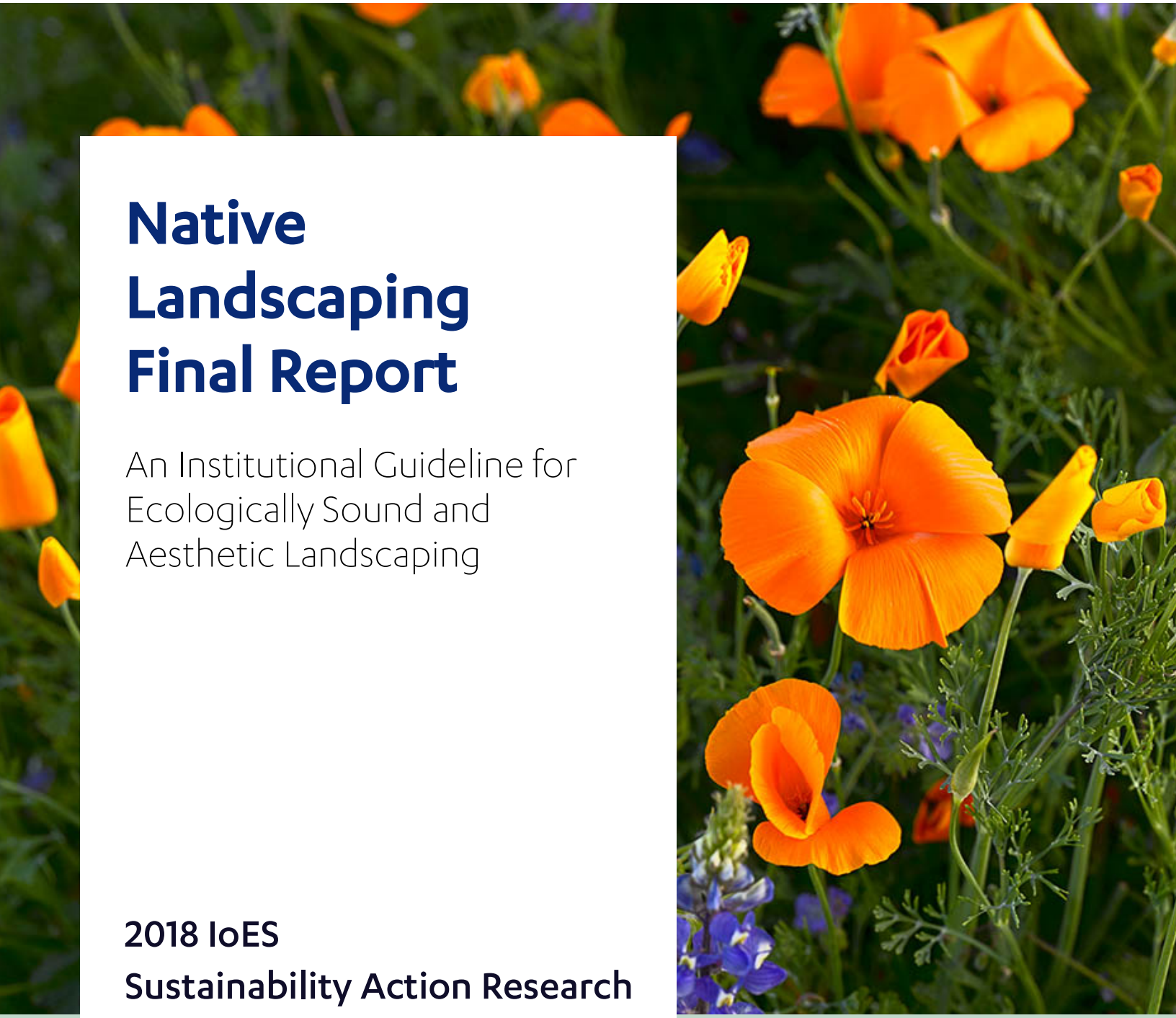

Native Landscaping Final Report

An Institutional Guideline for Ecologically Sound and Aesthetic Landscaping

2018 IoES Sustainability Action Research

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UCLA Sustainability Action Research

2018 Native Landscaping Team

Introduction

Over the past decade, UCLA has steadily begun to replace underutilized grass areas on the campus with drought tolerant plants as part of the university's efforts to reduce potable water use 36% by 2025. New construction projects like the Court of Sciences Student Center and Evelyn and Mo Ostin Music Center have also featured drought tolerant and native plants. The Landscape and Natural Areas Taskforce of the Sustainability Committee was established to address sustainable landscape planning. It was put on hold to focus efforts on Sage Hill through the Sage Hill Taskforce for the past couple years, and will be restarted now that the Sage Hill Taskforce has drafted its final report. Drought tolerant plant installations including those by Murphy Hall have saved millions of gallons of water a year. In more recent years some of these spaces have been converted to study spaces with tables, benches and outlets. However, after reviewing the plant palette for converted study spaces that have been completed and that will be completed in the future, our SAR Native Landscaping Team observed that non-native plant species are frequently used in the landscaping plans for these spaces, and are also still prevalent in older landscaping all over campus. These plants can pose challenges economic and ecological terms, as they often require water-intensive care, chemical fertilizers, and also threaten to degrade soil and hinder the growth of native species. When considering the negative impacts that these plants have on our campus, it not only makes sense to remove them but to ensure that no additional harmful plants are planted when new landscaping projects are implemented to mitigate any further negative impacts. Increasing the use of native and ecologically-appropriate plants that create self-sustaining ecosystems within campus landscaping projects would also be an effective way to create a beautiful environment for students, birds, pollinators, and other species that are native to the UCLA campus, and help the campus serve as a model for the Sustainable LA Grand Challenge that aims to enhance ecosystem health in LA County by 2050. The creation of these new study spaces poses the perfect opportunity for UCLA to increase the presence of native and ecologically-appropriate plant species on the campus landscape, and official UCLA policies should be designed and implemented to guarantee that these plants are prioritized in all future campus landscaping.

The pervasiveness of non-native plants in campus landscaping is not an issue that has gone unrecognized in the past; plenty of student groups, past and present, have made an effort to tackle this problem. In 2010, Team Native and Drought Tolerant Plants from the Education for

Sustainable Living Program at UCLA set out to address the non-native species issue. After visually assessing areas of campus that needed replanting and consulting with stakeholders such as Cully Nordby, the University Architect, the head of Landscaping, and the Head of Facilities, they decided to replant the corner of Hilgard Avenue and Wyton Drive, a popular bus stop location that receives plenty of public attention. Their objective was to introduce new, less water-intensive plants than the existing ones to the area without jeopardizing the area's beauty; they also wanted to introduce a xeriscape irrigation system that would be better suited for the new drought-tolerant natives, and to design a new sign for the corner.

They were able to establish all the designs for their project by working with students from the landscaping architectural program at UCLA Extension who provided the ART team with plant palettes and design plans. After the plans were completed, they gathered volunteers to help remove invasive plants and to replant natives through a Facebook event, and took about three days to complete the removal and replanting process. They also worked with Art Tieck to design their own drip-irrigation system and spent one day installing it. They felt that their project had been very successful, and were proud of the lengths that they had achieved to reduce water-waste in landscaping on campus through planting drought-tolerant plants and introducing xeriscape irrigation.

As part of an internship with the office of Sustainability, Misha Kouzeh, a student in the UCLA Extension Sustainability Certificate Program developed sustainable landscaping recommendations to aid the efforts of UCLA to reduce potable water use and transition to more drought tolerant and native landscaping. Kouzeh, the research intern, produced a report with primary tasks and objectives for integrating sustainable, native landscaping into water conservation efforts on campus. The report includes a comprehensive climate appropriate tree and plant palette, standards for incorporating stormwater management into future landscaping projects, and a framework for an advisory group. Kouzeh's report served as the base from which our project built upon. Starting with Kouzeh's plant pallet and framework for a suitable landscaping advisory group, we reached out to professionals at UCLA and four other institutions across California to expand upon the information compiled in the report.

Efforts to incorporate more native plant species have made way some areas around campus, but more can and should be done. Future landscaping projects should meet the minimum standard of being drought tolerant since the UCLA campus is located in the arid LA Basin and meet requirements to implement landscape designs that are sustainable, ecologically sound, contribute to the health of the entire UCLA ecosystem, and thus support the creation of a

beautiful habitat that can maintain itself long-term. As the Theodore Payne Foundation, a native California plant nursery in the area, advises, future UCLA landscaping designs should establish a minimum of fifty percent native biomass to ensure landscaping operates as a functional ecosystem. Our team essentially hopes to continue the work of past SAR teams who have accomplished these individual replanting projects by making efforts to create ecologically sound and appropriate planting into standards that are mandatory to meet when developing any future plans for UCLA landscaping projects.

While our project originally began as an initiative to bring urban agriculture to the UCLA campus, our team found that we were all very passionate about improving UCLA's ecosystem health. We originally hoped to replant a key area or two, but after sifting through past SAR projects, we realized how difficult the process of obtaining permission to replant spaces was. So collaborating with our stakeholder, Bonny Bentzin, Deputy Chief Sustainability Officer for UCLA, we came up with a new idea to further UCLA's efforts in this area: to establish methodology and guidelines for student projects and outside contractors to follow in replanting projects and new landscaping that increases ecosystem health. We want to make improving landscaping easy, and to make it a priority for UCLA going forward. So, after much deliberation, we decided on creating a set of recommendations to make campus landscaping practices ecologically sound by using the opinions and expertise of UCLA faculty, staff, students, and outside experts from organizations who focus on ecologically sound landscaping. We ultimately hope that UCLA will implement these recommendations in the process of approving future landscaping projects on the campus and use them to produce official native landscaping policies in the future.

