threatened species in March of 1993, and since the new building was being constructed on critical habitat for the species, field representatives of U.S. Fish and Wildlife Service (USFWS) advised that the work be stopped. The District complied, and continued to work closely USFWS to resolve the issue. Part of the resolution was to apply for a Habitat Loss Permit, which allowed for the removal of some critical habitat, while mitigating and protecting the rest of the existing habitat in the form of our current protected preserve. After the completion of the PE Complex, a restoration effort was conducted in 2000 in order to comply with the mitigation requirement.

All of this just for a bird?

Rarely efforts to save one species is about saving only that one species, because single species are a part of a community of both plant and animal groups that are interconnected to one another, and therefore, their survival is dependent on one another both directly and indirectly. Predator-prey relationships influence each other's population levels, which in turn may affect habitat availability or any other resource availability. For example, the California gnatcatcher has been documented to prey on grasshoppers and crickets, spiders, mites and ticks, beetles, aphids, wasps, bees, and ants, and the larvae of moths and butterflies (Mock 2004). Five of the seven representative orders of these prey items were encountered during this study without a dedicated search for any of them. These groups influence plant communities through pollination, predation, and altering distribution. Through this simplified example, one can quickly conclude that the removal of the gnatcatcher could cause the over-abundance of an insect that would over graze on certain plants, causing their decline, which may result in the loss of habitat or food for other birds or even mammals such as rabbits and mice. A healthy ecosystem is one with a high diversity of species to facilitate the many complex connections on which each is dependent for their survival. Often times, the decline of one species is an indication of a larger problem. By taking steps to save one species, we end up facilitating the health of the entire ecosystem. The habitat required by the California gnatcatcher is

known as coastal sage scrub, and is characterized by California sagebrush (*Artemisia californica*), California buckwheat (*Eriogonum fasciculatum*), and other sages (*Salvia mellifera,* and *S. apiana*), among others (Lightner, 2011). This type of habitat, however, has been reduced by an estimated 70% to 90% within the United States (Westman, 1981).

The Preserve's Recent History

During the late 90's and throughout the new millennium, the area was open to and in use by hikers, cross country teams, local firefighters interested in exercise training, and mountain bikers. During this time, another form of bike riders began using the preserve, the "dirt jumpers". This form of biking is not simply bike riding along a trail. It requires the movement of massive amounts of dirt which is formed into large jumps, some of which I had estimated to be over 8 ft tall (https://www.youtube.com/watch?v=66vOroPP8Rk). The consensus of the administrators at the time was to allow the people of the community to use the preserve for this form of entertainment. However, constructing the "jumps" not only involved the distribution of dirt, but native plants were also removed, and invasive plants were inadvertently spread, particularly *Arundo donax,* or giant reed, and *Brassica tournefortii,* or mustard plant. A clear violation of the Habitat Loss Permit, this activity was allowed to continue and grow until 2013, when California Fish and Wildlife ordered the activities to be stopped. We have estimated that about 3 acres of the preserve were disturbed. Eradication of invasive plants and restoration efforts have been conducted since the removal of the bike jumps to the present date. While personally, it was hard to exclude a group of people enjoying the outdoors and documenting their activities with well- produced videos (see youtube link above), this type of activity just could not continue in the preserve space on principle and by law.

Objectives of Sabbatical Work

The purpose of this sabbatical project was to collect baseline data on the identification and distribution of species occurring in the Cuyamaca College Nature Preserve. The Science department has had a desire to design curriculum and special projects around the preserve, but this is difficult to do when there is no basic knowledge of species occurrence and distribution. With the data collected here, new labs can be designed, as well as group activities, within and outside of the department that facilitate learning, health and well-being.

Observational data collection focused mainly on birds, with opportunistic data recorded on reptiles, arthropods (insects, etc.), and mammals. Initially, data was to be collected on amphibians, but it was discovered that the riparian area, where the amphibians occur, was too difficult to access due to previous El Niño storms. Clean up efforts will be required before proceeding in this area. But previous work has given us good information on how to continue with future studies on the main amphibian found here, the tree frogs (*Pseudacris regilla*).

