ESLP
Education for Sustainable Living Program

Biodiversity Action Research Team

Final Report
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1. Executive Summary:

The Biodiversity Action Research team was the first of its kind that chose to monitor biodiversity in different areas of campus and compare whether certain areas hosted greater biodiversity than others. We were then able to conclude that the more diverse the vegetation and landscaping of a region, the more biodiversity it is able to harbor and also withstand changes in the environment. We then suggested re-landscaping several areas on campus to mimic these biodiversity-attractive regions of campus.

To conduct our study, we looked at two different types of landscaping: manicured (Bruin Walk, Sculpture Garden, and Dickson Court) and non-manicured (Stone Creek Canyon, Sage Hill, and the Botanical Gardens). At each site, we gathered data about the birds, insects, and plants by indexing the species richness and performing bird sightings and insect captures.

We performed our data analysis by comparing what we found too what would be an ideal species richness for that region. The correlation between bird species richness and floral species richness is not a strong correlation but did display a positive trend that was indicative of greater flora richness serving as a varied niche space for greater faunal richness. We also found a significant difference in the bird sightings between manicured and non-manicured regions of campus. For insect data analysis, we counted the number of species in each data sample studies how insect species richness differed from region type to region type. Finally, for our floral data analysis, we see that the non-manicured areas have the greatest species richness and also the greatest native to non-native species ratio.

Based on our findings, we decided to identify areas on campus that could be re-landscaped to attract more biodiversity. We chose areas that are small, visible, and currently low in flora diversity and high in water taxing species. We have several proposed locations as well as a list of native, drought tolerant plants that could be used to guide new landscaping and re-landscaping decisions on campus. This will not only create a landscape that is drought tolerant but will also create a habitat for a wide array of fauna that serve very important ecosystem services for the environment of UCLA. These high biodiversity regions will also be less susceptible to stochastic environmental events.

2. Background and Significance:

When one thinks of UCLA and Los Angeles it is very easy to imagine the red bricked buildings, the snarling bruin bear, and thousands of students. What does not come to mind is a bustling urban environment that still shelters dozens of species of birds, insects, and plants. Despite first impressions, the campus of UCLA harbors a surprising amount of biodiversity within its planned and unplanned pockets of habitat. Unfortunately, UCLA's flora and fauna diversity, like almost everywhere in the world, faces stiff challenges due to the destruction of natural habitat.

The Biodiversity Action Research Team is one of the first of its kind to explore the interesting idea of preserving and promoting species diversity on UCLA's campus. With the recent drought that California faces as well as the ever-looming threat of climate change, there arises a greater need to have a sustainable and efficient campus. There is a distinct lack of areas on campus that both require little water and maintenance and possess native plants suited to Southern California's Mediterranean climate. This absence led to the motivation behind the action research team of the benefits of non-manicured, wildlife areas on campus. As of now, there are only a few such places that fit that description. The vast majority of areas on campus are finely manicured, require large amounts of water, and need constant maintenance.

The UCLA campus and community has come a long way since its foundations almost a century ago. The same cannot be stated about the state of its natural environment throughout the years. A survey of the UCLA campus from 1929 to 1944 reveals a vastly different campus community inhabited by over a hundred species of birds, varying through the seasons. Currently, there are only around 40-50 species that visit and live within the UCLA campus. With our research, we hope to provide evidence for new ecosystems and habitable areas that allows for greater amounts of animal and plant biodiversity.

As a large and well-respected university, UCLA has a unique opportunity to lead the way for institutions for education to promote a healthy and bustling ecological community. As a self-professed green university, UCLA has many resources and opportunities to ensure that it can maintain environments that are conducive to species richness and diversity.

There are many lasting benefits to a campus that is friendly toward flora and fauna biodiversity. Education is the best way to combat the growing threats of a changing environment. Climate change and the mass extinction of numerous species in the past few hundred years are incredibly important problems that threaten our homes and communities. By preserving and promoting biodiversity at UCLA, we have a chance to ensure that the student community is aware of the issues and will take measures to act in a more sustainable manner in the future. UCLA also has a great opportunity to spread its message to the other universities and schools in the area, which is be an enormous step in educating the Los Angeles area on how to adjust to a warming climate.

3. Objectives and Project Goals:

The goals of the Action Research Biodiversity team were as follows: first, we started with the premise that biodiversity is good and we must work to conserve, promote, and improve it on UCLA campus. Essentially, our group wants to see more living things on campus and promote education and conservation of the biodiversity that already exists. Our primary motivation comes from wanting UCLA to become a campus that attracts lots of fauna species and has more drought tolerant flora. We chose six locations to study, three wild type and three manicured, with the goal of finding out the biodiversity of each area and then creating a ranking system from most to least diverse.

Our second goal was to rank the biodiversity of our locations using the flora and fauna data we collected. The fauna data comes from birds and flying insects, and the flora data comes from plants in the specific areas we chose. Once we had completed our bird observations, we mathematically indexed the biodiversity on campus, counting the abundance of each species (birds, flying insects, and plants) in order to find what locations were most diverse.

Third, our team wanted to calculate how much water was being used in the manicured campus locations. This is related to our desire to show that locations with more biodiversity and native species save water. Manicured areas consume lots of water and grass generally does not attract fauna species in high numbers. Unfortunately, we were not able to obtain the necessary information to calculate how much water the manicured locations use because UCLA facilities do not store sprinkler time datasheets, but we do know that Sage Hill and Stone Creek Canyon do not use any water and they are the two locations at UCLA that have the most un-manicured flora and the most abundant biodiversity.

Our fourth and final goal was to compose two landscaping proposals based on our research. The first proposal will suggest that parts of campus with watered lawns be re-landscaped with flora that attracts more fauna, thereby increasing biodiversity on campus. The flora planted would be native trees, vegetation and water-saving succulents. This proposed landscape will attract the birds and flying insects studied and be drought tolerant. The second proposal is a three-tiered ranking system of what flora UCLA should plant in the locations we propose (Appendix C). More importantly, this list should be used as a reference by UCLA facilities every time our school develops new land. The top tier will include plants that are native to Southern California; the second tier will have plants native to the Southwestern United States; the third tier will have Mediterranean plants from around the world; and the fourth tier will be plants that should never be planted on UCLA campus. The first three tiers are drought tolerant plants, and the fourth tier will be invasive species and plants that consume too much water.

4. Research Methodology:

The ART Biodiversity team has performed several tasks over the past 20 weeks. Although these tasks have taken inspiration and also research help from several pedagogical sources, many have been devised and designed by the team itself.

In the beginning of winter, the team had to deliberate about the choice of areas to study as well as decide upon how best to represent the biodiversity of the campus. In order to show the importance of biodiversity, the team decided to differentiate its presence between manicured and non-manicured areas to show of differences these 2 ecosystems hold. Our manicured areas were defined by the fact that they had heavy gardening and watering implemented on them whereas the manicured areas were defined by their wild type growth with little to no gardening intervention. The team worked in collaboration with another research team (Dr. Brad Shaffer, Grand Challenged, 2015) that was studying change in reptile and amphibian populations over the years. The Grand Challenges team had already created a grid map of the campus and placed close to 90 cover boards that were used to capture the reptile and amphibians. We chose to have 2 study sites in 6 different areas. These 6 areas were divided into manicured and non-manicured ecosystems based on our definitions for each the area itself was represented by 2 study sites at either end of these areas near the vicinity of a cover board whose location was provided by the Grand Challenges team (Appendix A, Figure 1 and Figure 3 shows each of the 12 study sites on our 6 areas).

After deciding upon our study sites, we had to confine our study spaces to within 100 feet radius with the cover boards of our central point. The next step we took was to decide on the type of flora and fauna we would look at. Since mammals are grossly under-represented the team decided to look at birds and insects in fauna and also study all flora within our study site circles.

The methodology applied for each type of biota was slightly different and even the analysis performed was unique but very replicable. Before we started the actual experiments the team decided to familiarize themselves with each area and also trey and draw a preliminary list of species that could possibly be found in any of these areas. For the floral species, the team used a database provided by the Mildred E. Mathias Botanical gardens that listed all plant species that were present on campus. This database was also used to identify all species found in our study sites. Sarah Ratay, a botanist from the Ecology and Evolutionary Biology (EEB) department at UCLA who specializes in California endemics helped identify unknown species in 2/3 wild type sites that helped expand our list (204 species). For the birds, the team conducted preliminary surveys of each of the sites with help from ornithologist Richard Hedley of the EEB department at UCLA. Hedley and team were able to identify over 37 species of bird found on the 415 acres of campus and these were going to be used as our baseline species richness for all of campus. The insect's collections were treated slightly differently. Insects were caught using Malaise traps and only 6 (not 12) malaise traps were used, each being placed at a location that best captured the ecosystem as a whole.

a. Floral Data Collection:

All types of vegetation (plants, trees, shrubs etc.) was photographed for all directions within 100 feet of the cover boards. After photographing the plants, their identification was verified by a species list created by the UCLA Botanical Gardens that had the plant photo, name and even location on campus. The identification was re-verified by botanist Sarah Ratay who also helped identify the unknown species.

b. Floral Data Analysis:

The data was analyzed by comparing (correlation and regression analysis) the bird diversity and richness (see below) with the floral richness to check for whether or not there was any significant relationship of increasing floral richness leading to an increased bird richness and diversity.

c. Bird Data Collection:

There were a total of 12 sites to be surveyed for birds. We counted all birds found within a 100-foot radius from the cover boards as our central point. The birds were all observed using Eagle Optic Shrike 10by42mm binoculars by each team member so there was no variation in visualization. These instruments were made possible thanks to the funding the team received from The Green Initiative Fund. Each of the 6 were surveyed 3 times by different teams of 2 to ensure that there was no same pair of eyes looking at one area for each survey. All birds that fell outside of the 100-foot perimeter were not counted in the data, as they were not being attracted to any of the flora within the 100 feet perimeter. Each of the bird sightings was performed exactly at daybreak where each site within an area was studied for a period of exactly 15 minutes.