Background

Initial Approach

Members of our team were privileged to have attended a talk held by the Environmental Student Network on campus that featured Lisa Novick of the Theodore Payne Foundation, in which she gave an overview on the benefits and functionality of a properly designed landscape featuring native plants. We quickly realized that as a premier university in the world with such a large green-space footprint, nestled up next to a biodiversity hotspot that is the Santa Monica Mountains, our campus had both a moral and economic obligation to modify its landscaping practices away from just xeriscaping, and toward an ecologically sound and aesthetically pleasing landscape that is functional for the area. Conserving water could no longer be the end goal for our green-spaces, but we needed to utilize our space in a way that benefited everyone who stepped foot on this campus, from student, to faculty, extension, to lab school. Meeting with our stakeholder and conducting a second literature review, we spent the first quarter educating ourselves on all of the benefits and importance of having a healthy ecosystem that is climate appropriate, area-appropriate, and helps the campus meet water, green waste, and carbon neutral goals.

Further research revealed that a previous team and other groups had already tackled a grading project similar to what we had done, and in fact, what was needed now was to look at how to either create a policy or an institutional guideline that would benefit existing institutions on campus to adopt ecologically beneficial policies for future projects. These policies would incorporate all that we had learned from interviews with a wide range of experts, focus groups, as well as our own literature reviews and research into policies used at other institutions. As a team, we realized that a key element would be to adopt a 50% Biomass threshold rule as that would be the minimum amount of native plant material necessary to have a functional ecology that provides food and shelter material for a biologically diverse ecosystem. This became one of our project's most central recommendations to create change in landscape design at UCLA that incorporates native plants in a way that allows for great flexibility in budget, aesthetics, and use, while meeting a

wide range of positive goals at both the UC level, such as the Carbon Neutral Initiative, as well as for basic maintenance and aesthetics for facilities and architects.

Key Informant Interviews

Our initial project goal and first data collection strategy were to interview several people who we believed we were experts on UCLA landscaping practices to collect and compile relevant information about the current state of the campus landscape that could be used to inform the development of future formal landscaping policies at UCLA. The names of the interviewees, their qualifications to be considered landscaping experts, and summaries of the information they provided us with are as follows:

Dr. Wayne Dollase

Dr. Wayne Dollase is a Professor Emeritus at UCLA and formerly taught in the Earth, Planetary, and Space Sciences Department, and has conducted research in areas focusing on Geology and Tectonics. Professor Wayne Dollase has also created an online database of the more than 550 plant species on the UCLA campus. Suffice it to say that he is an expert on plants and biodiversity patterns spanning the entire UCLA campus.

Dr. Dollase was able to provide us with an in-depth understanding of the history of landscaping at UCLA that informed our understanding of the current state of the campus landscape. He explained that original campus plans aimed to create a campus landscape that mimicked a grand botanical garden filled with rare and exotic plant species from all over the world, and these efforts can be seen all around campus to this day. While beautiful, these efforts came at the price of reducing the number of native species used in campus landscaping and even introducing invasive species to the campus, species that UCLA still to this day spends time trying to remove. In any case, many of these exotic species are rare campus treasures and do contribute to the overall diversity of plant life on the campus. When discussing our project goal of incorporating more native and ecologically-appropriate plant species into the campus landscape, he emphasized the importance of incorporating more natives into the current landscaping that complement existing plants and to focus on increasing biodiversity. He agreed that invasive species need to be eradicated from the

campus, but strongly advocated for keeping and properly maintaining exotic species that are harmless and that add beauty and biodiversity to the campus. He explained to us that there were plenty of opportunities to incorporate native plants into underutilized spaces on campus, and informed us that an excellent example of this on campus was the stairwell between Ackerman Union and Engineering: the plants around this stairwell were chosen to mimic a Santa Monica Canyon and use mostly native plant species that need little maintenance when planted in a climate-appropriate area. He also provided us with information on UCLA's landscaping bureaucracy; we learned from him that most landscaping plans are overseen by Capital Programs but are contracted out to independent architects and landscapers.

Nurit Katz

Nurit Katz is the Chief Sustainability Officer at UCLA and is also the Executive Officer of Facilities Management. She has been at the forefront of implementing sustainability-focused initiatives at UCLA: she founded the UCLA Sustainability Resource Center and helped launch the UCLA Center for Corporate Environmental Performance. Currently, she also serves as an instructor for the Sustainability Certificate Program at UCLA Extension.

Based on her extensive experience addressing sustainability issues on campus, Ms. Katz offered us a thorough overview of the status quo of the landscape at UCLA. She described UCLA as a mini-arboretum in itself, full of a diverse array of flora and fauna. As such, great care should be taken care of when changing the landscape at UCLA since we do not want to disrupt any ecosystems that have been established gradually since the University's founding. She explained that it is oftentimes beneficial to pursue mixed landscaping, which can actually support more life than an entirely native landscape. In addition, she cautioned against rapidly transitioning to fully native plants and showed us the advantages of a more steady change that incorporates pre-existing landscapes as much as possible. She suggested that one effective approach would be to replace dying turf or ailing plants with native plants, which would allow for the gradual introduction of new native species.

Being in a unique position between the Sustainability Office and Facilities Management, she also illustrated the various efforts that are being made at UCLA for a more environmentally-conscious landscaping. Continuous emphasis has been placed on effective water use while maintaining plants healthy, an imperative issue since UCLA is one of the largest institutions in Southern California. She explained that native plants could contribute greatly to water use reduction. When asked about people's perception of native species, she

mentioned that one minor concern is the prospect of certain plants perishing during the summer, which is completely natural. Along similar lines, she illustrated the demand for climate-appropriate native plants that would survive under intense heat.

Above all, she emphasized taking a more holistic approach when expanding native landscapes on campus. It would be beneficial on both ends if various institutions managing the UCLA landscape could collaborate with faculty with expertise in sustainability studies or landscaping, an opportunity limited to an educational institution like UCLA. Furthermore, she explained the need for a master landscape architect who would ensure that landscaping developments remain cohesive among one another and do not interfere with the preexisting ecosystem. For this reason, she suggested that we develop a native plant palette that could serve as a reference in future projects.

Stephanie Landregan

Stephanie Landregan is the Director for the Landscape Architecture Program and the Horticulture and Gardening Program at UCLA Extension. Previously, Professor Landregan was the Chief Landscape Architect for the Mountains Recreation and Conservation Authority where she designed public access to open space in Los Angeles and Ventura Counties. Her private work is primarily native landscaping. Her gardens have been featured on the Theodore Payne tour and water tours. She also works with legislators to create landscaping legislation, and has helped develop codes and ordinances that include tree ordinances, fire codes, low impact development, and water conservation measures. Ms. Landregan graduated from the University of Kentucky in Arts and is a graduate of the UCLA Extension Certificate Program in landscape architecture. She currently chairs the Planning Commission for the City of Glendale, California. Professor Landregan is a registered licensed landscape architect in the State of California, #4093.

Professor Landregan was extremely excited about our initiative to add more native landscaping to the campus, but acknowledged the difficulties of trying to get administration on board for developing native landscaping policies that looked beyond planting for aesthetic purposes. She encouraged us to open up a dialogue about attitudes towards native plants on campus to assess student knowledge and appreciation of native plant species to develop a base of support to advocate for developing native landscaping legislation. She advised us to meet with the Facilities Grounds maintenance crews to assess their involvement in plant palette planning processes and the level of landscaping education and training they receive,

as they ultimately take on the role of landscapers and caretakers for landscaping projects once they are completed. She also suggested that UCLA would benefit from hiring an in-house landscape architect to oversee all landscaping projects, as a person with this background would have the educational foundation necessary to assess whether future plans designed by contracted designers bring ecological value to the current campus landscape.

Dr. Alison Lipman

Alison Lipman is a UCLA professor in the Ecology and Evolutionary Biology Department. Her specialty includes conservation biology with an emphasis on restoration ecology. She has worked on various projects including preservation of Amazonian turtles and the Palos Verde Blue Butterfly. Currently, she spearheads the Lawn Be Gone program which helps Angelenos convert their grass lawns to ocean-friendly gardens complete with local Californian native plants and simple bioswales. Having helped run a variety of native plant nurseries, including the Theodore Payne Foundation, Professor Lipman is extremely knowledgeable about California native plants and all of the benefits that come with their use in landscaping.

Professor Lipman provided significant information on how to help convert areas on the UCLA campus to more native landscaping. One of the major issues brought up by Professor Lipman was figuring out who is in charge of what landscaping projects around campus. This was something that the team ended up doing throughout the entire project. Additionally, she mentioned that budget was a key consideration for any projects like this. The other major consideration to take into account for the biodiversity of converting to native plants is the genetics of the plants. The proper genotypes for the Westwood area must be taken into account if the landscapes are to be truly and properly biodiverse. Many Southern California natives have large ranges, thus it is important to select plants that are genetically suited for the UCLA campus so they will thrive and contribute to the ecosystem. Professor Lipman noted that native plant nurseries would be helpful in finding the correct plants and getting local seed stock, while difficult, is one of the best options. Ultimately native plants could be cultivated at UCLA in the school's own nursery—this would ensure that the best-suited plants are making their way into campus landscaping.