Methodology

Surveys were attempted twice per week during March and April, weather permitting. Equipment used were a pair of 8x42 binoculars, and a Garmin Edge GPS unit. During each survey, existing trails were used, choosing a different pathway each time. Most trails started at the same few trailheads, and branched somewhere within the preserve. Attempts were made to remain on the trail for safety from rattlesnakes, but oftentimes birds were approached wherever they were perched. The GPS unit was set to record my movements, and began recording when I turned it on at the start of the trail (Appendix A).

Surveys were typically started in the morning, when birds are most active. As the temperature rose to temperatures approaching the 90's (°F), reptiles became more active and were more easily observed along the edges of the trails. Each time any animal was sighted, the GPS was used to record the latitude and longitude (lat/long) of the sighting. These coordinates were later over-layed onto the Google Earth map (Appendix B). Waypoints were not marked on every survey, however.

Most animals were identified in the field using Audubon's *Nature California* app on a smart phone. Since it was breeding season, many bird identifications were confirmed by matching the bird call included in the app to a calling male encountered during the survey. Once a sighting was made, the following information was recorded into the smart phone, later to be entered into an Excel spreadsheet: date, time, species, number encountered, time of sighting, and location (lat/long). Interesting behaviors, or associations with particular plants was also noted.

Most analyses were conducted on the bird data, as this was the focus of the study. Rate of discovery and percentage of new individuals encountered were graphed for birds, and sighting frequencies of different species were noted on all animal groups.

Results and Discussion

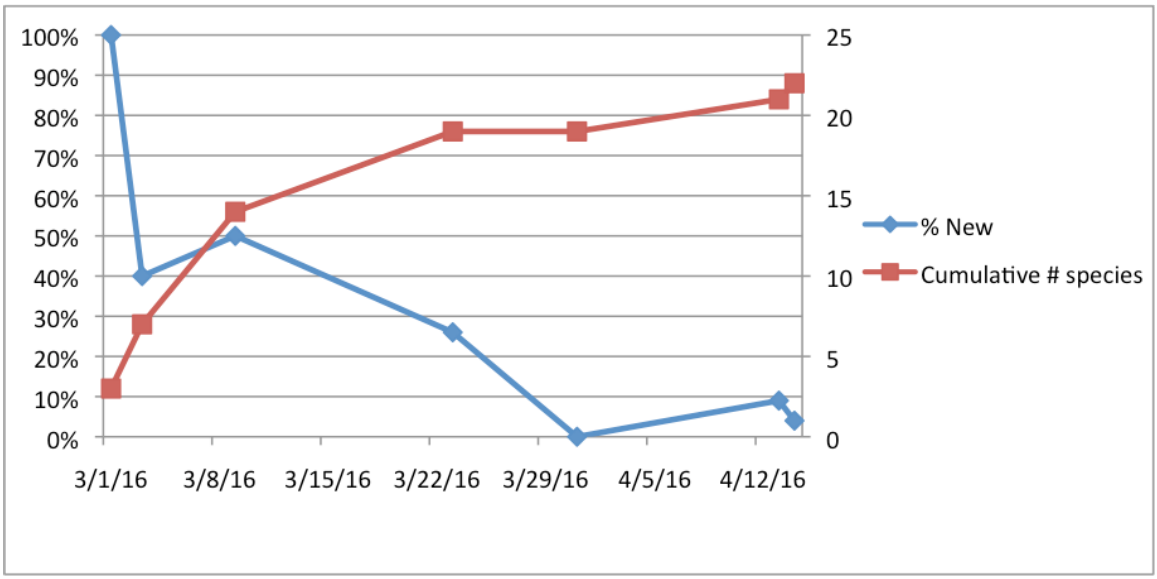
The following number of positively identified species were encountered: 21 species of birds, 17 insects, 5 reptiles, 3 mammals, and 1 mollusk (Table 1). The most commonly sighted bird was the California towhee (*Melozone crissalis*), a passerine, or perching bird, known for eating insects, seeds and grains from chaparral and sage scrub habitats (Stokes and Stokes, 1996). The most commonly sighted insects were honey bees and ants, probably because they were easily identified from a distance, and orange throated whiptail lizards (*Aspidoscelis hyperythra beldingi*) and western fence lizards (*Sceloporus occidentalis*) were the most numerous reptiles encountered, as they seem to prefer the edges of the trails (Table 1). Few mammals were encountered due to the fact that this was not a dedicated survey for this group, as they tend to be secretive, preferring to stay hidden in brush or burrows during the day.

