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Report of activities at Cañada de Los Osos Ecological Reserve (CDLOER) during January 1, 2018 through December 31, 2018.

During 2018 a total of 24 students from San Jose State University performed various biodiversity surveys at CDLOER. During the Spring 2018 semester students surveyed Fungi, Monarch Butterflies, Insects found in the bird houses, Bird box use and began complying information to create a Natural History Guide and identification key of organisms found at CLDOER. Their reports are included below.

During the Fall semester we surveyed small mammals in the restored and unrestored grassland fields just east of the entrance gate. We set out 100 live Sherman Traps from August 30 - September 1, 2018 in a grid with traps set 15m apart in both grassland areas. Over 400 trap night were recorded and unfortunately no captures of any kind occurred. We did observe a couple of Microtus spp. in fields during setup and or checking the traps, however, no species were trapped and therefore we have no data to report.

The students also took part in pulling Star Thistle from an area near Rocci's Line Camp to help contribute to the ecological restoration efforts taking place on CLDOER lands and spear head by Henry Coletto and Bob Clement. It was a wonderful experience for the students who learned the importance and the hard work that it takes to restore lands that will then be better able to support local flora and fauna.

2018 Spring Semester Survey Reports:

Fungi Identification in Canada De Los Osos

Introduction

Fungi are prominent members of an ecosystem often overlooked in ecology research. This overlook renders the organism a mystery to the public eye as well as many scientists. Fungi are primarily responsible for decomposition. However, they play a variety of roles in nature: symbiotic relationships with plants, nutrition for animals, life history stage for varieties of organisms, habitat determination of an environment and more. All roles of fungi are essential to an ecosystem, but one role that interests me is the impact fungi have on habitat determination. Habitat determination refers to their ability to sculpt an environment by eliminating target organisms while promoting growth of other organisms. This is commonly seen in mycorrhizae fungi that form a symbiotic relationship with many gymnosperms that aids in the facilitation of water and nutrient uptake, thus promoting forest habitat development. On the other hand, we see fungi killing trees and eliminating forest habitats, thus converting them into grassland habitats. By understanding the species of fungi present in an ecosystem we can begin to make conclusions on how a habitat came to be and the overall health of an established habitat.

Methods

Fungi identification was done via mushroom morphology in pair with the California Mushrooms: the Comprehensive Identification Guide. The mushroom is the "fruit" of the fungi, while mycelium is the "body" of the fungi. Mushroom have unique characteristics that make them easy to identify from one another. However, the morphology of a mushroom is complex. Each character we looked at we had to identify what form the character was. For example, once we identified a mushroom had gills we had to determine if the gill structure was adnate, adnexed, notched, etc. This variation in individual characters was common. The first character we looked for was the presence/absence of a spore production zone (gills, spines, folds, veins, etc.). When the spore production zone was determined we were able to narrow the fungi down to smaller groups (Spiny Fungi, Polypore Fungi, Crust Fungi, Gilled Fungi, Jelly Fungi, etc). Within these groups we had to determine what form the character was in, allowing us to narrow a fungus down to the genus level. Within the genus level characters such as color, stipe, size, and substrate became important. We found that color and substrate were some of the most important factors in determining the epithet. Most fungi grow exclusively on a specific substrate, for example a Turkey's Tail fungus will primarily grow on hardwoods while a Chanterelle fungus may only grow as a mycorrhiza in pines. Combining these levels of character investigation, we were able to identify a total of 14 species in Canada De Los Osos Ecological Reserve.

Results

Species	Group	Date Found
Coprinellus flocculosus	Coprinoid	3/17/2018
Omphalotas olivascens	Clitocyboid and Omphalinoid	4/14/2018
Phlebia acerina	Crust Fungi	4/14/2018
Schizophyllum commune	Pluerotoid	3/3/2018
Pleurocybella porrigens	Pluerotoid	3/3/2018
Calocera cornea	Jelly	4/14/2018
Tremella aurantia	Jelly	3/3/2018
Dacrymyces stillatus	Jelly	3/17/2018
Tremella foliacea	Jelly	3/3/2018
Crepidotus caspari	Dull Brown Spored Gilled	3/17/2018
Galerina semilanceata	Yellow/Reddish -Brown Spored Gilled	3/3/2018
Trametes versicolor	Polypore	3/17/2018
Ganoderma applanatum	Polypore	4/14/2018
Phellinus gilvus	Polypore	4/14/2018

Table 1: Species identified at CDLOER, organized by group of fungi and labeled with date found