Overall, Professor Lipman suggests that diversity does not necessarily ensure that plants and animals on campus will function and work together. In order to be an ecologically sound landscape, the plants and animals must function together to form a complete community including ecosystem services.

Dr. Thomas Gillespie

Dr. Thomas Gillespie is a professor in the Department of Geography at UCLA. His research focuses on the use of geographic information systems (GIS) and remote sensing data to predict plant and bird species richness and rarity patterns on a regional spatial scale. For plant species, his research focuses mainly on biodiversity hotspots in tropical dry forests. He has been a stakeholder for past SAR projects, namely the 2017 Biodiversity team that working on Sage Hill, a biodiversity hotspot tucked away in the northwest corner of the UCLA campus.

Doctor Gillespie's personal interest in native plant restoration in the Los Angeles region was apparent throughout our interview. He encouraged us to plant more natives on campus because they don't consume much water, bring in 3-D structure, and boost biodiversity. Despite evidently supporting native landscaping, he recognized that UCLA cannot transition to native only landscaping. Incorporating non-natives from Mediterranean climate benefits landscaping, as Mediterranean climate plants are aesthetically pleasing and require less maintenance. Water use and education are also important benefits to incorporating natives Professor Gillespie noted in his interview. He explained the broad advantages to planting mixed native and Mediterranean climate plants, from water use to biodiversity, while giving us a tour of campus plants, noting which assets each drought-tolerant and native plant brought to the landscaping area. Professor Gillespie concluded his interview by pointing out that wherever native plants are established on campus, lively, colorful animals will follow.

Doctor Gillespie advised us to incorporate native plants on campus, mixed in with plants from a Mediterranean climate, because they serve broad functions, from education to biodiversity to water conservation. Integrating native species on campus has the potential to create working ecosystems in a place where local ecosystems have routinely been disregarded.

Dr. J. Cully Nordy

Dr. J. Cully Nordby is the Academic Director of the UCLA Institute of the Environment and a behavioral ecologist in the Department of Ecology and Evolutionary Biology.
She has a B.S. in zoology from the University of Wisconsin-Madison and a Ph.D. in animal behavior, as well as a graduate certificate in conservation biology, from the University of Washington. While doing postdoctoral research at UC Berkeley, she held a David H. Smith

Conservation Research Fellowship through The Nature Conservancy. Her current research focuses on the behavioral ecology and conservation biology of birds, with particular emphasis on understanding how native species respond behaviorally to exotic species invasions. She also teaches courses in environmental science and sustainability, and serves as one the academic advisors and research stakeholders for the UCLA Sustainability Action Research program.

In 2008, she was appointed as chair of the UCLA Sustainability Committee and she now also serves on the Environmental Sustainability Committee for the Culver City Unified School District.

Dr. Nordby stressed the importance of developing landscaping plans with plants that can "support another layer of biodiversity at another level (animals, birds, insects) looking ahead to being resilient in face of climate change" and that are regenerative and water conscious, and landscaping plans that use space-appropriate planting to create campus microbiomes. She strongly opposed mono-planting/culture on campus. "You may have a California native that's drought-tolerant and looks nice but if it's just a field of the same native–that's a problem" because monoplanting only supports a single level of biodiversity. She listed some of the benefits of planting native flora as providing educational opportunities for research; stimulating biophilic appreciation; and honoring the cultural and natural heritage of the UCLA landscape. She suggested that signage be used to label native species as an interactive educational component, and encouraged the development of student positions for maintaining and monitoring native plant species as well. She recommended providing maintenance crews with formal landscaping education and training so that they are able to properly maintain native species with irregular life and growth cycles. She also strongly advocated for the development of a formal document that prioritizes native and ecologically-appropriate plants in landscaping plans.

Lisa Novick

Lisa Novick is a former Bruin, having earned her B.A. in philosophy before earned her teaching credentials at Cal State LA. Her love of ecology and environmental activism led her to her current position as Director of Outreach and K-12 Education at the Theodore Payne Foundation for Wild Flowers and Native Plants. As the director, her primary responsibility has been to create an education curriculum, and oversee a variety of outreach programs aimed primarily at elementary to high school children, as well as write about the crucial ecological

importance of native plants, the crisis of green lawns in Southern California, and how to build a resilient Los Angeles in respected publications such as the Huffington Post.

In our interview, Ms. Novick highlighted the importance of landscaping for resilience, water conservation, education, biodiversity, and ecology. Plants are not just planted for aesthetics, but as part of a functional landscape to fulfill a multitude of biophilic goals. A key element of her interview was how different native landscaping is with regards to maintenance requirements, such as training staff to be aware that different plants abilities for hosting birds with their blooms and how shearing can affect that. Also how different plants need different watering regimes and when mixing native and non-native species, watering based on timers can be detrimental to the health of the species.

As a leader in K-12 outreach and education, she informed us that with the right palette and landscaping program, green-space areas around campus can be utilized as part of the science education and ecology programs at the UCLA Lab School and other campus educational programs. Similar to how the Court of Sciences landscaping mimics various native landscapes found throughout California, with consultation with the Lab School and the Theodore Payne Foundation, different areas can be created to bring in native butterflies, birds, and fulfill multiple educational requirements for K-12 programs.

Another aspect of the interview was the ideation of the 50% biomass rule. 90% of all insects can only eat native plants, and they are a vital component of the food web in order to have a functioning ecosystem. By having 50% of all plant biomass in an area being native, you cross the threshold necessary for insect life to thrive, birds to find appropriate nesting materials, and for enhanced biodiversity of the area.

Ms. Novick pointed out that there is a strong fiscal reason for native plants, with areas such as the City of Santa Monica utilizing 83% less water, 56% less green waste, and 68% less labor when compared to their previous non-native plant palette. Native plants are also adapted to our local soils, requiring less fertilizers and toxic chemicals, and are more resilient to extreme variations in our local climate and campus microclimate.

Shift to the Three-Pronged Approach

At the end of the first quarter of our project, after working on developing our project ideas and goals, we were left with a lot of raw information. We had formulated our overarching project goals about increasing native plants and biodiversity on campus and we had interviewed experts - "key informants" - on these topics on and off campus. We had a wealth of information about how to approach the topic of increasing native plants in campus landscaping, we had valuable contacts to help guide us, and we had a list of what needed to be considered in improving the landscaping. But, as the year shifted from winter quarter to spring quarter and we moved into the second half of the project, it was time to decide what actions to take to move towards these goals.

When we reconvened at the start of spring quarter, we had a newfound energy amongst the group due to the Earth Day fair. After we were able to talk to the campus community about our project at the fair, we were ready to dive into the next phase of our project. In order to accomplish our goals efficiently, we first brainstormed ideas about deliverables that would help us to create a final product that would be beneficial in supporting the actors on campus in their efforts to improve campus landscaping. We narrowed down what we wanted to accomplish into three parts: this became our "three-pronged approach." The first part was community outreach; we wanted to speak to universities and other groups that had already transitioned to more native landscaping, to see how they were able to accomplish this shift. The second part involved collecting data on the campus community's perceptions and knowledge of native plants and landscaping through a survey developed from the data collected during our key informant interviews. Finally, the third part of our project was to develop a plant palette with a list of native plant options that could be used to select what to include in future landscaping projects, as well as a map of green spaces on campus that could be used in identifying and assessing spaces to be re-landscaped in the future.

The Three-Pronged Approach

Outreach

External Campus Outreach

After conducting our key informant interviews, we better understood UCLA faculty and shareholder consensus regarding current limitations and future possibilities for native landscaping. Each key informant brought a unique perspective to the potential assets native landscaping could precede. To comprehend how universities with programs incorporating native landscaping on campuses are developed and maintained, we reached out to institutions with programs advancing native landscaping or biodiversity. We were able to discuss native landscaping programs with Chico State, Santa Monica College, Stanford University, and UC Santa Barbara. Each program was unique to the campus and influenced by the campus size, location, administrative support, and budget. Below are the questions we lead with in our interviews:

- Why did you start your program?
- Do you have a specific school-wide policy that mandates the use of native and drought tolerant plants for landscaping?
- What were your biggest hurdles when establishing the program?
- What have been the benefits of starting your program?
- Have you seen significant changes in water usage and labor costs? Have you done any sort of cost-benefit analysis on switching to the use of native and drought-tolerant plants?
- How do you maintain these spaces? Do maintenance workers receive special training or are these areas maintained by students/professors/researchers?
- Have you had issues maintaining these spaces at all?
- Any advice for establishing a program? Anything you wish you knew before starting?

Chico State University

Information about landscaping practices were provided by **Michael Alonzo,** Supervisor Grounds/Landscape Services.