Area	**Mon**	**Tues**	**Wed**	**Thurs**	**Fri**
Winter15 - Week 10					
Bot Gard	H and Wu				
Stone Creek		G and P	P and Wi		
Sage Hill	S and Wi				
Bruin Walk					
Sculpture Gard				S and Wu	
Sunken Gard				G and H	
Spring15 - Week 1					
Bot Gard	G and S				
Stone Creek		G and Wu			
Sage Hill	H and P				
Bruin Walk			P and S		
Sculpture Gard			H and Wi		
Sunken Gard	Wi and Wu				

Spring15 - Week 2					
Bot Gard	P and Wu				
Stone Creek	H and S				
Sage Hill			S and Wu		
Bruin Walk	G and Wi				
Sculpture Gard		G and H			
Sunken Gard			P and Wi		

Table 1: The table above explains the scheduling for bird surveys that took place over a 5-week period between the Winter and Spring quarters of 2015 calendar year. Each of the sites was visited 3 times by a new team to take care of any bias. The initials in each box represent the last name of each group member that went out for the surveys. All surveys took place at daybreak for a period of half hour with each site being surveyed for 15 minutes.

d. Bird Data Analysis:

We first looked at what the ideal makeup for birds would be at each site. We found a total of 37 species of birds (Appendix A, Figure 4) and if the campus were homogenous, ideally each site would have 37/6 birds at every survey. Since we surveyed each site 3 times the ideal species richness we would see for birds would be the sum of the average sighting for each area divided by 6.

We also performed two tailed t-test to analyse the statistical difference between the birds we saw vs. the birds we should see with a prediction that the non-manicured areas and manicured areas would have a significantly different sighting of birds. A correlation analysis was performed on the bird richness and diversity to the plant richness to show any statistical significance in relation between the 2.

e. Insect Data Collection:

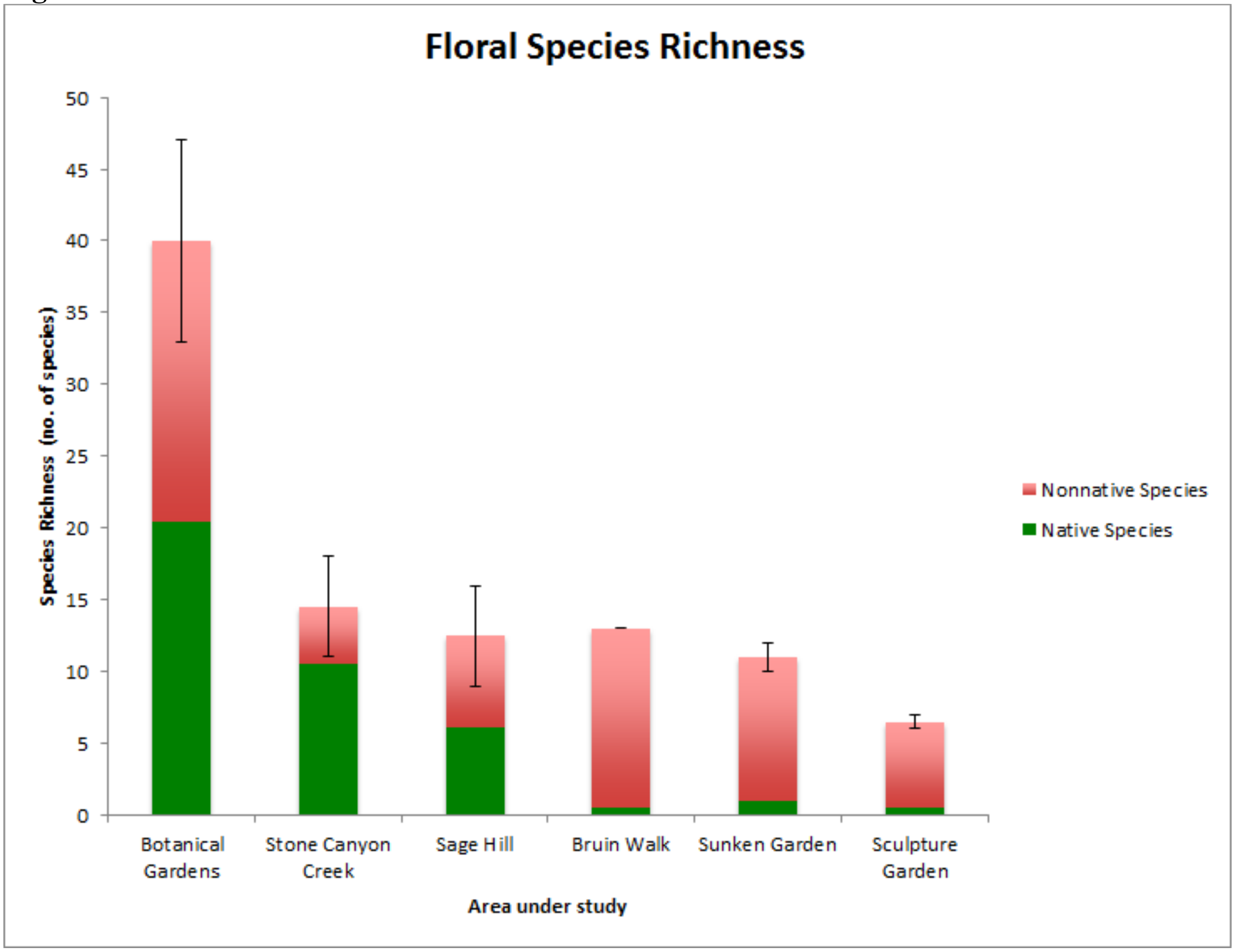
Six malaise traps of dimensions 4' square x 7' tall (1.2 m x 2.13 m) were set up in all 6 areas in regions that best encompassed that ecosystem. The malaise traps had an inverted funnel shaped collecting head with a strip of DDVP fumigant inside that killed the insect upon it entering the collection jar. Each collection jar was left out for a week and was replaced at the end of the week. This was repeated 2 times with a total of 3 collections and a total of 18 jars (3 for each area).

f. Insect Data Analysis:

Since there was no database to match the species we found against and little to no entomological knowledge sources on the UCLA campus the team decided to identify based solely on morphological features. Each team member was given 3 random jars and each jar from which all insect species for that jar were counted using morphological differences. An average species count was found for each area and these species richness were then correlated to the floral richness of each area to check for any statistical significance in the relation. To further analyze the data, we checked if the insect species richness matched the bird species richness.

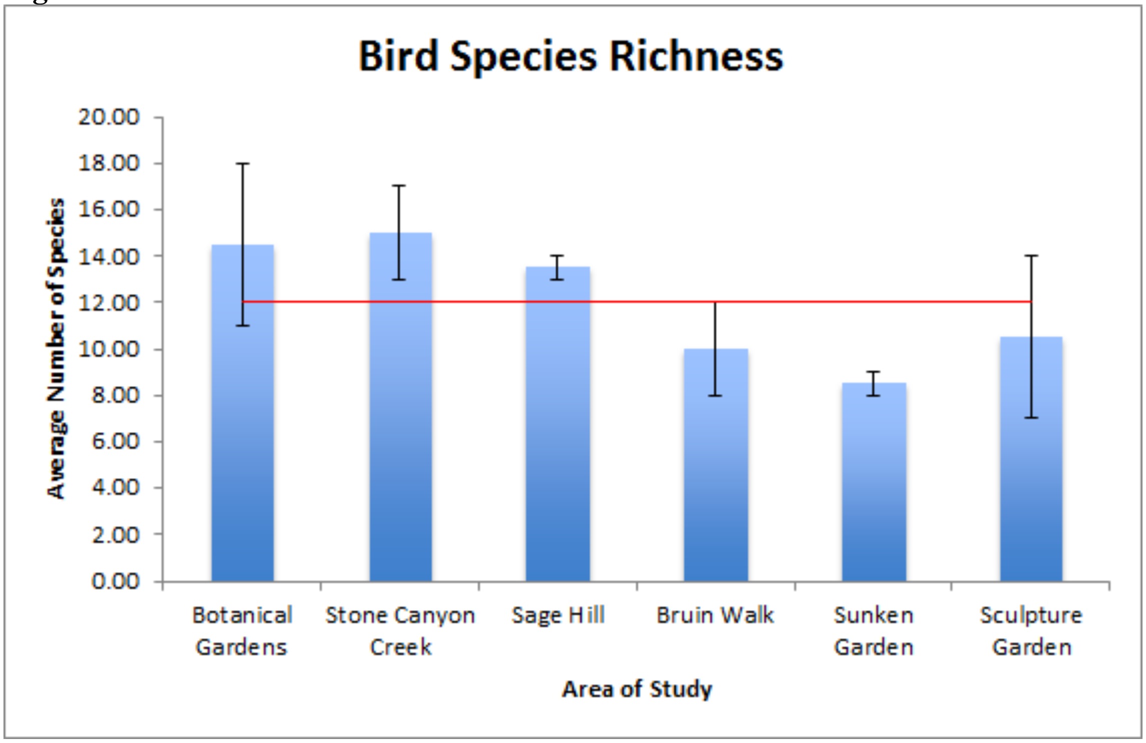
5. Results:

Figure 1.