Table 1. Species encountered by animal group.

Birds	Insects	Reptiles	Mammals	Mollusks
American Crow (*Corvus brachyrhynchos*)	Acmon blue butterfly (*Plebejus acmon*)	Orange throated whiptail lizard (*Aspidoscelis hyperythra beldingi*)	Desert cottontail rabbit (*Sylvilagus audubonii*)	Snail (Family:Helicidae)
American Goldfinch (*Spinus tristis*)	Argentine Ant (*Linepithema humile*)	Rattlesnake (*Crotalus* sp.)	Deer mouse (*Peromyscus* sp.)	
Anna's Hummingbird (*Calypte anna*)	Ants-other (Family-Formicidae)	Striped racer snake (*Coluber lateralis*)	Squirrel (Family: Sciuridae)	
Bewicks wren (*Thryomanes bewickii*)	Behr's Metalmark butterfly (*Apodemia virgulti*)	Western fence lizard (*Sceloporus occidentalis*)		
Black-chinned hummingbird (*Archilochus alexandri*)	Buckey butterfly (*Junonia coenia*)	Western side blotch lizard (*Uta stansburiana elegans*)		
Blue gray gnatcatcher (*Polioptila caerulea*)	Cabbage White butterfly (*Pieris rapae*)			
Bullock's Oriole (*Icterus bullockii*)	Checkered white butterfly (*Pontia protodice*)			
California Thrasher (*Toxostoma redivivum*)	Crane fly (Family: Tipulidae)			
California Towhee (*Melozone crissalis*)	Dragonfly (Order: Odonata)			
Common Yellowthroat (*Geothlypis trichas*)	Honey bee (*Apis mellifera*)			
House finch (*Haemorhous mexicanus*)	Ladybug (Family: Coccinellidae)			
Mourning dove (*Zenaida macroura*)	Monarch butterfly (*Danaus plexippus*)			
Red tailed hawk (*Buteo jamaicensis*)	Mourning Cloak butterfly (*Nymphalis antiopa*)			
Savannah sparrow (*Passerculus sandwichensis*)	Pinacate beetle (*Eleodes* sp.)			
Song Sparrow (*Melospiza melodia*)	Sara Orangetip butterfly (*Anthocharis sara*)			
Spotted Towhee (*Pipilo maculatus*)	Western Tiger Swallowtail butterfly (*Papilio rutulus*)			
Tree swallow (*Tachycineta bicolor*)				
White crowned sparrow (*Zonotrichia leucophrys*)				
White tailed kite (*Elanus leucurus*)				
Wrentit (*Chamaea fasciata*)				
Yellow rumped warbler (*Setophaga coronata*)				

In order to analyze the rate at which new species of birds were identified, rate of discovery was plotted as the percentage of new sightings and cumulative number of individuals identified along consecutive survey days (Figure 1). The rate of discovery curve shows an increase during the first 3 surveys (64% of species observed were identified), then approaches asymptote, indicating that few new species were being encountered. The slight uptick during the last 2 surveys is due to surveying in the riparian habitat, a different ecological habitat than the rest of the preserve. However, only 3 new species were added during these last 2 surveys, whereas almost 40% of species were encountered during the first 2 surveys in the sage scrub habitat. This does not mean that all species using the area were sighted. Rather, this may reflect those species using the preserve during this particular season. Future observations made during summer, fall, and winter seasons may show a pattern of habitat use by new and different species.