Information About Native Landscaping Practices	Suggestions for Future UCLA Practices
• Chico State's objective for integrating native landscaping on campus was to "take advantage of open sites on campus to install meaningful landscapes that utilize both CA native and other drought-tolerant plant material". Their program originated as a response to the severe drought conditions across California in 2015. In an effort to minimize water and fertilizer use under harsh conditions, Chico moved to 90% organic landscaping. Not only a functional response, the movement at Chico State to more incorporate native and drought-tolerant plants has made the university an authentic reflection of the region. • Forming a campus vegetation committee allowed Chico State to develop a bias towards native plants and distinguish appropriate plant materials on campus. As Michael Alonzo, the Supervisor of Grounds & Landscaping Services at Chico State, advises, active discussion and experimentation with native and drought-tolerant landscaping, rather than strict policy, can facilitate the introduction of sustainable landscaping on campus. • Though Chico State has not conducted a cost benefit analysis to transforming conventional green spaces to native, drought-tolerant spaces, the landscaping staff has seen immediate benefits. The staff finds native, drought-tolerant landscapes easier to maintain and irrigate and less prone to disease. With less diseased plants,	• By performing a cost-benefit analysis, UCLA may be able to find funding for the short term due to the long-term cost benefits of native, drought tolerant landscaping. • Quarterly collaboration between interdisciplinary stakeholders and professionals with landscaping knowledge at UCLA, much like at Chico State, could progress the discussion on suitable landscaping practices for the campus. • UCLA has access to the Landscape Architecture Program at UCLA Extension, a notable resource for Landscape & Grounds to make use of as the campus moves towards native landscaping. By educating the grounds staff on proper native maintenance practices, UCLA can invest in workers through new skills development, ensuring outdoor spaces are maintained by knowledgeable, proficient staff. • Current UCLA landscaping has a number of examples of non-native bushes showing signs of disease, namely along the LaKretz stairs and along MS 4000A (see figure

less preventative and curative treatments are required.

- Overall, native and drought-tolerant landscaping can alleviate potential health problems arising from treating diseased plants on campus and promote labor efficiencies. As the campus integrates more native and drought tolerant landscapes, Chico State is interested in holding seminars for their landscaping staff.
- While expanding native and drought-tolerant landscaping on campus, Chico State noted a number of obstacles. Finding the financial support to transform outdoor spaces proved to be the most notable challenge. Alonzo explained that there was difficulty knowing how close to plant natives, deciding if they can be mixed in with other plants or planted en masse, and stocking enough to adequately occupy an area in the beginning stages of implementing natives.

1). Native and drought-tolerant landscaping can alleviate potential health problems arising from treating diseased plants on campus

Figure 1. Non-native Bushes Showing Disease

- Planting in the proper location and finding a suitable irrigation system for new landscapes are challenges that UCLA should be prepared to encounter. By experimenting in different locations with various plants instead of abiding by strict guidelines, UCLA can move towards integrating more natives on campus. With a bias towards natives, biodiversity in the area can be expected to augment.

Stanford University

Information about landscaping practices were provided by **Cathy Deino Blake,** Director of Campus Planning and Design and University Landscape Architect, FASLA, LEED® AP, SCPM.

Information About Native Landscaping Practices	Suggestions for Future UCLA Practices
• Stanford University has had a plant and animal preservation program in place since its conception. Species preservation on the Stanford campus allows for interdisciplinary research and education, exterior residential and academic programming, and habitat restoration. The university is committed to landscape designs that encourage climate responsivity, native plant material, and water conservation. • Stanford understands the significance of location-based planting. Lawns are essential to large university campuses as meeting spaces; they are multi-use, cool off the air, and keep people outdoors in warm months. Food producing plants are educational and useful, though they consume more water than other plants. • In shady areas, the soil will often not mimic that of a native environment for most Southern California native plants and should therefore be prioritized for other uses. With ways to maximize the use of outdoor spaces, natives are not meant for every location and therefore are not planted in every location. • Cathy Blake, Stanford's Director of Campus Planning and Design, had a wealth of planting knowledge useful for beginning a program biased towards native plants. Blake emphasized the importance of integrating bioswales and detention	• As an urban campus, UCLA has the chance to focus on preserving native pollinator and plant species. • In addition, like Stanford, UCLA can use climate responsive landscaping designs to reach its goal of carbon neutrality. • UCLA should emphasize a bias for native plants when transforming underutilized spaces or in new construction projects to create ecologically sound landscaping without restricting designs to native only, as some locations are better suited for other uses. • Outdoor landscaping design at UCLA should not follow rigid guidelines, but the university should explore which locations can effectively support native plant species to provide the opportunity for interdisciplinary education, improve biodiversity and ecology on campus, and improve underutilized spaces.

areas within native vegetation in new landscape designs. ● Stanford also maximizes the use of reduced green waste from native plants by converting trimmings into compost and wood chips which are reused on campus. ● Acknowledging challenges posed by native plants, Blake cautioned that natives are at times short-lived and must be irrigated for approximately two years before they can be self-supporting. ● Stanford's extensive preservation program demonstrates functional design and optimization of exterior landscaping.	

Santa Monica College

Information about landscaping practices were provided by **Gustavo Gutierrez,** Supervisor Grounds/Landscape Services.

Information About Native Landscaping Practices	Suggestions for Future UCLA Practices
● At Santa Monica College, native and drought tolerant planting began in correlation with transportation, waste reduction, and other practices to promote a more sustainable method. Like UCLA, the campus looks to approach zero waste, and native and drought tolerant plants presented a holistic approach to zero waste in outdoor spaces. ● Gustavo Gutierrez, the lead Groundskeeper and Gardener at Santa Monica College, has championed these efforts in recent years through a particular interest in healthy soil. By planting properly and gradually changing landscapes to include native and drought tolerant plants, he	● When conducting a cost-benefit analysis for converting underutilized, traditional lawns on campus to native and drought-tolerant spaces, UCLA can also measure the impact of integrating compost usage into soil for native and drought tolerant species. ● Continuing to integrate more native and drought tolerant plants on campus in locations like Bunche and Mathematical Sciences, UCLA should use ecologically sound

believes he can create healthier soil environments with nutrients that better support natives. Longevity rather than trend must be prioritized when working towards establishing the proper soil-plant symbiosis. Goals of reducing food waste and creating healthier soil can be met by developing a vermicomposting program. • As SMC moves forward with sustainable landscaping practices, they hope to transform outdoor spaces on campus into balanced, healthy ecosystems that are aesthetically pleasing and attract life. • Education, like in Stanford, is a key motivator to creating a functional landscape design. • Intentional planting in outdoor spaces can promote a sustainable model helping reduce waste, approach carbon neutrality, and improve campus ecology. • At SMC, the program owes much of its growth and success to being headed by an individual with training in landscaping and environmental management practices.	spaces for education and species preservation. • Since UCLA is a large campus, measuring 419 acres, having an active plant committee or a landscape architect could benefit the advancement and coherence of ecologically sound landscape design.

University of California, Santa Barbara

Information about landscaping practices were provided by **Raimond Calderon**, Superintendent/Grounds and **Lisa Stratton**, Director of Ecosystem Management.

Information About Native Landscaping Practices	Suggestions for Future UCLA Practices
• UC Santa Barbara is in a unique position to conserve native plant and animal species as the campus lines the coast. Because the campus has a comprehensive program, they offered extensive	• UCSB strongly recommended gradually incorporating more native plant species on campus. • Like Chico State, UCSB advised creating a landscape review

insight regarding how UCLA can champion biodiversity despite limited space. ● Like UCLA, UCSB benefits from The Green Initiative Fund (TGIF), which they suggested UCLA should use to audit the campus, mapping out invasive species. ● UCSB emphasized the importance of investing in natives through long-term management and maintenance education.	committee, not only to choose which native and drought tolerant plants to include in designs, but also to ensure no invasive species are planted and allowed to proliferate. ● A campus campaign educating students about the long-term impacts native plant integration could lead to may provide the support needed to continue converting areas with a bias towards native. ● Signage, UCSB also stressed, is crucial to educating the UCLA community and providing a visual experience to an often overlooked component of a sustainable model with consequential outcomes.

Discussion

Each university we spoke with offered valuable recommendations for UCLA to progress with expanding native and drought tolerant plant use on campus. With unique locations and possibilities, UCSB, Chico, Stanford, and SMC provided insight on the benefits and potential issues applicable to UCLA's urban campus. From vermicomposting and healthy soil cultivation to educational outreach, integrating native plants on campus requires intentional efforts in maintenance, education, and administration. As UCLA continues to transform underutilized spaces into areas with native and drought tolerant landscaping, the university should further explore the potential outcomes of certain designs and plant pallets through active, evolving discussions between knowledgeable stakeholders at UCLA and, potentially, a landscape architect. With goals of zero waste and carbon neutrality circulating UCLA, ecologically sound and functional landscaping is a necessary component of the sustainable model. As a renowned public research institution, UCLA can gain from investing in the grounds staff to properly care for and maintain ecologically functional native and drought tolerant plant spaces.

The universities we reached out to each emphasized that the process of establishing sustainable landscaping is often marked by trial and error, but when pursued intently reaps educational, environmental, and ecological benefits.