Through our identification of all plant species within a 20ft radius of our central two locations in each area as well as the extra trees within a 100ft radius, we found that the non-manicured areas had slightly higher species richness. The Botanical Gardens had extremely high species richness in comparison to all the other areas we analyzed, however, in this respect the Botanical Gardens are an outlier because this area was specifically designed to incorporate a wide variety of species in a small area. The non-manicured areas also had more variation in species richness between the two survey sites whereas the manicured areas were more uniformly diverse. The non-manicured areas also had much higher numbers of identified native species than the manicured areas. Though the Botanical Garden is a collection of species from all over the world, one of the sites within the Botanical Garden we surveyed was in the California Natives section of the garden that is why we found such a high count of native species in that area. Despite the claim that Sage Hill is the only remaining undeveloped, native chaparral area of campus, there were a surprising number of nonnative plants. This may be due to the fact that there have not been any recent efforts to restore Sage Hill whereas Stone Canyon Creek has had a recent restoration project to remove invasive and nonnative species.

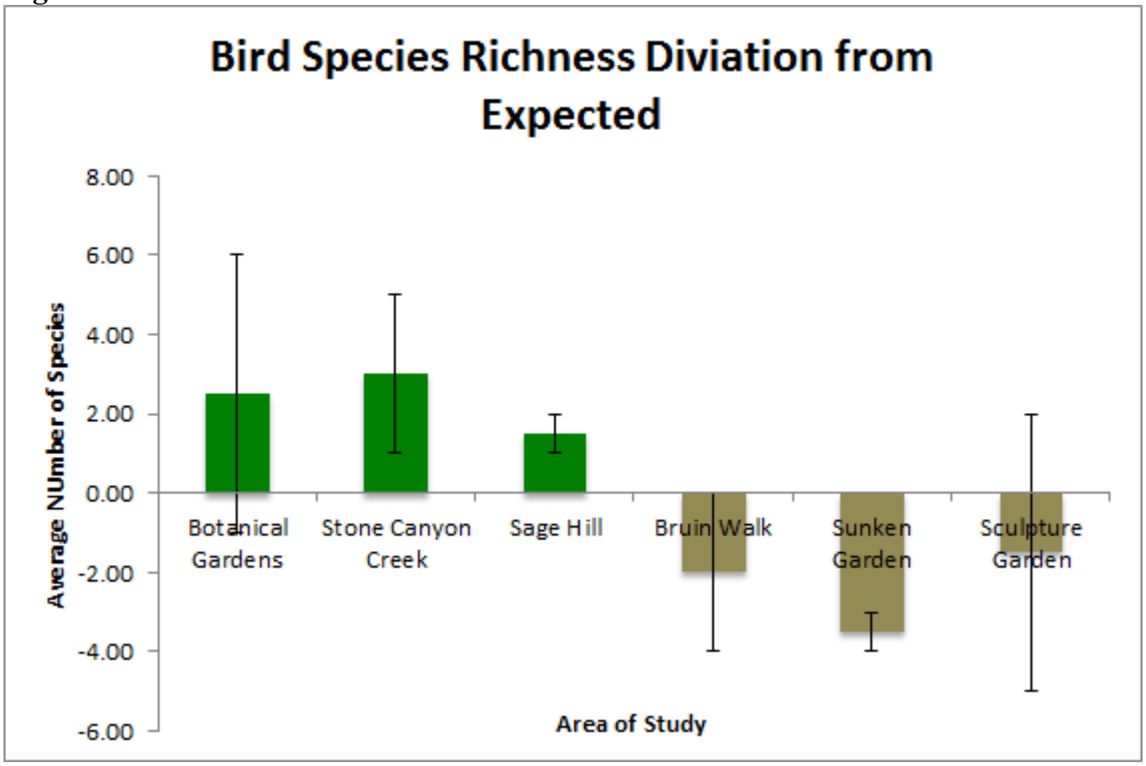
Figure 2.



The graph above shows the average number of birds sighted at each location and the error bars show the maximum average for the site with higher species richness observed and the minimum average for the site with lower species richness observed within the designated location. These averages are shown in relation to the expected number of bird species we could see in any given area on campus by dividing the sum of the averages observed by the number of areas we surveyed. This set the expected number of bird species at 12. At all three non-manicured areas we observed an average number of species above the expected and all three manicured areas were below the expected. This is further demonstrated in the graph below where we have the expected number of species set at the zero mark and the deviation of each location from the expected.

Sage Hill and the Sunken Garden had the most consistent distribution of bird species richness since there was less deviation between the numbers of species observed at the two different assessment sites within the areas. Contrarily, the Botanical Gardens and Sculpture Garden had large deviations between the numbers of species observed at the two sites.

Figure 3.



We conducted a two-tailed t-test to assess the significance of the correlation between the number of bird species observed between the manicured and non-manicured with the hypothesis that the sightings would be significantly different. Our **p value was 0.00441** which indicated significance proves that there is a significant difference in the amount of biodiversity that is being harbored between the manicured and non-manicured regions of campus.

Figure 4.