Figure 1. Percentage of new sightings and rate of discovery for birds identified in the study area for all surveys.



Conclusions

Although identifying the plants of the preserve was not an objective of this study, trends on the health and recovery of the former bike area were noted. The most disturbed area is where the largest of the bike jumps were located, just north of the riparian area and west of Fury Road. Since large amounts of dirt were moved during the building of the jumps and the subsequent bulldozing to remove the jumps, there are still open spaces that lack vegetation. Some of the open spaces, however, have been encroached by mostly invasive plants, such as mustard and giant reed. During past "clean up" events with students and employees, one area of giant reed was cut down, and members of the grounds department continue to go back to regularly apply an herbicide to facilitate its eradication. In the surrounding areas, students

also worked to pull mustard plants. This removal allowed for a native plant to move in, and one such large area includes stinging nettle (*Urtica dioica*). While it is a native plant, it is not a desirable plant for hiking trails, as its common name implies. But it may prove to be beneficial in the short term, as it is best for hikers to stay out of the area while recovery is taking place.

As we move to the northwest of this disturbed area, paralleling Fury Road, native plants begin to fill in close to groups of mustard, and into the former bike pathways. The main plants recorded were red maids (*Calandrinia breweri*) and popcorn flower (*Plagiobothrys* sp.) characterized by small purple and white flowers, respectively. Continuing further northwest, mustard begins to disappear, and the dominant plant species are native broom baccharis (*Baccharis sarothroides*) and California buckwheat (*Eriogonum fasciculatum*). Moving further northwest, mostly buckwheat and coastal sagebrush (*Artemisia californica*) begin encroaching into the pathways and dominating the area. While more work needs to be done in the heavily disturbed area, it was very encouraging to see more and more native plants filling in spaces in the surrounding areas.

The rest of the preserve is mostly characterized by native plants, too numerous and beyond the scope of this study to list here, but the biodiversity is encouraging. The main areas where invasive plants have moved in are areas along hillsides exposed to the campus such as those overlooking the tennis courts and soccer field. This illustrates the importance of keeping invasive species off campus grounds. Also, mustard fills in spaces at the bottom of natural drainage canyons, indicating rainwater bringing invasive plants from neighboring communities.

With so many native species of plants in the majority of the preserve, my initial impressions are that it is in a healthy state. This is further suggested by the large number of bird species observed in a short period of time (Table 1, and Figure 1.) These native plants are supporting the birds, by providing food in the form of seeds, flowers, buds, etc., and habitat for nest support and nesting materials, while also providing habitat for numerous insect species that also serve as food for the birds. The different bird species also impact plants by spreading seeds, allowing more plants to thrive, which positively impacts the insects. It's an important web that links each organism to one another, with each one being as important as any other. In the heavily disturbed area, characterized by large stands of giant reed, I observed few birds here, and when sighted, they were mainly flying through the area, never perched or using giant reed in any other way. While this observation is more anecdotal due to the short amount of time spent in the area, it is a telling first impression, compared to the large number of species observed in the healthy areas within the same short time span. Plants like giant reed are also known to burn very hot, causing a fire hazard in our dry climate. Aside from the obvious danger of fire to our campus, fire can cause the coastal sage scrub habitat to covert grasslands, causing a reduction to gnatcatcher and other bird populations (Mock, 2004).

Implications for students

Having this baseline knowledge has allowed me to devise many activities that students can participate in to learn about conservation, ecology, and acquire practical skills with equipment such as GPS and other data gathering and lab techniques.