Internal Outreach

Our team also had the opportunity to meet with the UCLA Facilities Management Grounds and Capital Programs with, who both provided us with information about their role in campus landscaping. We met with Associate Vice Chancellor Peter Hendrickson from Capital Programs once, and received a detailed presentation about the development of the campus and history of campus landscaping. We met with the Grounds department on three occasions, including with Chris Gallego who oversees the department. Our first meeting provided us with some information on Grounds' role in landscaping at UCLA. We learned that their role primarily involved maintaining the campus landscape, but we also learned that while Grounds crews training on the job, they receive no formal landscaping education or training and that there are no education/training requirements for landscaping when grounds crews are hired. This means that grounds crews do not receive an education on how to create healthy, productive, resilient zones of landscape based on ecology-based principles. Some individuals within Grounds have extensive knowledge, but the average Grounds worker does not. This meeting also gave us the chance to request and collect information about which locations on campus had been selected for turf removal and replanting (see **Figure 2** on pages 24-25). The next meeting involved organizing a time to meet with and shadow maintenance crew workers to get an idea of the amount of time it takes mow some of the grass spaces that have been designated as "underutilized" and that are planned to be replanted with native and drought tolerant plants, and the third meeting involved actually shadowing workers (see **Figure 3** on page 26). This was by far one of the most informative meetings we had throughout our project.

We met with grounds at 8 AM and walked with them to observe the "small mowing team" mow grass gradients called the "Westwood Islands" on Westwood Boulevard just off of Le Conte Boulevard (in front of the Jules Stein Eye Institute; see **Figure 4** on page 27). The small mowing team is in charge of using small/hand mowers to cut grass in spaces that are too small for large, driven mowers: this means that all these spaces are cut by hand. We were told that crews spend four days a week mowing grass all over campus, and the section of spaces we visited typically takes at least 3 hours to mow before the crew moves onto a new section of campus to mow. It was also generally agreed that these spaces do not add any

particular landscaping value to the UCLA landscape in their current form as grass gradients that are located by busy pathways and streets populated by rushing cars and pedestrians, and yet their maintenance still takes up a considerable amount of time and resources.

The first thing we noticed was that crew workers had to mow the gradient in the middle of traffic, which we considered a major safety concern. We were informed that all of the grass areas mowed by the small mowing team could produce up to 100 black trash bags with grass/green waste that cannot go into green waste bins because 1) grass is only transported in non-compostable black trash bags, and 2) there is a shortage of available, convenient green waste bins for the small mowing team to use on their daily mowing routes. When grass is cut when its wet (a common occurrence as crews are scheduled to mow early in the morning after sprinklers go off), crew members estimated that the bags were at least three times as heavy as trash bags filled with dry grass, and posed another safety concern for workers who have to lift these bags in and out of their carts to collect and dispose the bags. We were also informed that all of these underutilized spots are fertilized with chemical fertilizers at least three times a year. Ultimately, we found that plenty of valuable resources were going into otherwise value-less patches of the campuses landscape. We also asked maintenance if they had seen a difference between the amount of time and resources they spent tending to parts of campus that have been planted with native and drought-tolerant plants. They said that they spent significantly less time tending to these areas once plants were established. Xeriscaping significantly reduced any manual watering needs, native and drought-tolerant plants are trimmed seasonally, and crews have found that they only occasionally have to sweep fallen leaves and debris away from these spaces.

We believe meeting with Grounds allowed our team to get a better picture of how many resources are used to maintain underutilized grass spaces that are ultimately disliked on campus. Our meeting also indicated that continuing to plant native, drought-tolerant, and ecologically appropriate plants could significantly reduce the amount of time and resources spent on landscaping maintenance for Grounds crews. Reducing the frequency of maintaining areas like gradients in the middle of traffic could also significantly reduce the amount of exposure to the risk of injury that crew members often face. Ultimately, we would like to eventually have these observations quantified by formally measuring workers' exposure to risk, green waste produced, time spent maintaining, water used, and mower pollution generated by these traditional grass gradients and by new, native and drought-tolerant study spaces to analyze differences between the two landscape types.

Summary of Outreach Findings

We were ultimately able to speak with a very diverse group of experts to better understand the types of best practices that would lead to the incorporation of more native, ecologically-appropriate plants that would provide functional benefits to the UCLA campus landscape. We spoke with several universities and key campus stakeholders, and ultimately found that there is not a single strategy that works–UCLA as a campus and as an ecosystem is totally unique. However, we developed some key recommendations from all of our outreach that we believe would maximize UCLA's potential to create a fully-functioning, ecologically-productive campus landscape.

- UCLA can benefit from space-based planting and using green spaces for education
- Natives must be incorporated gradually and based on location, rigid guidelines are constricting
- While UCLA is already moving towards integrating natives and drought-tolerant landscaping…
    - UCLA stakeholders should thoroughly review pallets and guidelines as underutilized spaces are transformed, and monitor these spaces
    - Plants should be chosen with the aim to minimize pesticide use, mowing, watering, maintaining, and polluting mower exhaust by persons with formal landscaping education and training.
    - Providing funding for a more rapid implementation of planned turf removal projects will yield savings in the form of water conservation, maintenance time and reduced injury risk.

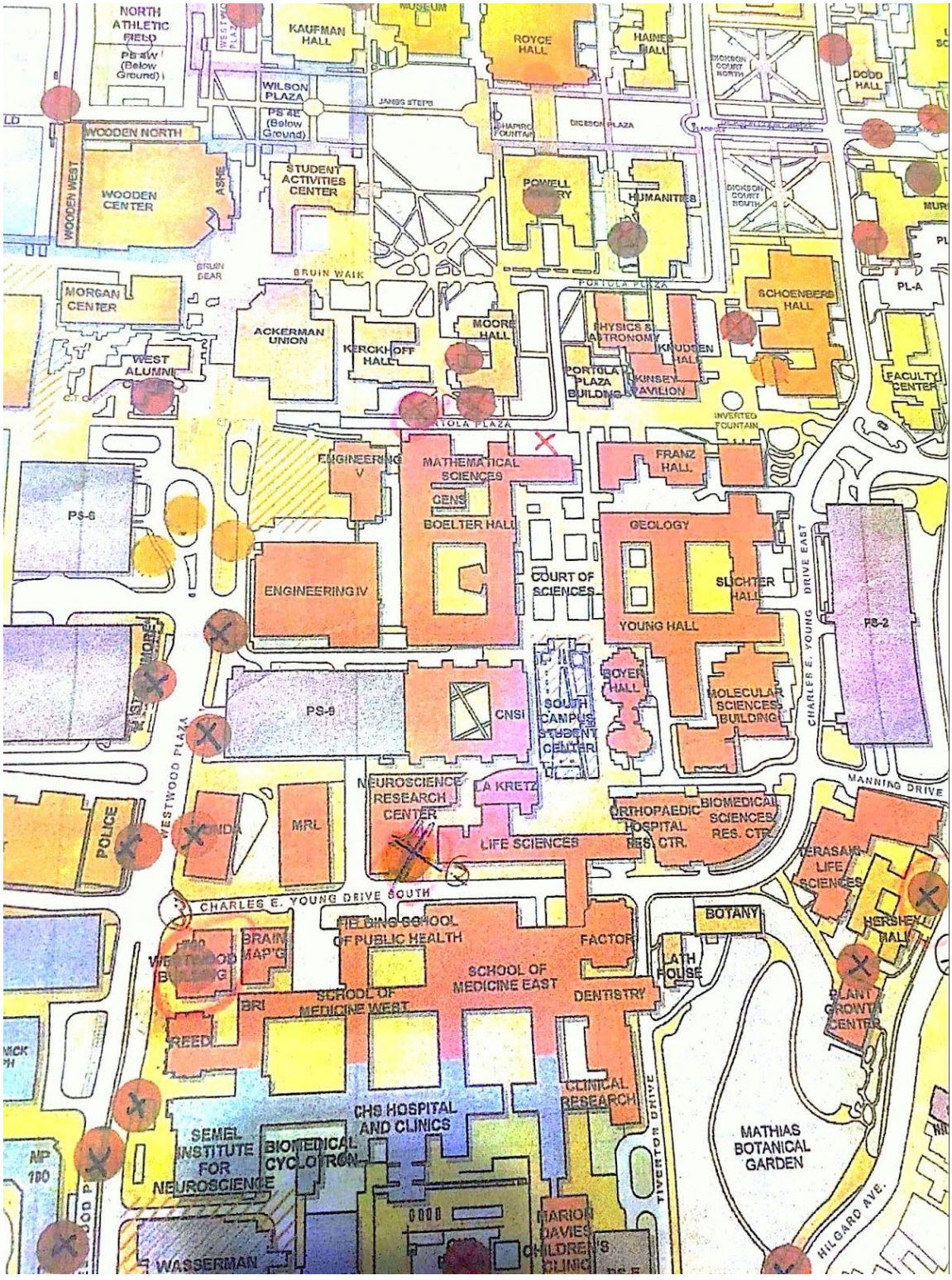


Figure 2. Facilities Grounds' Map of Underutilized Spaces Tagged for Turf Removal