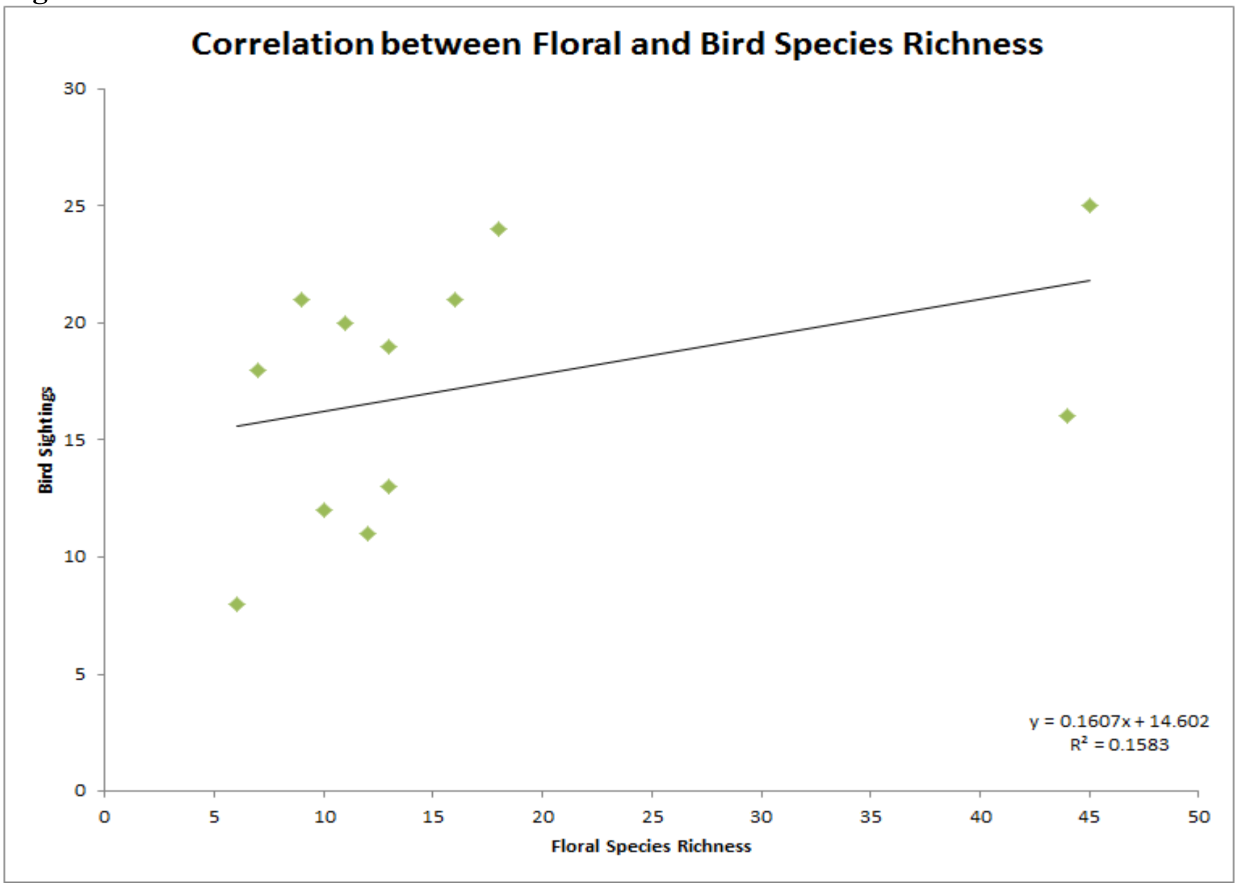
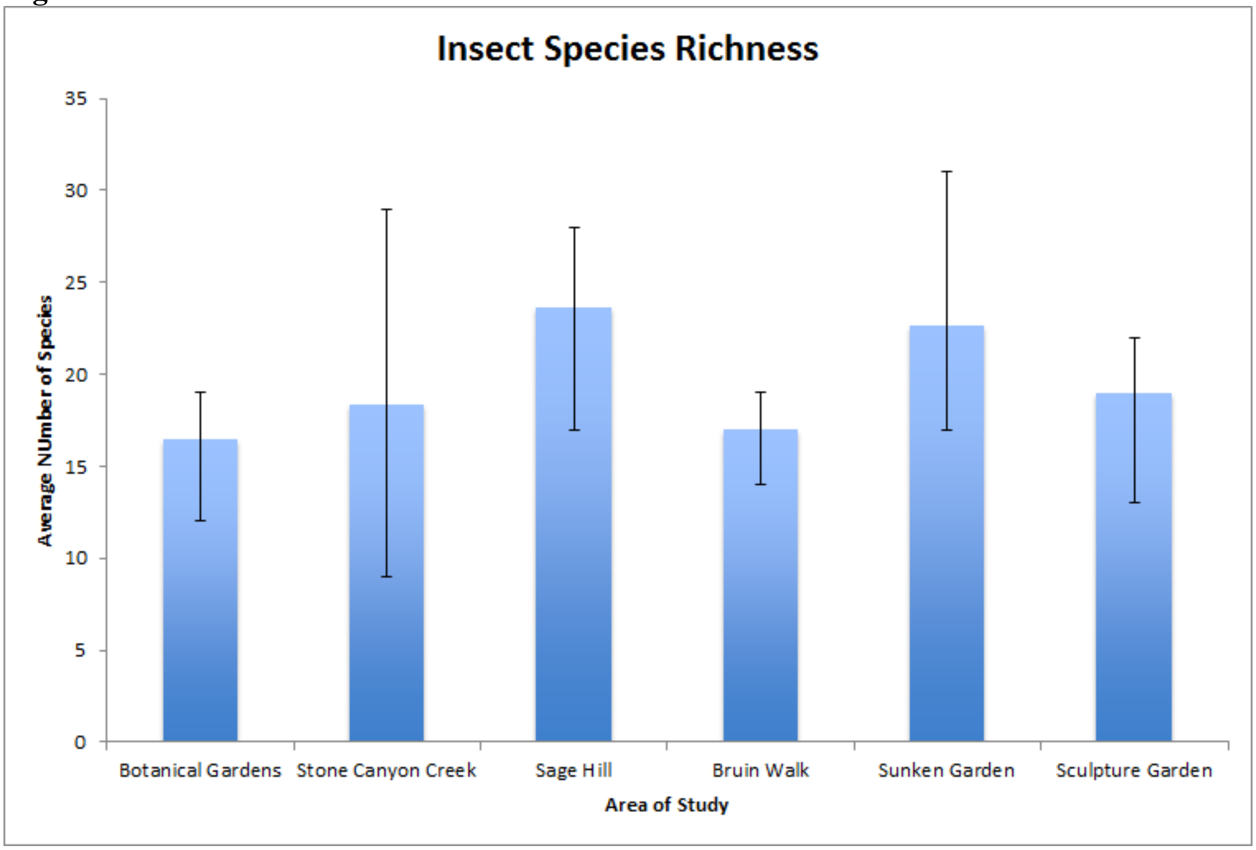
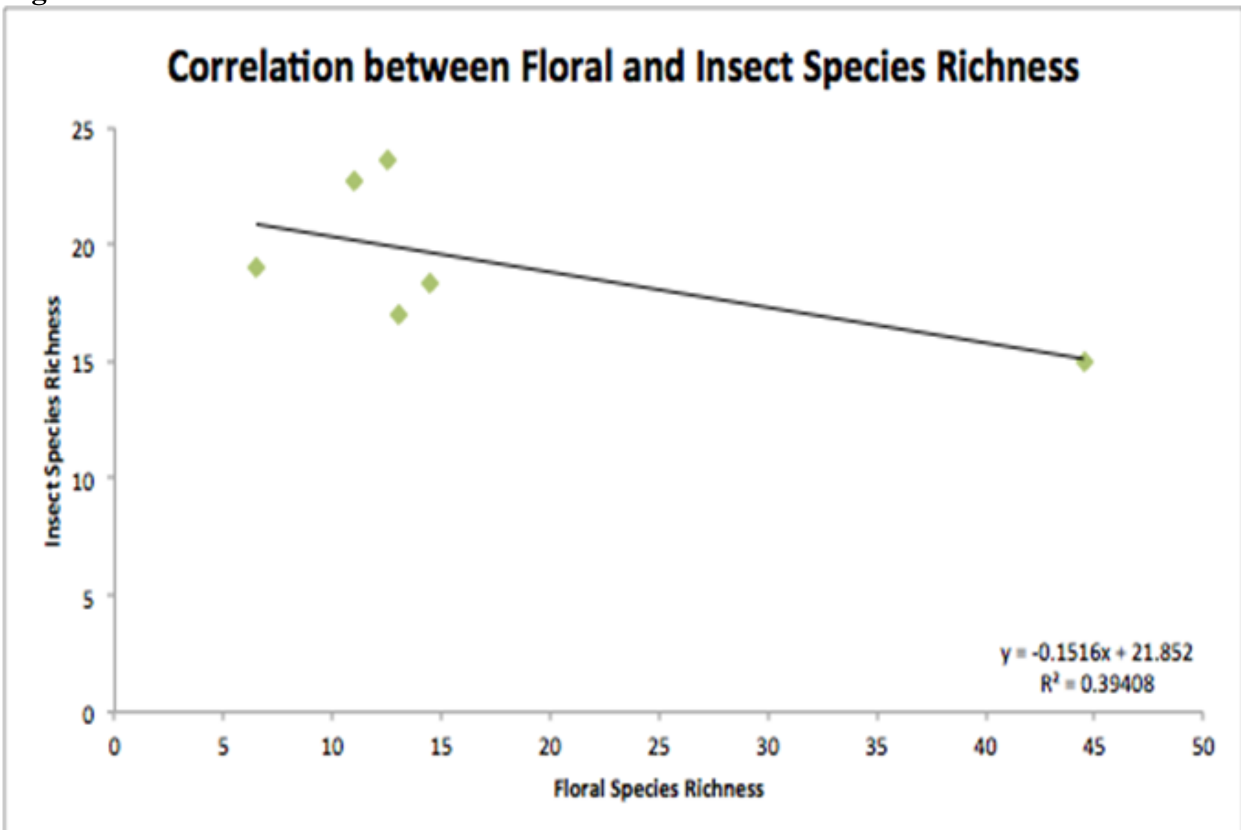

Correlation between Floral and Bird Species Richness
Bird Sightings
Floral Species Richness
0
5
10
15
20
25
30
35
40
45
50
y = 0.1607x + 14.602
R² = 0.1583

Figure 5.



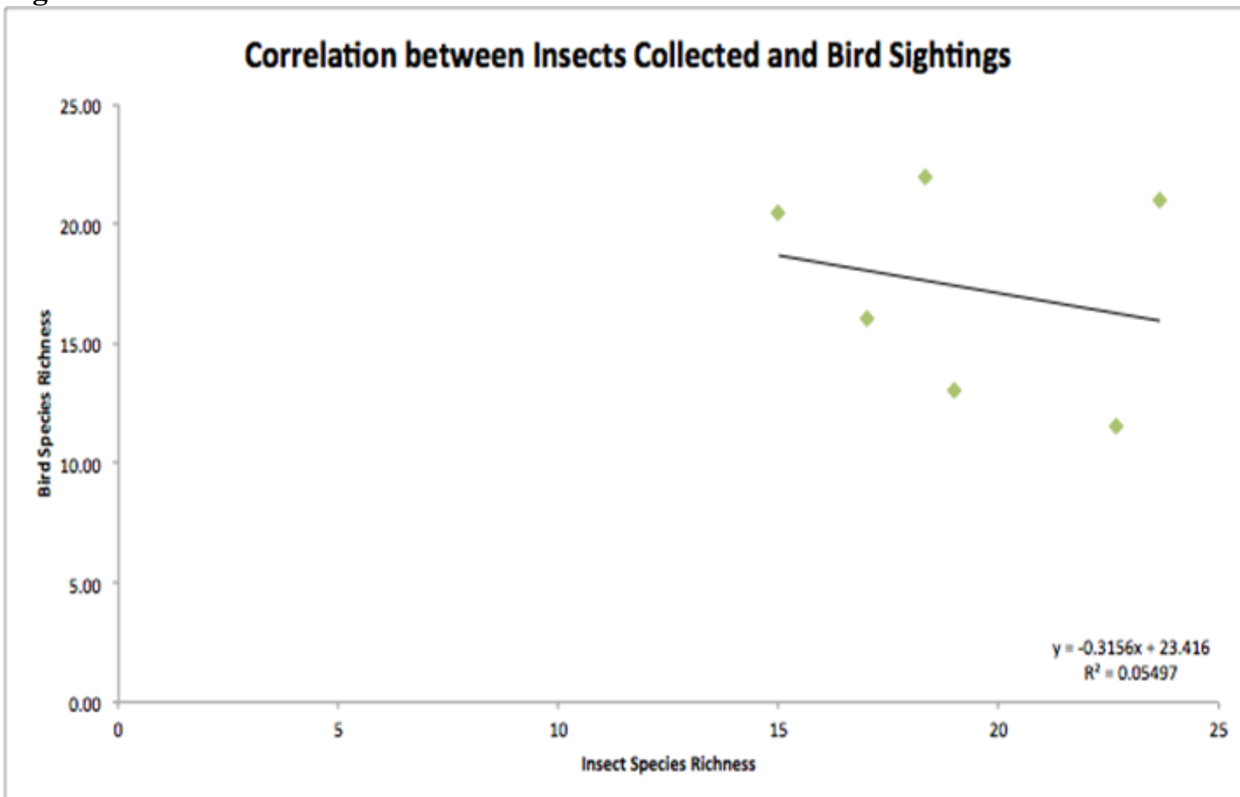
Insect Species Richness
35
30
25
20
15
10
5
0
Average NUmber of Species
Botanical Gardens
Stone Canyon Creek
Sage Hill
Bruin Walk
Sunken Garden
Sculpture Garden
Area of Study