Activities for Conservation of the Cuyamaca Nature Preserve:

- Students use GPS to determine the ratio of non- native plant areas to native areas. Each spring, students walk around the perimeter of mustard patches while holding the GPS. GPS will calculate size of the area. Area can be compared across years, especially after eradication efforts to assess success of these efforts. Recorded data will be on file to access if and when Department of CA Fish and Wildlife ask about progress of restoration and maintenance. Students learn the use of a common piece of field biology equipment, the GPS, and how to store and analyze data acquired from it.
- Johnny Appleseed Days: During rainy season, students go out and pull mustard plants, which is relatively easy to do a few days after a rain. Immediately after removing the mustard, students drop native seeds into the hole. The above monitoring system can check success of this activity over time. (I have found this to be an easy and effective means of controlling mustard at my own home.)
- Students hike along existing pathways, each taking a different path, while holding the GPS. GPS will track movement patterns, and data can be downloaded to Google Earth. Hiking trails will, therefore, be mapped and can be printed out as a guide to anyone interested in accessing the preserve.

Activities for learning ecological principles:

- Conduct bimonthly or monthly Cuyamaca Bird Watch days. Students and interested employees will first be introduced to how to use identification guidebooks and apps for smart phones. With binoculars in hand, we identify bird species in the field, and record their location with GPS. Any nests can also be recorded during breeding season. This information can be downloaded to a database that students can later analyze for distribution of species across habitat type and over different seasons. Also, pictures can be taken and loaded to an online Citizen Science site called iNaturalist where biodiversity and differences in species composition can be compared across San Diego County.
- Student project in the majors biology class Bio 240: students work in groups to collect and/or identify plants, insects, and vertebrates. Using the library resources, they determine how each of these organisms are connected to one another, building an ecological web. Students learn ecological principles on how species are connected to one another, and the importance of biodiversity. The information

gathered can be used to further our understanding of the specifics of the natural processes of our preserve.

- Tree Frog Project Reboot: Students go to riparian area to capture and swab tree frogs, following a detailed protocol. Through either an independent lab project, or a lab conducted in Bio 230, students run material collected on swabs through PCR to determine if our frogs have the deadly chytrid fungus that is causing the demise of numerous frog species around the world. Information can be analyzed and submitted to local frog researchers at the San Diego Natural History Museum and/or the San Diego Zoo's Save the Frog initiative.

Community Involvement with the Cuyamaca Nature Preserve

During the time I spent in the preserve for my sabbatical, I observed people from the community using the area almost every day. Most were running or hiking the trails, and some did so with their dogs. It is good that the community is using the area recreationally. My impression from past meetings with the community over the illegal bike park and during at least two different Spring Garden Festivals, where students, Michelle Garcia, and myself held a conservation information table, is that the majority of the public does not know that the surrounding area around campus is a protected preserve owned by Cuyamaca College. Most assumed it is just un-owned land. Therfore, I believe it is important that we put up signage in order to inform the community about the preserve, indicating where the trail heads are, what plant and animal species they may see, events planned (bird identification days, clean ups, etc.), rattlesnake warnings, and dog etiquette. I am envisioning large signs at trailheads along Fury Rd. with plexi-glass style doors where information can be posted and locked. Also, bag dispensers with a supply of bags to help encourage people to pick up after their dogs. Currently, I do not believe that supervised dogs are a threat to anything in the preserve. The most immediate problem I see with dogs is there is a large amount of dog feces along the trails. As is the case at other preserves around the county, more people will be willing to pick up after their dog if they understand that they are entering a protected preserve, and they can do their part by picking up after "Fido". We can initially provide doggy bags and encourage the public to bring their own in the future.

At trail heads along the apartments at the north side of the preserve, smaller signs can be installed indicating that guests are entering the Cuyamaca College Preserve. Trail signs can be placed further from trailheads providing information on birds, lizards and other animal and plant species guest might observe, as well as how native peoples once used the area. Further, I would like signs indicating the name of each trail (once mapped, I'd like to assign each department a trail that they can name). We should have a nice hiking system for students, employees, and the surrounding community to enjoy.