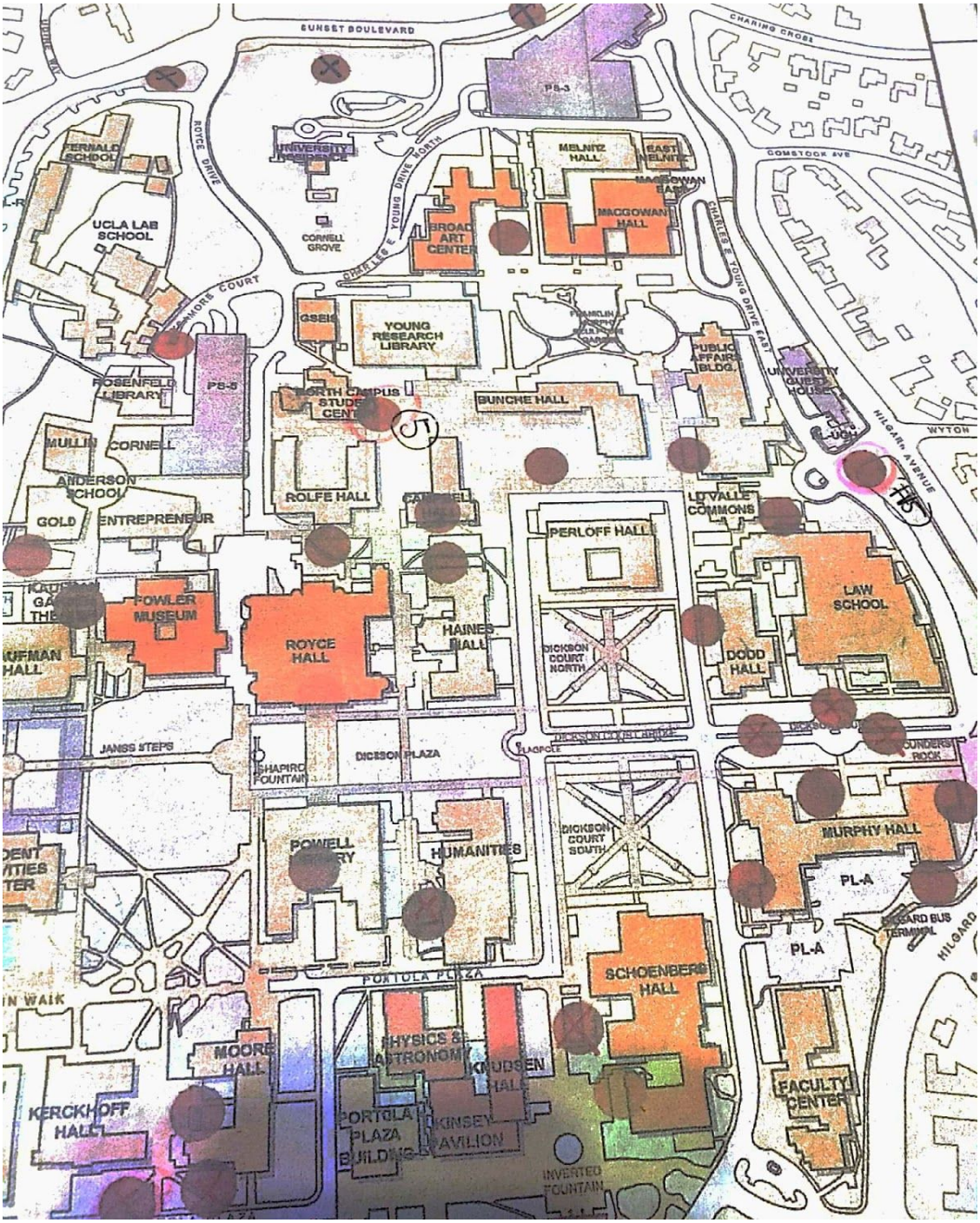
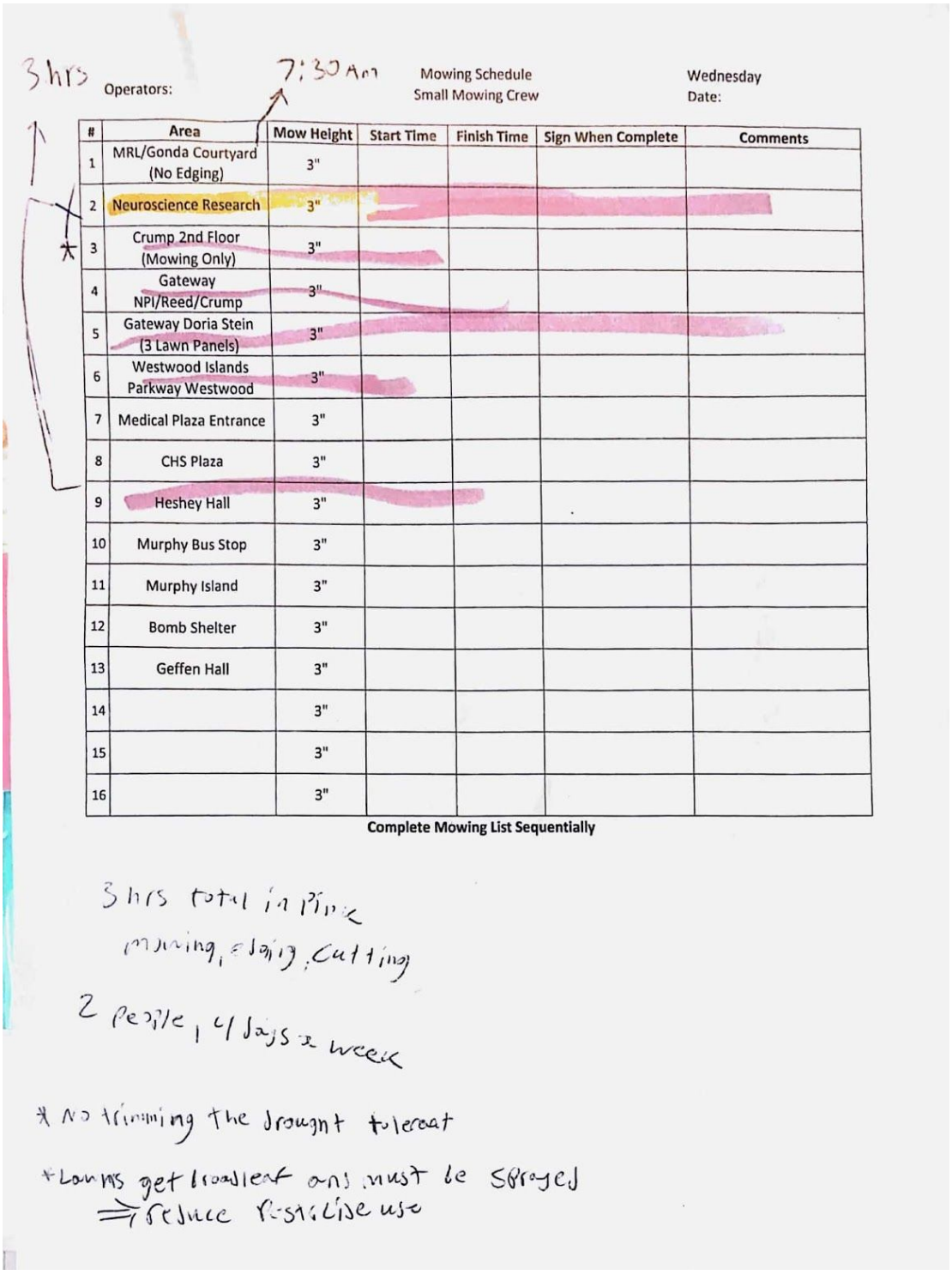


Figure 2 (cont'd). Facilities Grounds' Map of Underutilized Spaces Tagged for Turf Removal

Figure 3. Small Mower Crew Mowing Schedule



3 hrs Operators: 7:30 Am Mowing Schedule Small Mowing Crew Wednesday Date:

#	Area	Mow Height	Start Time	Finish Time	Sign When Complete	Comments
1	MRL/Gonda Courtyard (No Edging)	3"				
2	Neuroscience Research	3"				
3	Crump 2nd Floor (Mowing Only)	3"				
4	Gateway NPI/Reed/Crump	3"				
5	Gateway Doria Stein (3 Lawn Panels)	3"				
6	Westwood Islands Parkway Westwood	3"				
7	Medical Plaza Entrance	3"				
8	CHS Plaza	3"				
9	Heshey Hall	3"				
10	Murphy Bus Stop	3"				
11	Murphy Island	3"				
12	Bomb Shelter	3"				
13	Geffen Hall	3"				
14		3"				
15		3"				
16		3"				

Complete Mowing List Sequentially

3 hrs total in prac
mowing, edging, cutting

2 people 4/days a week

* No trimming the drought tolerant

*Lawns get broadleaf ons must be sprayed
⇒ reduce restrictive use

Figure 4. Small Mower Crew Member Mowing Westwood Island in the Middle of Traffic

Survey

Methodology

Our methodology for the survey revolved around a relatively brief survey conducted through a Google Form both in person and online. While developing our survey questionnaire, we were fortunate to work with the UC Stormwater Study Team led by Gregory Pierce and Kelsey Jessup at the Luskin Center for Innovation. Along with invaluable advice, they offered us Rippy and Grant's (2018) cross-UC survey questionnaire, which served as the basic template for our own survey. The majority of the questions below are adaptations of the questions that appear in the cross-UC survey. The images of landscapes, most of which are of UC Irvine, were taken directly from the survey questionnaire.