Figure 6.



Our malaise traps caught the highest average number of insect species richness at Sage Hill and the Sunken Gardens and though there is no significant correlation between flora species richness and insect species richness, there is a slight trend that suggests and negative relationship between floral and insect species richness. There were, overall, more insects found in the manicured areas despite the high count at Sage Hill. The area with lowest insect species richness was the Botanical Gardens.

Figure 7.



When comparing the richness of insect species to bird species we found a slight negative trend as well. Areas with more bird diversity tended to have lower average insect diversity. This could be due to a predator-prey relationship or due to habitat differentiation. It's possible that ideal bird habitats are not insect attractant.

6. Discussion:

Apart from our flora species count at the Botanical Garden, there was very little significant difference between the number of species richness at the manicured and non-manicured areas. The likely contributing factor to the difference observed in bird species richness is the kind of flora species found in each area. A greater variety of plant species filling different ecological niches creates a more complex and stable ecosystem that can support a wider range of bird and other animal species. The best way to know if the non-manicured areas had greater species diversity both of plants and birds would be to use a phylogeny index that would give the relatedness between the observed species. This would require counts of individual animal abundance and the specific species of each area. We did not collect data on species abundance and therefore cannot draw specific conclusions about the species diversity of each area. This is in part due to deficiencies in our bird watching abilities and inability to catch, tag, release, and re-catch the birds to get accurate number of individual counts.

The non-manicured areas did have higher native flora species abundance which could be contributing to the higher number of bird species in those areas. We would need to prove the significance of this data to draw any conclusions about the correlation between the number of native plant species and the number of observed bird species. In the future, it would be interesting to identify the number of native bird and insect species of each of our samples as well to see if there is a correlation between areas with higher flora nativity attracting more native fauna species diversity.

Since we didn't do abundance counts of any of our data we do not know the volume of individual birds or insects attracted by the different types of landscaping. It is possible that the number of individual birds or insects supported by the flora of an area is high but the diversity of the species in the area is low. For example, an area might support 100 birds but these birds only represent two different species while another area might only support 30 individual birds but that 30 contains representatives of five different species. The later location would have higher species richness.

Some of the species we observed were specific to a particular landscape and not found in the other areas we observed. Other species were ubiquitous across campus and found both in manicured and non-manicured areas. To increase biodiversity of an area, it is important to support niche specific species that make key contributions to the ecological community. It is possible that the reason we found a negative correlation between the insect species richness and bird species richness is because areas with higher bird diversity are keeping the number of insect species down which may be indicative of a more stable ecosystem. By doing insect abundance counts it would be easier to draw conclusions about the relationship between landscaping, bird species, and insect species. The manicured areas that have lower bird diversity may have higher insect counts but they may all be flies of similar phylogeny that would indicate lower species diversity despite high species richness. Many of the manicured areas also have flowering bushes that may be attracting more pollinating insects whereas the flora in the non-manicured areas may be better suited to nesting territories and seeds that are supporting a greater variety of birds.

Originally we had planned to get abundance counts from our insect data, however, counting the number of individual insects in a sample proved to be difficult. This was due to our sample size.

Counting for abundance may have been easier if we can caught fewer insects in each sample by collecting the insects more frequently instead of once a week. One week's worth of insects was too many in most instances to count abundance.

7. Recommendations:

Our team has numerous recommendations for how the Biodiversity Action Research Team can be improved for the years to come. The most important element to future biodiversity teams is that they have both a scientific advisor and a facilities stakeholder who has the political influence and knowledge of UCLA's landscaping to make change on campus. Ryan Harrigan, our stakeholder, is fantastic for advising the group about accurate science. We suggest there is a second stakeholder in facilities who has a vested interest in making UCLA's landscape more suitable for Southern California who can consult with the team about the cost and feasibility of implanting more drought tolerant and native landscaping.

The main purpose and primary recommendation to come out of our research is the promotion of more drought tolerant landscaping on campus. Our group has developed a list of native plants that are best for Southern California; drought tolerant plants that are not native; and plants that should never be included. We need stakeholders who will ensure that UCLA follows through on our recommendations for which plants are best suited to Southern California's climate. A perfect example of where our recommendations could be used is for the new convention center and hotel under construction behind Pauley Pavilion. The landscape has not been planted yet, but projected photos of the fully constructed building suggest that grass will be planted. Having a stakeholder in facilities who has influence to make sure big projects have drought tolerant landscapes would be ideal.

Our team has many technical suggestions for all future teams that have to do with shrinking the scope of biodiversity research. Our team did not have time to study what specific plants attract different fauna. For example, we did find that the sycamore trees, a California native on Bruin Walk, tend to attract lots of western bluebirds. If another team took the time over two quarters to focus on only two or three areas of campus instead of six and really observe which flora attract specific fauna, that would be crucial to better landscaping suggestions. The group would be able to show if a specific species would bring more beneficial insects or birds to further develop the ecological community on campus. For example, a group could compare which trees attract more cedar waxwings or which succulents attract more native, pollinating insects. We strongly urge a future biodiversity team to spend two quarters studying and restoring Sage Hill and Stone Creek Canyon. Restoration might include invasive species removal, reintroduction of native species, and educational signage.

Future teams could expand in more detail on a specific species or group of species building from our broad research of flying insects, birds, and plants. Also, another group could focus on reptiles and amphibians by using Brad Shaffer's' cover board method. However, we suggest that no group works with the Grand Challenges teams because their deadlines and timelines for projects are much different than ours. There is much more to be studied regarding the two wild type areas of campus: Stone Canyon Creek and Sage Hill. How might elements of these areas be incorporated into more UCLA landscaping?

Our team conducted surveys where we asked 200 students their opinions about biodiversity on campus. We found that 25 percent of students prefer a grassy landscape over California coastal chaparral or Mediterranean landscapes. We feel this number is much too high and indicates that more effort needs to be put into educating students on campus so the importance of drought tolerant and native landscaping becomes more universally understood.. This promotion could be part of orientation, campus tours and advocated in classrooms. We believe it is also necessary for UCLA to implement more water metering so we know what areas of campus are consuming more water.

Ultimately, we want UCLA to take the lead in prioritizing and valuing the goal of creating a more biodiverse campus. We estimate that only three percent of the UCLA campus is wild type, and only two percent of flora does not get watered. These areas are also highest in biodiversity, which indicates that, where implemented, biodiverse landscapes will increase the amount of fauna and save water. The more biodiverse an area is, the better it copes with natural stresses like droughts because the location remains cooler in higher temperatures and retains more water. There is an absolute practicality to caring about the campus biodiversity. If it is not cared for, more species will be lost. We have evidence for loss due to the bird surveys conducted by Dr. Loyle Holmes Miller, who documented over more than 100 species of birds on the UCLA campus in 1947 (Finley, 2005). UCLA now only has approximately 60 bird species on campus, as species were lost due to increased urbanization and habitat destruction. We hope our research and plant recommendations can aid influential UCLA faculty members in creating policies that promote biodiversity. We would like to see a biodiversity reserve on campus with educational signage. We have photographically documented many suggestions for these locations. The Appendix B includes four photos of examples of areas that could be converted into a drought tolerant landscape including grass by the Public Affairs building, Anderson School of Management, Hedrick Hall, and De Neve Residential Suites. UCLA is one of the most influential schools in Southern California, and if we implement more drought tolerant landscaping other schools in drought plagued areas will follow our lead.

8. Final Recommendations and Conclusions:

The six members of our Action Research Team have proudly pioneered and laid a foundation for researching the biodiversity of the UCLA campus. All of us learned a great deal regarding UCLA politics, flora and fauna, campus water management, and landscaping. We believe that there are many more specific studies that can be carried out by future teams. Our research gives a broad perspective on the UCLA campus biodiversity and it is the future teams' responsibility to narrowing their focus to certain areas and species. The reason why the scale of the study needs to be reduced is because an imperative point of inquiry for biodiversity research will be documenting what specific flora attracts unique fauna.