Two groups of fungi that were most abundant were the polypore and jelly groups. Half the total species we found belonged in these two groups. *Trametes versicolor* was abundant all over the reserve on downed/rotting hardwood trees. The jelly fungi found were equally as present as *Trametes versicolor*, however they were less obvious because they would change color to match the wood when dehydrated. Species *Omphalotas olivascens, Galerina semilanceata, Coprinellus flocculosus,* and *Crepidotus caspari* were observed in a single location, and not found again in our surveys. All these fungi grow from decaying wood with an exception for *Galerina semilanceata, Omphalotas olivascens,* and *Coprinellus flocculosus.* Jelly fungi and polypore's had a longer reproductive life then mushrooms with caps and gills (*Galerina semilanceata*). Certain clusters of *Trametes versicolor* and jelly fungi were seen every week in the same locations.

Discussion

The abundance of polypore's and jelly fungi illustrates the high levels of decaying hardwood that is being recycled back into the ecosystem. We see an increased life-span in the mushroom of these fungi because of their morphology. Polypore's are very "woody" and tough, allowing them to withstand drought and herbivores. Jelly fungi can dehydrate and hydrate with water availability, thus leaving them less susceptible to drought then gilled fungi. Although they are edible, the unusual colors of jelly fungi (bright orange/yellow) may act as a warning to herbivores to not eat them. The dehydrated state of jelly fungi (brown/black) may camouflage the fungi from herbivores. These fungi are vital in recycling the nitrogen of fallen trees. Based off our observations it appears there is a "flush" of nutrients being recycled back into the forest system of CDLOER because of the sheer abundance of these two groups of fungi.

Alternately, Sean and I did not find many field mushrooms within the grassland areas of CDLOER. This is probably because of our lack of attention to these areas, as well as the timing of our visits to CDLOER. Our visits were mostly directly after large rains, rendering our visits too soon for field mushroom surveys. If we went a few days after any rains the field mushrooms may have had more time to grow. The lack of water retention and shade in the fields limits the life of field mushrooms, and they may have fruited and wilted too quickly before our visits. Biodiversity of mushrooms is much lower in the spring than in the fall. Perhaps most field mushrooms in CDLOER fruit in fall to avoid the harsh summer sun, thus increasing their reproductive lifespan. Mushrooms in the forests may favor spring because of the protection they receive from shade and the fresh substrate they receive from winter storms. This could explain why we saw primarily mushrooms fruiting on hardwoods, rather than in the fields in spring.

Overall, the experience at CDLOER was phenomenal and fungi abundance was much larger then I had hoped for. Looking back into this semester I would redo a few things when surveying for mushrooms. First, I would have liked to visit very early in the semester to see the end of the fall fruiting fungi. This would have allowed me to see the transition from fall fungi to spring fungi. When viewing the transition, I could compare the prominent habitats mushrooms were found between both seasons. Second, I would have dedicated a week after a large rain to surveying areas in CDLOER to see if I can witness the different stages of mushroom production. I would have liked to revisit sites more frequently to observe the rates at which mushrooms grew, and how long they stayed in full form before wilting. Lastly, I would have taken better notes in my field journal to identify latitude and longitude of all species and paired it with the substrate they were found on. This would have given me a better "bird's-eye" view of where certain substrates were clustered within the reserve and what fungi were taking advantage of the substrates in those clusters. Fungi are an important element in setting and strengthening the foundation of ecosystems. My hope is that future students recognize their importance and begin to understand how they fit within the ecosystem of Canada De Los Osos Ecological Reserve.

The Monarch Butterfly Species at Cañada de los Osos Ecological Reserve

Introduction

We chose to look at the population density of the Monarch Butterfly species in the Cañada de los Osos Ecological Reserve. We chose this project because the population of the monarch butterfly is drastically dropping due to a loss of habitat, and changing environmental conditions. We wanted to take a look at how many Monarch eggs and larvae survived the full cycle until they transformed into adult monarchs. This is an ongoing project and we hope to have a plethora of data by the end of the summer.

Cañada de los Osos Ecological Reserve is almost 6,000 acres large. It has many ponds and houses various wildlife such as deers, mountain lions, and wild pigs. It is protected and thus is a perfect, undisturbed environment to conduct such a study.