The survey's first purpose was to assess students' familiarity with native plants and landscaping, as well as their presence on campus. In addition, we found it useful to assess their ability to distinguish them from non-natives by asking them to categorize a series of landscaping photos as either native or non-native.

The second portion of our survey aimed to compare respondents' priorities in regards to aesthetics, utility, ecological benefits, etc. to learn exactly what respondents want from their campus landscape and what it should look like to please and serve them best.

Finally, and arguably most importantly, our survey aimed to gauge respondents' willingness and interest in paying more (and how much) to fund functional native landscaping changes on campus. We did this by first asking if they would support increased investment from UCLA's general fund, and then following by asking about specific dollar amounts respondents would be willing to pay in an effort to ensure our proposed native landscaping changes are implemented.

Results

Demographics

The survey received 81 responses from undergraduates, graduate students, faculty, and staff in 33 departments. Of those surveyed, Juniors were the largest group, and Environmental Science was the most popular major followed by Computer Science.

Figure 5. Demographics by Year and Profession Department

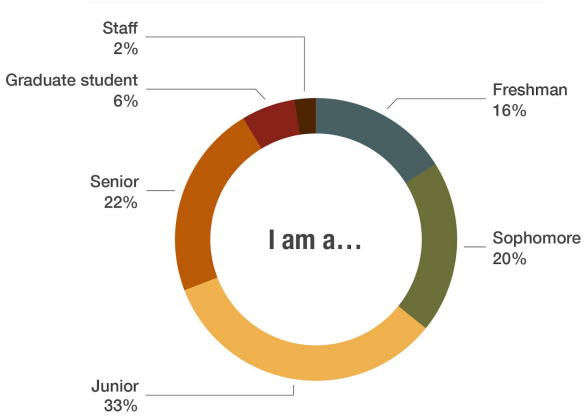


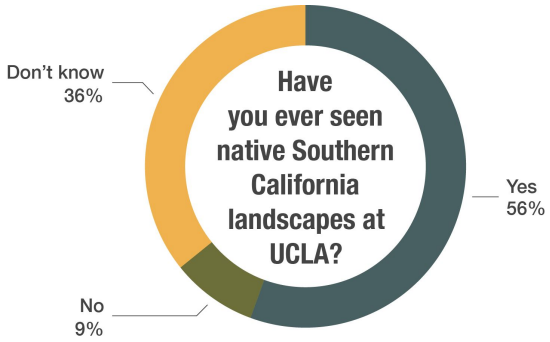
Table 1. Demographics by Major and Department

MAJOR/DEPARTMENT	COUNT
Anthropology	1
Asian Languages and Linguistics	1
Biochemistry	3
Biology	5
Chemical Engineering	2
Chemistry/Materials Science	1
Chicano Studies	1
Chinese Language and Culture	1
Civil Engineering	2
Communication	1
Communication Studies	2
Computer Science	6
Ecology and Evolutionary Biology	5
Economics	3
Electrical and Computer Engineering	1
English	4
Environmental Science	16
Financial Actuarial Math	1
Geography	7
Geology	1
History	1
International Development Studies	1
Materials Engineering	2
MCDB	1
Mechanical Engineering	1
Neuroscience	1
Political Science	1
Psychobiology	3
Psychology	1
School of Dentistry	1
Sociology	1
World Arts and Cultures/Dance	1
N/A	2
Total	81

Previous Experience with Native Landscapes

When asked the question, “Have you ever seen native Southern California landscapes at UCLA?” 56% of respondents replied yes. However, the majority of those who answered yes were uncertain of their answers. When asked “How did you know that the landscape was native to Southern California?” the most common response was because they had been informed by someone else.

Figure 6. Prior Exposure to Native Landscapes



Knowledge of Native Landscapes

People were given 12 pictures showing both traditional and native landscapes and were directed to choose the ones they believed were native. Of the 12 choices, C, D, G, and L were of native landscapes. The responses showed an accuracy of around 52.4%, which illustrates the fact that people are not well-educated of native plants. However, this could also have a positive interpretation: people do not distinguish native landscapes from conventional, non-native landscapes or prefer one over the other. Moreover, people were generally uncertain of their responses.

Figure 7. Pictures of Various Landscapes

Rippy, M., & Grant, S. (2018). FIGHTING DROUGHT WITH STORMWATER: The Perceived Services and Disservices of Natural Water Treatment Systems, 23.

Figure 8. Choices of Native Landscapes

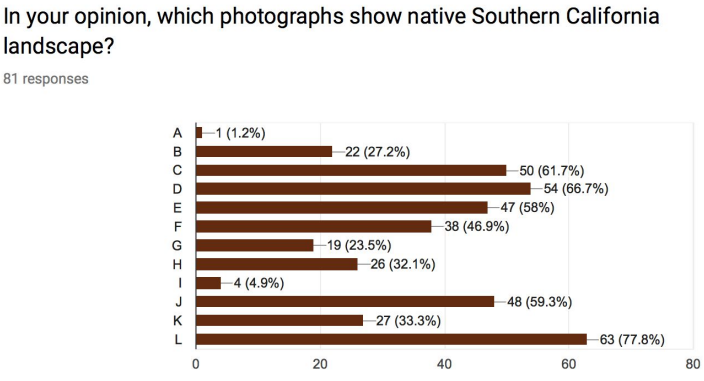
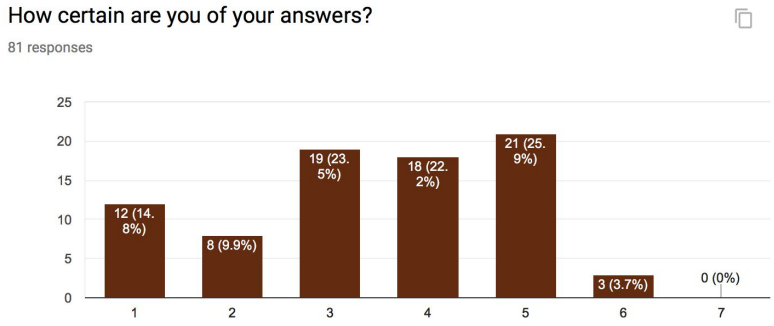


Figure 9. Certainty of Responses



Values Assigned to Landscapes

In order to gauge what the public looks for or hopes to gain from a certain landscape, we listed a variety of functions or problems that landscapes offer or pose to the surroundings. The respondents were then asked to rank each characteristic on a scale of 1 to 7, with 1 being least important to 7 being the most important. After calculating the mean value assigned to each characteristic, it was evident that people place the functionality of a landscape above its aesthetics. This is clearly evident in the fact that the characteristic was ranked 7 out of 11, below other values relevant to functionality.

Table 2. Values Assigned to Landscape Characteristics

1 - Does not matter at all 7 - Matters a lot

CHARACTERISTIC OF LANDSCAPE	AVERAGE ASSIGNED VALUE	RANK
Improves water quality	6.62962963	1
Removes CO2 from the air	6.567901235	2
Cools down the urban environment	6.283950617	3
Attracts bees and other pollinators	6.222222222	4
Reduces flooding	6.074074074	5
Increases diversity of animals	6.037037037	6
Makes the urban scene look more beautiful	5.802469136	7
Requires a lot of water and causes droughts	5.716049383	8
Provides space for relaxation and recreation	5.641975309	9
Attracts mosquitoes and other pests	5.222222222	10
Causes allergies	4.086419753	11

Landscape Preferences

To get a detailed insight into people's opinions of real landscapes, we selected four locations on campus: the Study Space next to the Humanities Building, the lawn in front of Royce Hall, an ivy wall next to the Mathematical Institute, and the plant beds adjacent to the Engineering VI building modeled after the Santa Monica Canyons. We intended the Study Space to represent a native/non-native integrated area; the lawn to be an entirely conventional landscape; the ivy wall to represent other ivy walls that Facilities is planning to phase out; and the Santa Monica Canyon plant beds to represent a fully native area.

Based on the mean scores assigned to each area, it is evident that people know that areas that contain native landscapes will increase animal diversity. This is seen from the fact that the Royce Hall Lawn and ivy wall received low scores 1.975 and 1.704, respectively compared to the other areas containing some native plants, for the criteria .
As for aesthetics, people assigned roughly similar scores to all four landscapes, highlighting the fact that they do not perceive native landscapes to be particularly aesthetically displeasing. People tended to believe that lush, green areas would require more water. Lastly, the respondents found more relaxation and recreational value in areas that were flatter or contained lawns.

Table 3. Averages Scores Given to Each Landscaping Criteria

			1 - Strongly Disagree 5 - Strongly Agree	
Location	**Humanities Building Study Space**	**Royce Hall Lawn**	**Mathematical Institute Ivy Wall**	**Engineering VI Santa Monica Canyon Gardens**
Picture				
I believe that this landscape will	**Average Score**			
Increase diversity of animals	3.037	1.975	1.704	3.420
Make the urban scene look more beautiful	3.469	3.654	3.160	3.753
Require a lot of water and causes droughts	2.272	3.815	2.506	3.148
Provide landscape for relaxation and recreation	3.210	3.457	1.864	2.802

Opinions on Funding

Our respondents were strongly in favor of UCLA allocating more funds to increase native landscapes on campus. More than half of those surveyed replied 4 or higher, on a scale of 1-7 with 1 being not supportive at all to 7 being very supportive.