From the research we have conducted during the past two quarters, we have concluded that there is more biodiversity and water savings in non-manicured sites. Comparing the species richness of plants to the species richness of birds, we found a positive correlation between the two. In addition, there is a negative correlation between the species richness of birds and species richness of insects, which is expected in an ecosystem. Therefore, a landscape that promises greater biodiversity will attract a greater varied amount of species, while also making that region resilient to any abrupt change.

Furthermore, we have concluded that grassy areas on campus, that attracts very little biodiversity and consumes a large amount of water, should be converted to biodiversity reserves. Moreover, any upcoming landscaping constructions should take into consideration our recommended plants and , since UCLA currently has many areas with water consuming grass and other non-native vegetation that do not reflect well on its biodiversity and sustainability.

Our research has laid the foundation for a future that would see a college campus that harbors a greater amount of biodiversity and that is also resilient to the ever-changing environment. As an Action Research Team, our project provides not only useful information for changes in UCLA landscape, but also for beneficial changes in communities outside the college campus.

9. References

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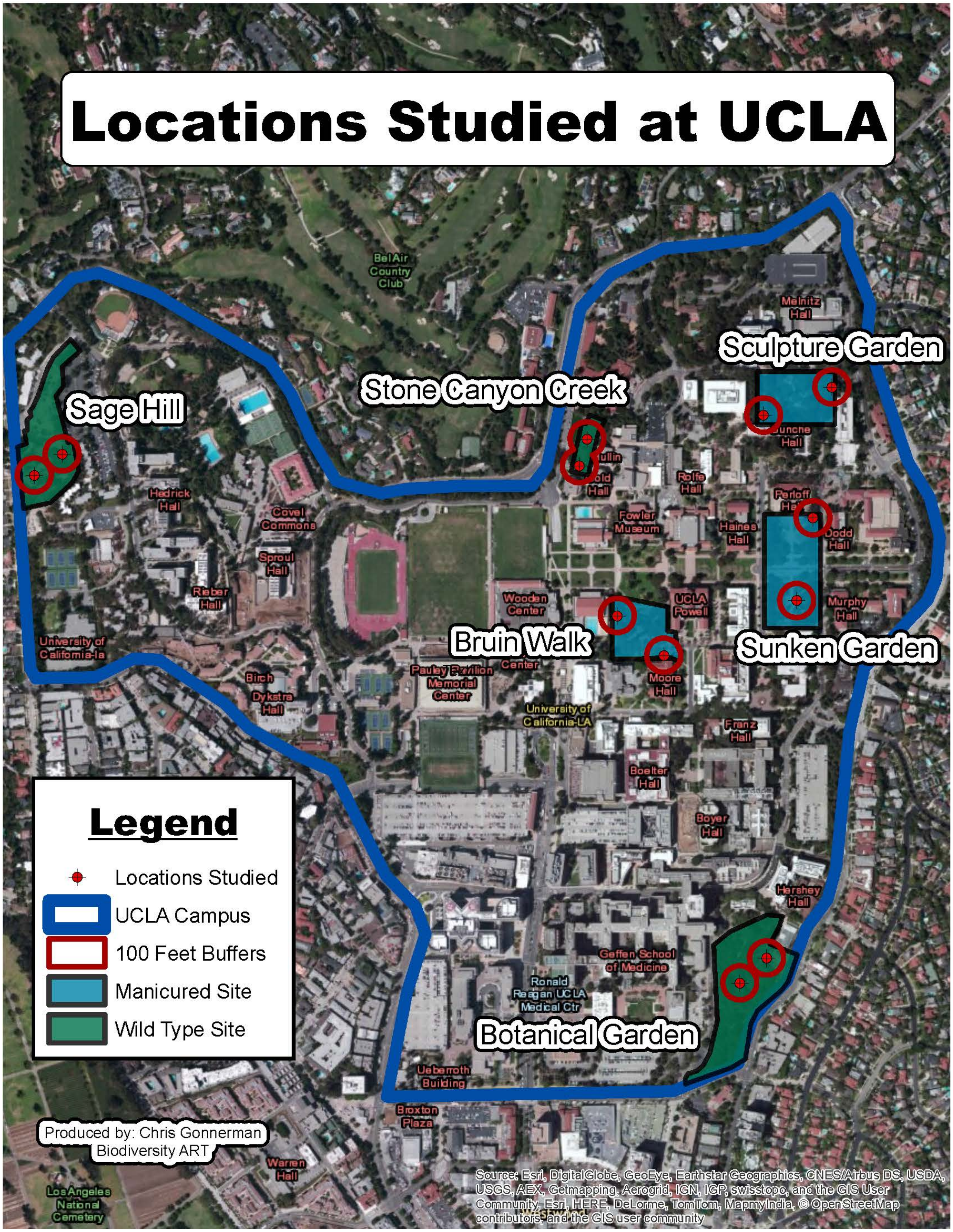
Appendix A – Site Survey

Figure 1.

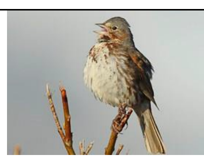
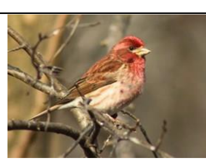
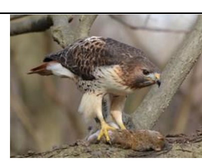
Figure 2.

Figure 3.



Locations Studied at UCLA
Bel Air Country Club
Melnitz Hall
Sculpture Garden
Stone Canyon Creek
Sage Hill
Bunche Hall
Rolfe Hall
Hedrick Hall
Covel Commons
Perloff Hall
Fowler Museum
Haines Hall
Dodd Hall
Sproul Hall
Rieber Hall
Wooden Center
UCLA Powell
Murphy Hall
University of California-la
Bruin Walk
Sunken Garden
Pauley Pavilion Memorial Center
Moore Hall
Birch Dykstra Hall
University of California-LA
Franz Hall
Boelter Hall
Boyer Hall
Legend
Locations Studied
UCLA Campus
100 Feet Buffers
Manicured Site
Wild Type Site
Hershey Hall
Geffen School of Medicine
Ronald Reagan UCLA Medical Ctr
Botanical Garden
Ueberroth Building
Broxton Plaza
Produced by: Chris Gonnerman
Biodiversity ART
Warren Hall
Los Angeles National Cemetery
Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community, Esri, HERE, DeLorme, TomTom, MapmyIndia, © OpenStreetMap contributors, and the GIS user community

Figure 4. Birds surveyed by the ART Biodiversity Team. Total of 37 Species.

 Allen's Hummingbird	 American Crow	 American Goldfinch	 Anna's Hummingbird
 Band-Tailed Pigeon	 Bewick's Wren	 Black Phoebe	 Bushtit
 California Towhee	 Cedar Waxwing	 Collared Dove	 Cooper's Hawk
 Dark-Eyed Junco	 Fox Sparrow	 Hermit Thrush	 House Finch
 Lesser Goldfinch	 Mockingbird	 Mourning Dove	 Nuttall's Woodpecker
 Orange-Crowned Warbler	 Purple Finch	 Red-Tailed Hawk	 Ruby-crowned Kinglet

 Say's Phoebe	 Song Sparrow	 Spotted Towhee	 Townsend Warbler
 Western Bluebird	 Western Scrub-Jay	 Western Tanager	 Yellow-Rumped Warbler

Appendix B - Recommended Re-landscaping Areas

Figure 1. Next to Public Affairs Building

Figure 2. Near De Neve Residential Suites

Figure 3. Near Anderson School of Management

Figure 4. Near Hedrick Hall

Appendix C - Southern California Landscaping Guide (tri-fold brochure)

Plants to Avoid

- **Invasive species**
  these plants are often generalists who can adapt to a variety of climates and habitats. Since they have no natural predators, they can quickly out-compete indigenous plants disrupting the ecosystem.

- **Water-taxing species**
  UCLA is located in a sub-tropical, coastal chaparral habitat with very little annual rainfall. Tropical plants require more water than is naturally available in Southern CA and therefore require extra watering and maintenance.

- **Non-native species**
  Non-native plants will not support the native wildlife as well as naturally occurring species native to the Southern CA ecosystem.