Lastly, (for now) we should provide a visitor's center where the community can go to learn more about the Cuyamaca College Nature Preserve, pick up trail maps, and look at displays done by our students. Information on animals, plants, and Native

Americans can be linked back to courses offered at our college. Once the One Stop Center is moved, one of the A- buildings would be ideal, like A109 and A112 area. There is a nice trailhead starting behind the A buildings with a big tree where a picnic table can be placed, making that area the perfect spot for a visitor center.

Nature and our health

There is one final note I would like to make about the importance of protecting and maintaining our natural preserve: the idea that a "nature-rich life" can contribute to overall health and intelligence. There has always been an assumption that human contact with nature can help improve mental health, and stimulate creativity and learning. But within the last 10 to 20 years, scientific research has been confirming this hypothesis again and again (Louv, 2016). One of the ways nature seems to be enhancing intelligence in some people is by stimulating our senses. The idea is this: when we are in nature, we use all of our senses: seeing, listening, smelling, and we even taste the air. This sensory experience seems to stimulate our awareness, the ability to pay attention, and therefore, more clear and creative thought processes (Louv, 2012). More specifically, stress can really interfere with our ability to think clearly and process information. And just walking around campus, one can witness the stress experienced by students over-enrolled in difficult classes, worrying about the next test, or employees taking on more responsibility during budget crises and staffing problems. But recent research is showing that people regularly exposed to nature exhibit lower blood pressure and reduced stress hormones (mainly cortisol), and an increase in activity in the parasympathetic branch of the nervous system, known to calm us down (Selhub and Logan, 2012). As an instructor, I see first hand the experiences of the students in the classroom. Many of them approach me and tell me about their anxiety disorders, problems with depression, and the drugs they are using to control it. But the growing body of scientific research is providing us with evidence that experiences in nature help individuals reduce symptoms of Attention Deficit Hyperactivity Disorder (ADHD), reduce depression and anxiety, and boost the immune system (Louv, 2016), thereby reducing the need for drugs, which may carry their own side effects. This body of research not only reinforces our need to protect the natural preserve, but to continue to keep our "Grand Lawn", also known as "Central Park", free of buildings or other structures. In my own past experience teaching outdoor education to inner city kids, I would ask the kids to close their eyes for 30 seconds and listen. They told me the sounds they heard were birds, wind, and even a lizard scurrying by. I asked them how it made them feel. The most common adjective was "peaceful". Then I asked them what they usually hear at home. They said sirens, cars, people yelling. I asked them how that made them feel, and most commonly they said, "upset". This experience stuck with me over the years, driving my passion to not only protect natural spaces, but to educate others on the importance of it.

With these benefits in mind, I would encourage other departments to join the movement of incorporating natural spaces into their curriculum (Louv, 2016). Music instructors can encourage students to practice the guitar or other easily carried instrument while sitting in the preserve, or to sing along with the birds. Imagine the

music that might be inspired by listening to the natural sounds. The Art Department can encourage students to sketch or paint what they see at different times of day to experiment with changing light. And we can think outside of the box: I can imagine one day with an extensive named trail system, a math instructor assigning students to hike out to the bench on "Descartes" trail, and solve a set of math problems. Many employees enjoy walking around the track, but armed with a nice trail map, it would be easy to extend that walk to experience more nature, and return to work more refreshed and relaxed.