Method

For our study, we set up a transect wherever we found an abundance of milkweed. We labelled these areas with colored flags that denoted different milkweed plants and noted the GPS plot for them. Blue flags marked the beginning and end of our transects. Yellow flags marked every individual milkweed plant and orange flags marked areas where milkweed is expected to grow. These plots were then plotted on a google satellite map allowing us to observe the terrain and different elevations. We counted how many eggs were found on each milkweed leaf and then looked at how many of those eggs were parasitized or failed in situ. We collected parasitized eggs for further analysis in a lab setting. We also noted how many larvae we found on each plant and their instar. For larvae in the fifth instar, we will collect them and then monitor their growth through the pupae stage. For our transects we conducted bi-weekly pollard walks with a determined distance of 2 m in each direction to count monarchs for our study.

Results

So far, we have found that Cañada de los Osos Ecological Reserve contains many points with dense milkweed populations. We have plotted 57 GPS waypoints denoting milkweed plants. We have found over 20 larvae combined so far up to the fourth instar.

Discussion

We have found that Cañada de los Osos Ecological Reserve is a good location to conduct this study as there is a significant amount of milkweed plants for the monarch larvae to consume. We acknowledge that the colored flags could interfere with the monarchs finding the milkweed however since monarchs use chemoreceptors to find milkweed, this is not a big concern. We will continue to monitor for new milkweed growth and repeatedly check them for monarch eggs and larvae.

Insects in Birdhouses

Introduction:

The purpose of this project was to analyze the biodiversity of insects located in the birdhouses located at Cañada De Los Osos Ecological Reserve, thus, we wanted to record the different insect orders we encounter. The null hypothesis is that our total insect count will be encompassed by an even distribution of insect orders. We do not expect a specific insect order to make up most of our total count.

Methods:

To collect data, we first had to obtain contents from which to examine. I, along with Bob Clement, Claire Widman, and Danielle Thomas, removed all contents from 54 of the 60 birdhouses at Canada De Los Osos. The six uncounted birdhouses were excluded as they showed signs of new nests and were necessary for a separate, unrelated project.

All contents and debris from these birdhouses were stored in Ziploc bags then placed into large garbage bags. The bagged contents were frozen for, at least, 48 hours prior to thawing and examination. The freezing assisted in preservation of specimens, elimination of vectors, and prevention of fungal growth. Unsearched bags were kept in the freezer to preserve specimens.

A station set up was required prior to our specimen search. As we were dealing with waste and other organic materials, we utilized gloves and protective face masks. A biohazard container was also present for proper disposal of debris, waste, and other unnecessary contents. A trash bag was wrapped around and taped over a plastic container prior to every session. Contents and debris were placed in one side of the container and scrutinized for insects or pupae prior to being moved to the other side of the container. We chose to include pupae because they in some cases contained larvae and were indicators of the individuals that used the birdhouses as a housing location. We chose to exclude insect exuviae, or husks, as an individual can molt multiple times and thus have multiple husks.

After all contents have been searched, contents were disposed in a biohazard container. Insects were placed under a microscope for identification, if necessary. The insect count was recorded in a notebook along with the Order or Family, if known. Distinct items, such as acorns bird skeletons, and eggs were also recorded.

Results:

Our data did not support our null hypothesis; therefore, it must be rejected. Our count primarily consisted of only two families. From our data, we gathered that the two most commonly found insect Orders in these birdhouses were Diptera and Coleoptera. These two families are also commonly known as flies and beetles. Of 2,363 different specimens, 2,094 were from one of these two Orders. While including pupae, we obtained a specimen count of 1,798 fly specimens and 298 beetle specimens. The most prevalent fly family was Sarcophagidae, also known as flesh flies. We obtained a total count of 1196 Sarcophagidae pupae and 594 Sarcophagidae larvae. In the Order Coleoptera, we primarily found the Family Dermestidae or Family Curculionidae. All members of these two Families were in the larval or pupa stage. The dermestids were widely distributed amongst the birdhouses. The Curculionidae, or weevils, were found in only one birdhouse. This birdhouse was full of acorns, their primary food source. Additionally, we found 14 unviable eggs and 20 bird skeletons or decaying birds in 16 of our 30 birdhouses. Most of the other Families that had over 10 individuals, such as Vespidae (wasps) and Thysanura (silverfish), were found in only a few birdhouses.

Discussion:
The two most prevalent families, Sarcophagidae and Dermestidae, use dead animals or animal waste as a source of food. In this study, it is reasonable to attribute the presence of these two most commonly observed families to the presence of decaying organic material. The flesh flies and dermestids were found in most of the birdhouses. Some limitations to this study included limited knowledge in attempting to identify insects past any level beyond Family. Further studies are needed to expand on the specific species that are present. Any further studies will also require additional personnel as well as much more time to adequately complete the study.