BIODIVERSITY
Action Research Team
2015

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1 Photographs provided by LA Department of Water and Power
2 Photographs provided by Las Virgenes Municipal Water District

ESLP Education for Sustainable Living Program
UCLA Institute of the Environment and Sustainability

Ideal LANDSCAPING GUIDE
Southern California

Tier 1: CA Natives


Coastal Live Oak [2]
Quercus agrifolia


CA Black Walnut [1]
Junlans californica


Toyon [2]
Heteromeles arbutifolia


Laurel Sumac
Malosma laurina


Lemonade Berry [2]
Rhus integrifolia


Black Sage [2]
Salvia mellifera


Giant Wild Rye [1]
Leymus condensatus


CA Purple Needle Grass [1]
Stipa lepida


CA Morning Glory [1]
Calystegia macrostegia


Bush Sunflower [2]
Encelia californica

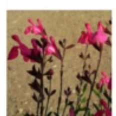
Tier 2: SW Natives


Yellow Columbine [2]
Aquilegia chrysantha


Spanish Bayonet Yucca [2]
Hesperoyucca whipplei


Texas Red Yucca [1]
Hesperaloe parviflora


CA Fuchsia [2]
Epilobium canum


Autumn Sage [1]
Salvia greggii


Indian Paintbrush
Castilleja affinis


Bush Monkey Flower [2]
Mimulus aurantiacus


Juniperus Hybrid [1]
Juniperus deppeana


Arizona Cypress
Cupressus arizonica

Tier 3: Mediterranean


Orange Stalked Bulbine [1]
Bulbine frutescens


'Bowles' Mauve' [1]
Erysimum


Blue Oat Grass [1]
Helictotrichon sempervirens


Mediterranean Spurge
Euphorbia characias


Elijah Blue Fescue [1]
Festuca glauca


Azure Bush Germander [1]
Teucrium fruticans


African Sumac [1]
Rhus lancea


Peruvian Pepper [1]
Schinus molle


Basket of Gold [1]
Aurinia saxatilis


Carob Tree [1]
Ceratonia siliqua

Appendix D - Copy of Student Survey Questions

1. How are you affiliated with UCLA?
   a. Student
   b. Staff
   c. Faculty
   d. Other: _________________
2. How often have you stopped to notice and enjoy the biodiversity on the UCLA campus?

. Never
a. 1-2 times per month
b. 1-2 times per week
c. Daily
d. Multiple times a day

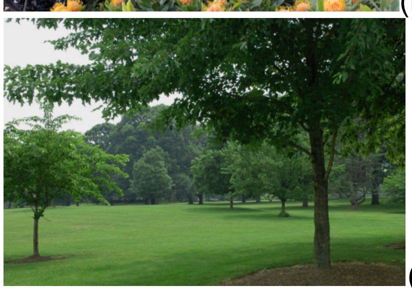
3. How satisfied are you with the biodiversity on campus? (1=unsatisfied, 10=very satisfied)
   1 2 3 4 5 6 7 8 9 10

4. Would you want UCLA to put more funds towards creating drought-tolerant landscapes? (1=no additional funds, 10=funding priority)
   1 2 3 4 5 6 7 8 9 10

5. Which landscape would you enjoy most at UCLA?

a.  (southern CA chaparral)

b.  (Mediterranean landscaping)

c.  (grass/deciduous trees)

6. How strongly would you feel about a new biodiversity hotspot created on the UCLA campus? (1=hate 10=love)
1 2 3 4 5 6 7 8 9 10

7. How many bird species do you think inhabit UCLA's campus?
a. Less than 5
b. 5-20
c. 21-35
d. 36-50
e. 50+

8. What's your favorite green space on UCLA's campus?
Botanical Gardens   Janss Steps/Bruin Walk   Sage Hill
Sculpture Garden   Stone Creek Canyon   Dickson Court/Sunken Gardens
Bombshelter garden   Sunset Rec   Other ______________________

9. What is your background knowledge about environmental biodiversity? (1=no knowledge, 10= very knowledgeable)
1 2 3 4 5 6 7 8 9 10

10. How often do you visit these areas on campus?
Weekly   Quarterly   Yearly   Never   I Don't Know Where that is

	Weekly	Quarterly	Yearly	Never	I Don't Know Where that is
Stone Canyon Creek					
Botanical Gardens					
Sage Hill					

Appendix E - Student Survey Results

Figure 1. Student Satisfaction with UCLA Campus Biodiversity
- refer to survey question 3