How my sabbatical work benefits me

Aside from the knowledge gained on species distributions and ideas for classroom and research activities, I benefited immensely from this experience. My original education training was as a field biologist. I have spent years on the oceans and in the jungles of Costa Rica, on a small island in the Pacific Ocean, the waters of Tampa Bay, and off our own coastline, as well as the San Diego Zoo and Safari Park. Studying natural populations and behaviors of animals has not only been my job, but my passion. I feel at home in nature, and it is probably the above health benefits that subconsciously caused me to pursue this line of work. While I enjoy sharing my experiences in the classroom to inspire new generations of researchers, working outdoors in my preference. This sabbatical allowed me to get back that part of myself, not only during the sabbatical period, but now I have a plan to incorporate it into my everyday teaching duties. The benefits of the sabbatical also extended to my 3 dogs, as I was able to spend a good portion of each day rubbing their bellies. Who can argue with that?

Acknowledgements

I'd like to thank the following people who assisted me directly or indirectly on this sabbatical project:

David Burnett, who served as an emergency backup in case an encounter with a rattlesnake went wrong. Luckily, although my one encounter did cause a large increase in both mine and the snake's blood pressure, we both backed out of the area unharmed. And Dave was able to share a laugh with me.

Christina Burnett, who helped me identify some insect and plant species. Her knowledge of nature and ecological processes is second to none. She also took over one of my classes.

Greg Brulte, who also pitched in on a couple of my classes and kept students on their toes.

Stu Matz, for taking over physiology and reinforcing to students that physiology is hard, but not impossible.

Kathryn Nette, for putting up with one of the few full time science instructors not being available for a full semester! Sorry to put you through that. You could use a sabbatical!

And to my husband, Steve Hales, for putting up with me being home all semester!