Bird Boxes at Canada De Los Osos. Mar.3, 2018- April 21, 2018

Research Question:
Whether different areas on the reserve create better conditions for the nests of bluebirds and tree swallows than other areas, based on bird boxes' proximity to water, and surrounding tree density. The birds we focused on in this study are the tree swallow, the violet-green swallow, and the bluebird.

Methods:
Cleaned out bird boxes, collected data by counting the number of nests in the 55 boxes on each day at the reserve after cleaning them out on Day 1.
Then, we identified the birds we saw around each box, estimating which birds were heavily dense in which areas, and recorded observations in general.

Figures:

Figure 1: Total Egg and Nest Count

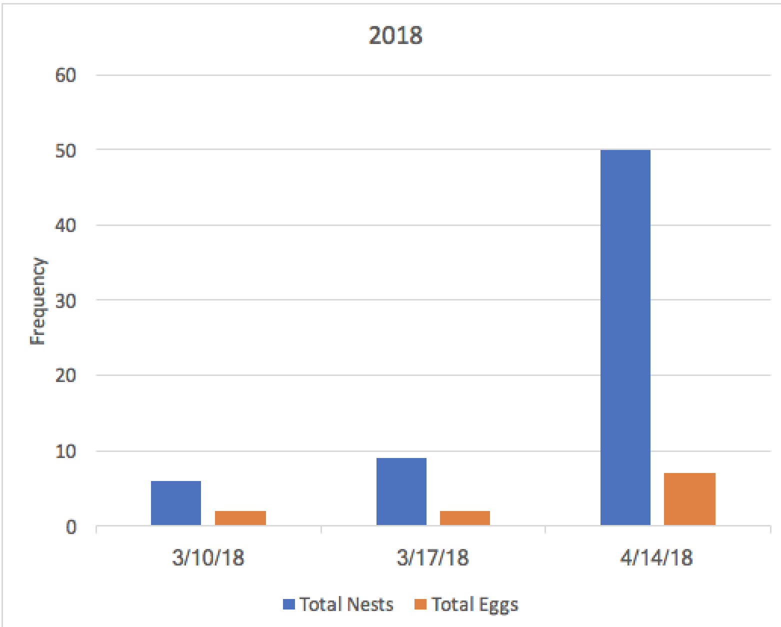

Figure 1: The orange bars represent the total number of eggs including the previous weeks eggs. The blue bars represent the total nests created in the different boxes.

Figure 2

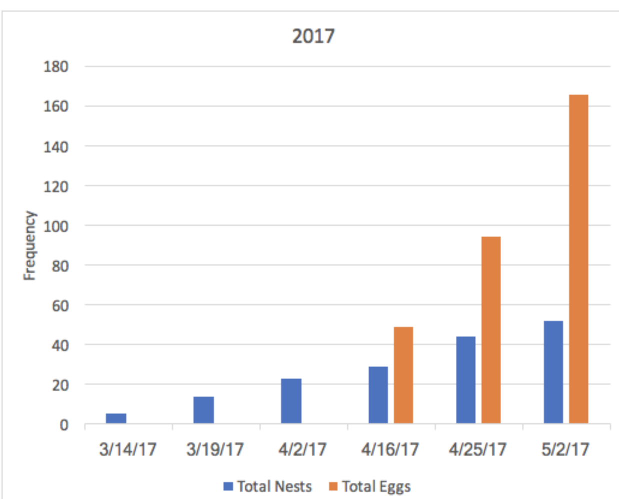

Figure 2: This is last year's data using the same parameters as this year's egg counting.