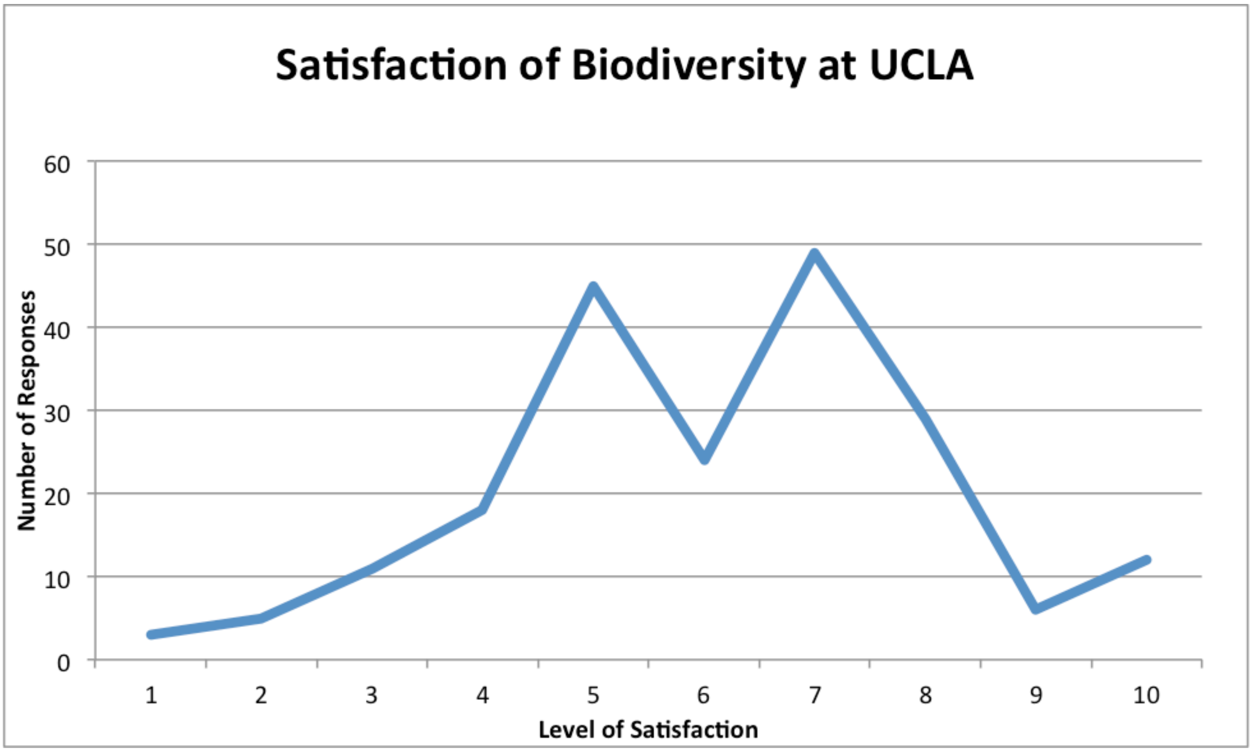


Figure 2. Preferred Landscaping on Campus

- refer to survey question 5

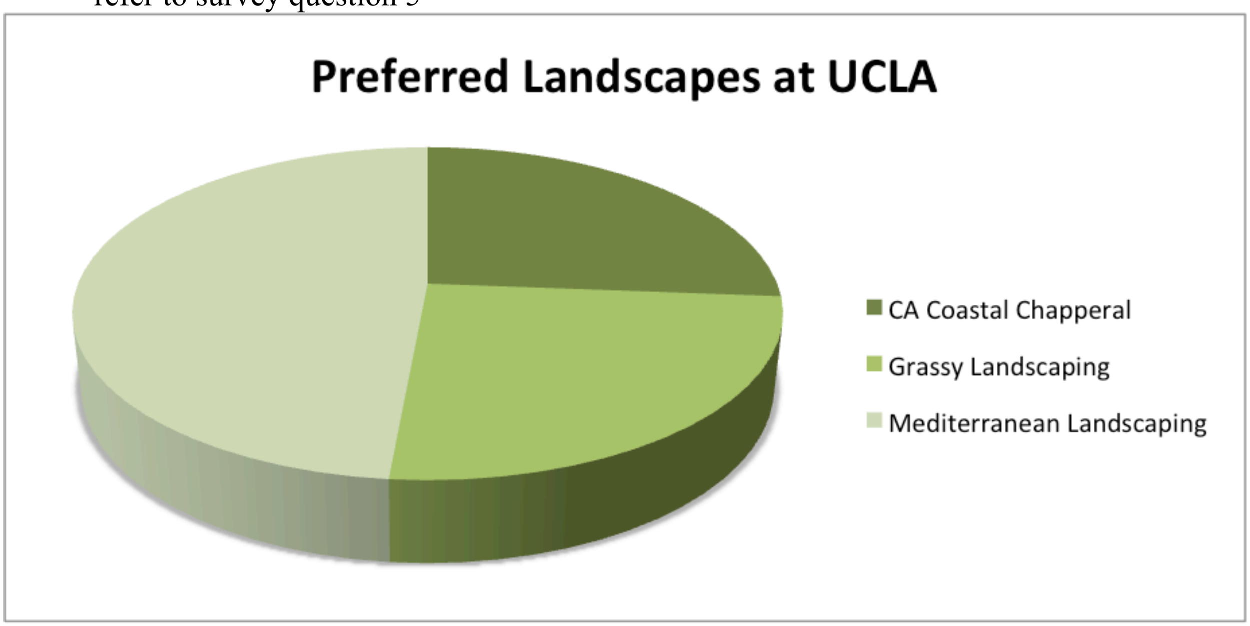


Figure 3. Student Support for Increased Funding for Drought Tolerant Landscaping

- refer to survey question 4

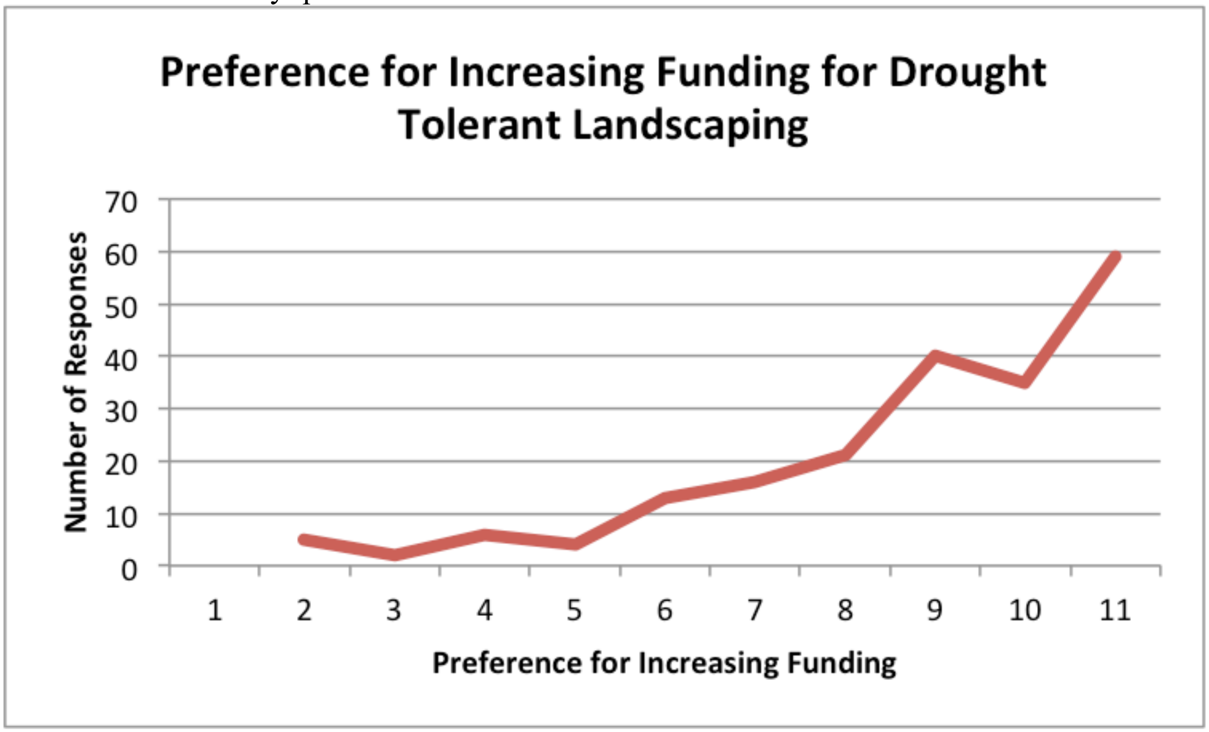


Figure 4. How Often Students Visit Sage Hill

- refer to survey question 10
- "Don't know" indicates students are not aware of what Sage Hill is or it's location

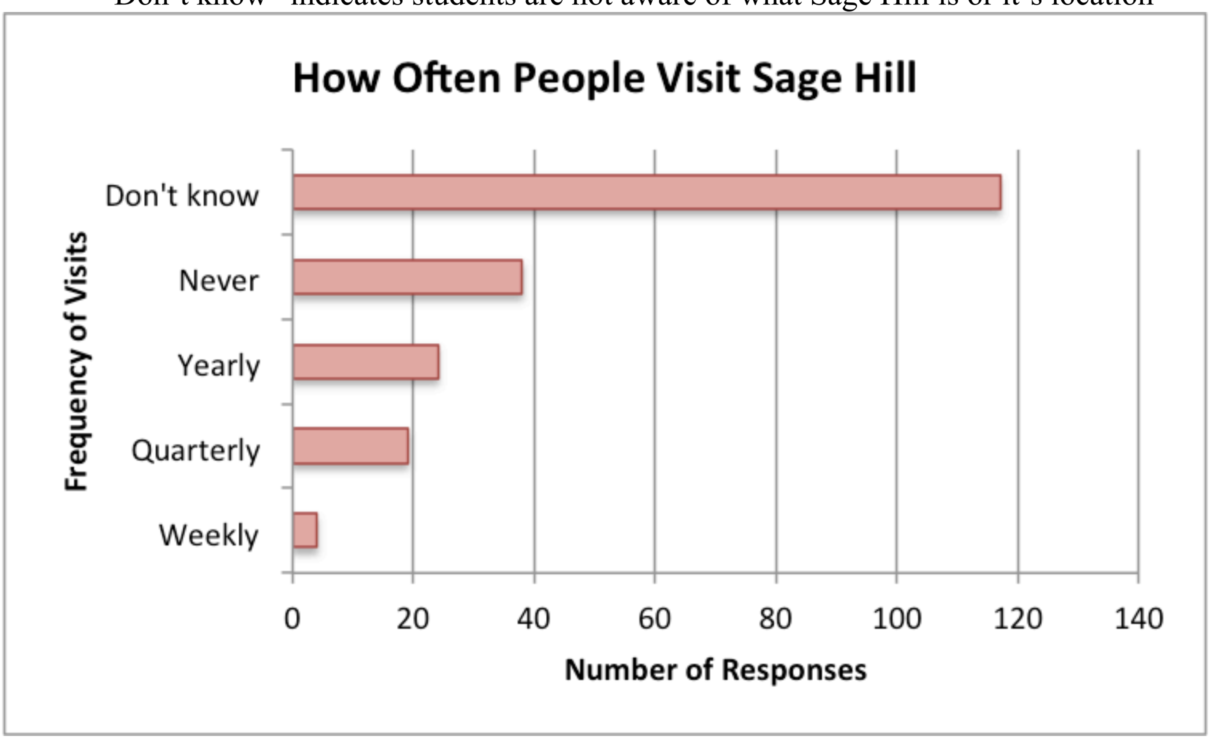


Figure 5. How Often Students Visit Stone Creek Canyon

- refer to survey question 10
- "Don't know" indicates students are unaware of what Stone Creek Canyon is and where it is located.

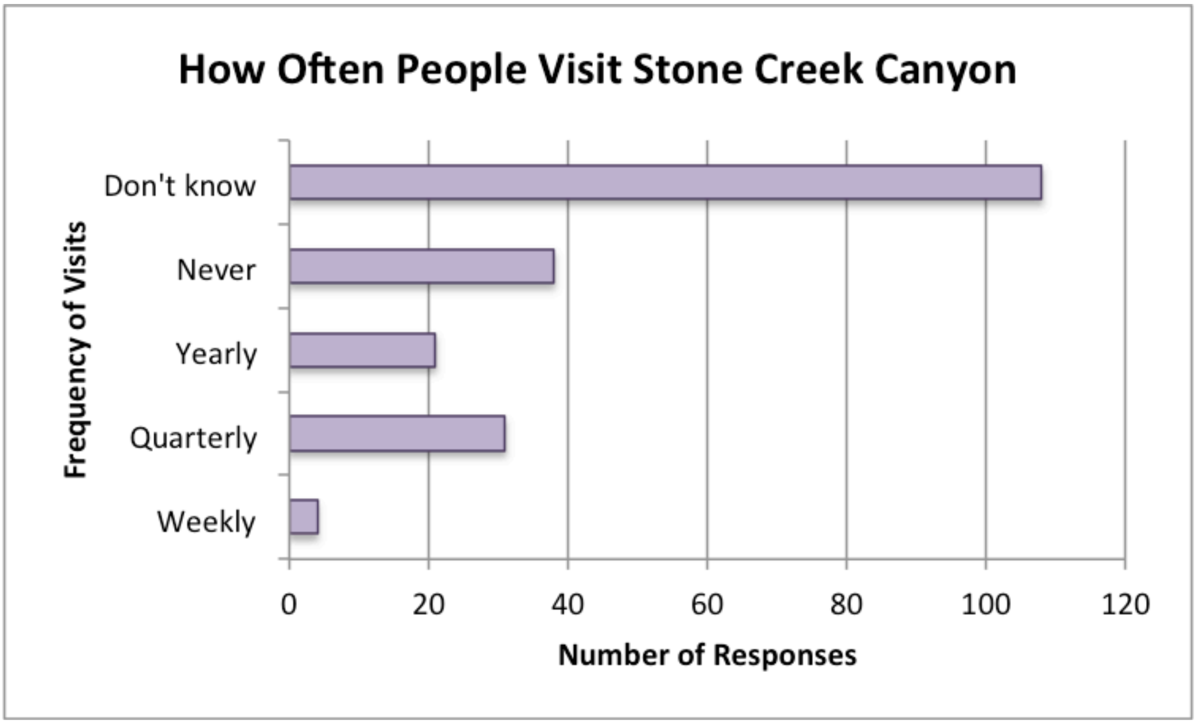


Figure 6. Student Awareness of Bird Species on Campus

- refer to survey question 7