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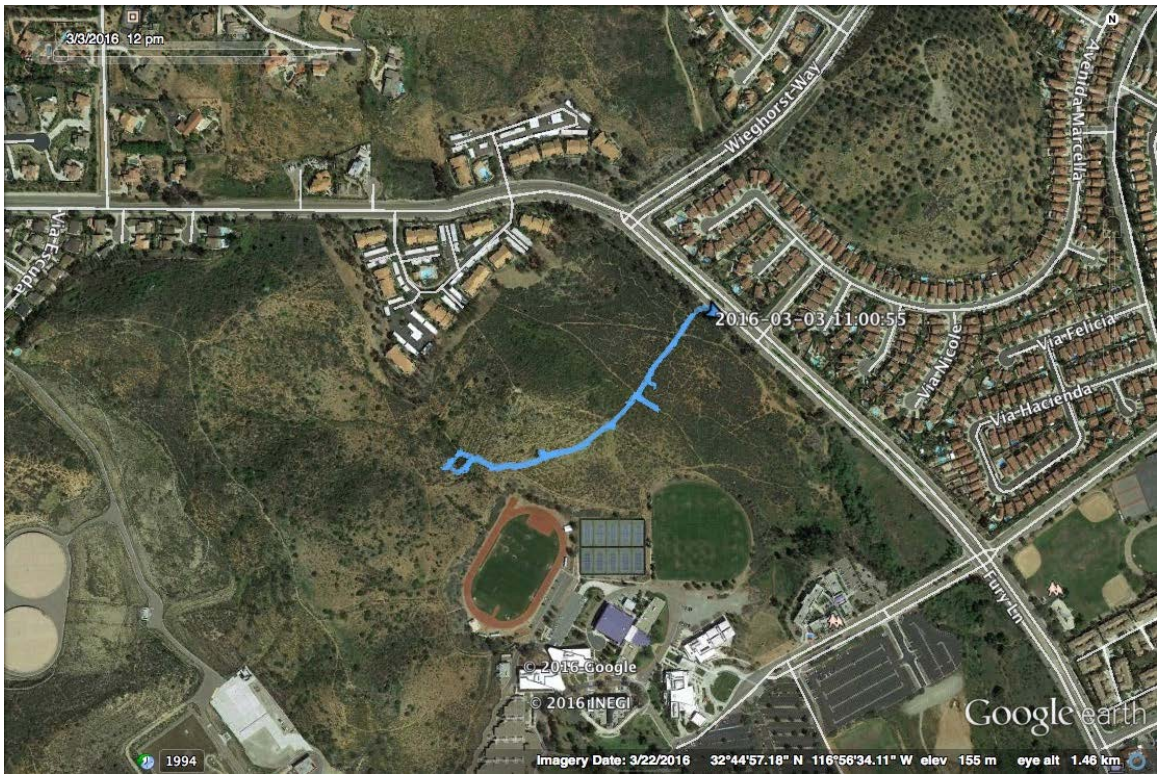
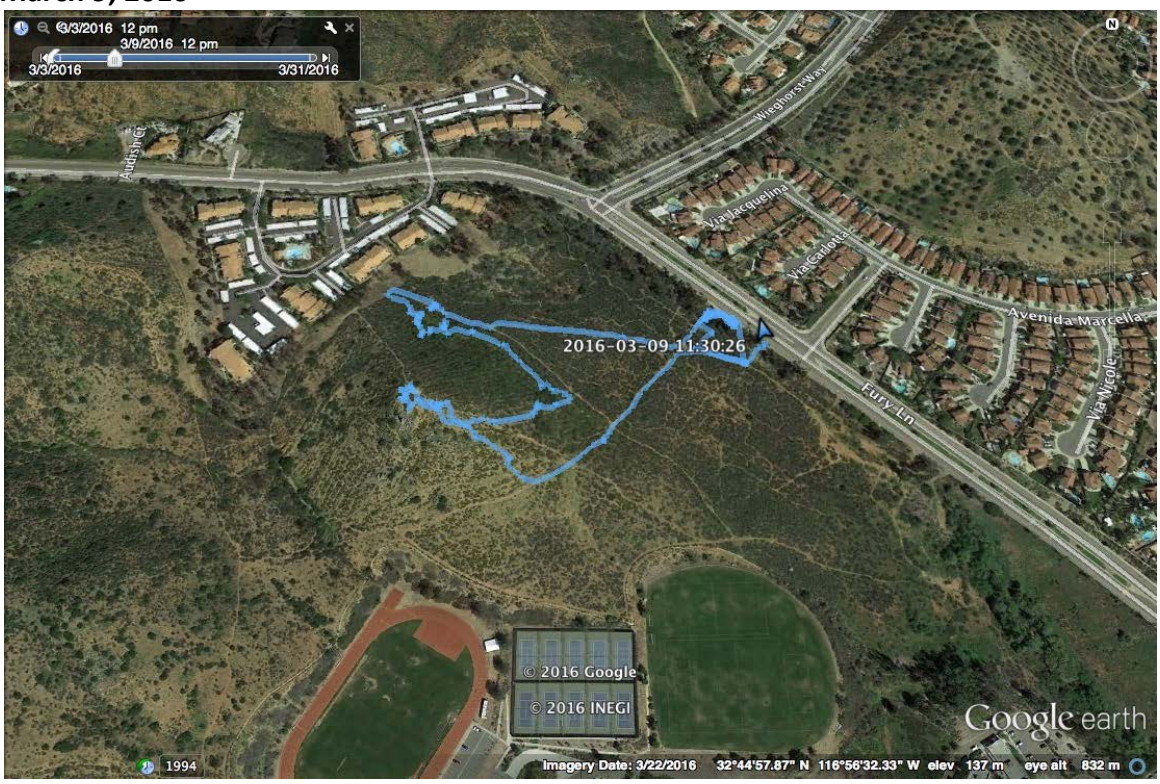
Appendix A
GPS Tracks of Surveys
Google Earth

March 3, 2016



March 9, 2016



March 23, 2016

March 31, 2016

April 13, 2016

April 14, 2016

Appendix B

Species locations per survey

The following pictures are screen shots of the locations of species mapped on Google Earth. However, these pictures do not provide the interactive capabilities, such as clicking on each numbered flag for more information, such as name of species.

March 3, 2016

March 9, 2016

March 23, 2016

April 13, 2016

April 14, 2016