Figure 3

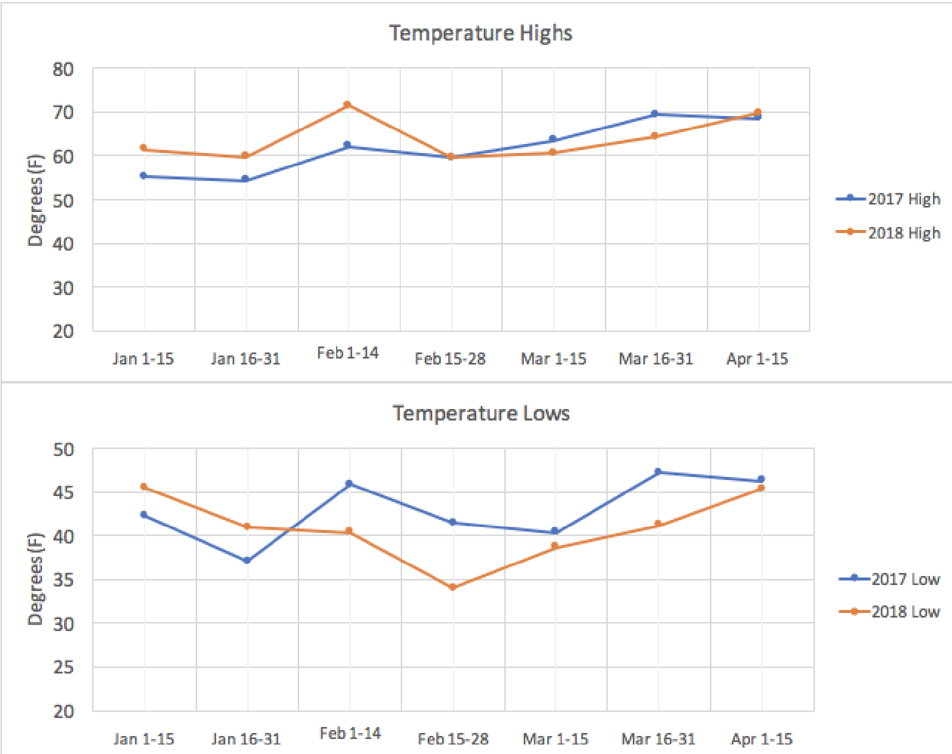

Figure 3: Shows the high and low temperatures of each year's time spent in the field. 2017 is represented with the blue and 2018 is represented by the orange

Conclusions:

There was a considerably smaller number of eggs from each bird species. The bird nests were not arranged in a significant pattern due to location or species, indicating that temperature and precipitation could have played a more significant role in reproduction than previously predicted. However, due to the shortened time in the field, our data is not conclusive of confirming or denying our hypotheses. The weather was more variant this year, suggesting that reproduction could have been slightly delayed or affected. Other things affecting our results could have been the weather affecting the insects, which are an important food source of the species we were focused on.

Create a Natural History and Identification Key for CDLOER

During this research opportunity led by Professor Trewhitt from SJSU, my team and I set out to begin putting together an animal identification guide for the Canada de los Osos Ecological Reserve (referred to here as CDLOER). The basis for such a project was to make an animal guide specifically tailored to CDLOER and the species present in this ecologically significant plot of land. Having such a guide in the future may perhaps better the publics' and various institutions' understanding of the importance of the land and the species present on it. This knowledge may also contribute to future conservation efforts in the area.

My undergraduate team and I went into CDLOER to document species in journals, as well as take pictures of any species we saw. With this information, and previous documentation of species noted on the reserve, we began to compile information in a guide, including information like seasonal morphs, habitat, range, diet, and behavior.

Our hope is that future teams working in CDLOER will continue to compile the guide until it is completed, and ready to be used as an official animal guide for CDLOER.

Purpose of an Animal Guide for CDLOER

- Create a guide for natural history of CDLOER
- Identify and Document different ways of identifying species
  - Droppings
  - Tracks
  - Fur
- Create a guide for future generations to add to

Guide Layout: Sample pages

Mammals:
Deer, *Cervidae*

Image of animal 	Description of animal Tan or brown in the summer and grayish brown in winter. It has white on its throat, around its eyes and nose, on its stomach and on the underside of its tail.
Habitat and Range The most suitable environment include a mixture of hardwoods, croplands, brushlands and pasturelands. They prefer an interspersed habitat including meadows, forested woodlots, brushy areas and croplands.	Diet foods can be classified as browse (leaves and twigs of woody plants), forbs (weeds), grasses, nuts and fruits and mushrooms.
Behaviors Timid; usually found with other deer.	Additional Information 

Mammals:
Bobcat, *Lynx rufus*

Image of animal 	Description of animal Bobcats can kill prey much bigger than themselves, but usually eat rabbits, birds, mice, squirrels, and other smaller game. The bobcat hunts by stealth, but delivers a deathblow with a leaping pounce
Habitat and Range Prefer rocky hillsides that are well-vegetated, they are found in numerous different habitats throughout their natural range including mountain woodlands, coniferous forest, swampland, deserts and even in suburban areas in some places	Diet Carnivore: Rabbit, Mice, Deer
Behaviors Solitary and nocturnal animal that is most active in the darkness of night, tending to hunt most during dawn and dusk (crepuscular)	Additional Information I ALMOST RAN THIS LITTLE GUY OVER….