More importantly, however, they were willing to contribute out of their own pockets. This is a significant result, because the replies were taken after informing our respondents that they are already paying $4 per quarter to the TGIF fund. This clearly illustrates the financial feasibility of funding more native landscaping projects because the public is willing to contribute more in addition to relying on external funds.

Figure 10. Opinion on External Funds

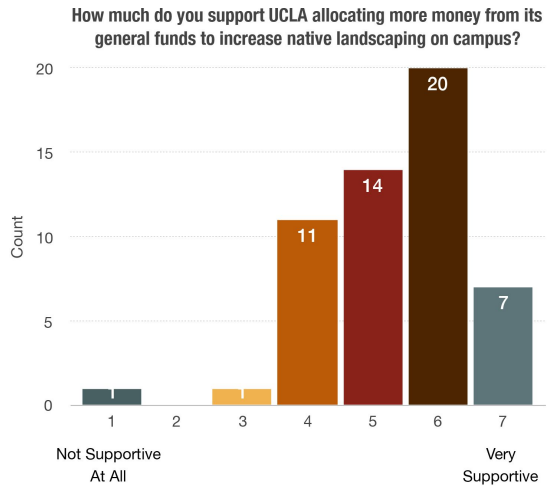
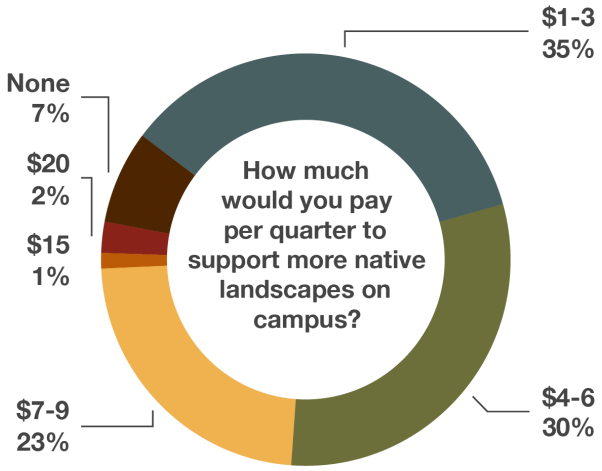


Figure 11. Opinion on Self-Contribution



*Currently, UCLA's tuition includes a $4.00 fee that contributes to the Green Initiative Fund, a program intended to increase campus sustainability.

Plant Preferences

To aid future landscaping project, we also surveyed the public of their preferences of native plants. Native plant species were taken from our plant palette developed by Audrey and Hogan. People were asked to rank how much they wanted to see each plant on campus, on a scale of 1-7 with 1 being not at all and 7 being definitely. Taking the mean score for each plant, we created a ranked list of a select species of native plants. In general, flowering plants were the most popular, followed by trees and shrubs.

Table 4. Native Plant Palette Preferences

		1 - Do not want to see at all 7 - Definitely want to see	
Yarrow	*Achillea millefollium*	6.148148148	 
Tree anemone	*Carpenteria californica*	6.12345679	 
Channel Islands tree poppy	*Dendromecon harfordii*	6.012345679	 
California tree poppy	*Romneya coulteri*	5.987654321	 
California brittlebush	*Encelia californica*	5.962962963	 
California buckeye	*Aesculus californica*	5.950617284	 
California bay	*Umbellularia californica*	5.666666667	 

Table 4 (cont'd). Native Plant Palette Preferences

		1 - Do not want to see at all 7 - Definitely want to see	
Toyon	*Heteromeles arbutifolia*	5.49382716	
Pacific madrone	*Arbutus menziesii*	5.456790123	
Bearberry	*Arctostaphylos uva-ursi*	5.12345679	
Coyote brush	*Baccharis pilularis*	4.851851852	
Dune sedge	*Carex pansa*	4.62962963	
Deergrass	*Muhlenbergia rigens*	4.62962963	

Opinions on Future Developments

To gain insight into what people at UCLA looked forward to in terms of future landscapes, we asked respondents about their opinions on the plant species, need for plant signs, and the kinds of spaces that should be increased on campus.

Trees were overwhelming popular compared to other types of plants. We believe this is due to the fact that they provide shade under the Southern California sun and make walking on campus more enjoyable. Furthermore, shady areas are necessary when studying outdoors on laptops.

Another interesting result is the opinion on plant signs: Although we were anticipating most of the respondents to reply yes when asked, “Do you think it is necessary to install signs labeling types of vegetation on campus?” about 61% of the responses were positive. We believe this is due to the fact that the cost of installing signs for each plant outweighs the information that they provide.

Preferences for places were closely aligned with the plant types that people anticipated to see more on campus. Areas that provide shade were the most popular option, which partly explains the overwhelming support for trees. The next favored option was study spaces with tables, which is closely related the need for shade when studying outside on laptops. In fact, we received numerous comments that the study spaces should also contain some charging stations, which Facilities has been implementing in the latest study spaces created on campus.

Figure 12. On-Campus Plant Preferences

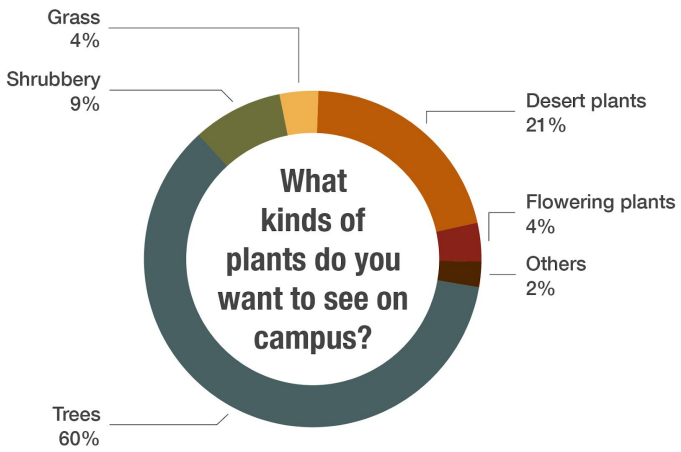
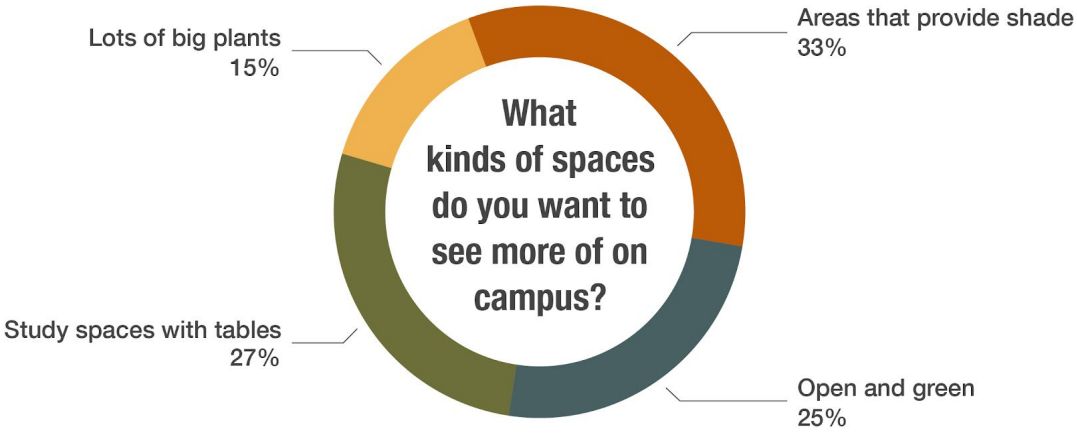


Figure 13. On-Campus Space Preferences



Summary

There were some really powerful takeaways from the survey. The data is especially promising since we had 81 respondents spanning 33 majors across campus (in addition to a few faculty members and graduate students). Our initial probing questions about respondents' ability to recognize native landscapes indicated that even if they were able to guess correctly (about 52% of the time), they were relatively unsure of their responses.

The questions pertaining to urban landscaping values yielded a lot of important information in support of native landscaping. We found landscaping functionality in regards to increasing biodiversity, improving air and water quality, reducing flooding, and cooling down the urban environment all ranked higher than aesthetics in respondents' responses.

When respondents were asked to rank the characteristics of a few different areas on campus (some grass areas, some invasive, some native), it was found they identified the native status of plants correctly about 50% of the time and were relatively unsure of their answers.

Likely most useful to an administration looking to make changes to campus landscaping, we found nearly all respondents were supportive or very supportive of allocating more money from UCLA's general fund to increase native landscaping on campus. In addition, when asked if they would be willing to personally pay more to ensure it happened, 93% of respondents said they were, with specific dollar amounts differing among respondents. Currently, UCLA tuition

includes a four dollar fee that contributes to The Green Initiative Fund, so this fee is in addition to that. Of those surveyed, 23% said they were willing to contribute up to nine dollars!

Finally, we solicited respondent opinions on specific plants and plant types that we have identified as good candidates for introduction to campus as part of our Native Plant Palette. We found people don't like shrubbery or grasses, but do enjoy native flowers for their aesthetic and trees (60% of respondents wanted more trees) for their shade and utility in creating pleasant and usable study spaces outdoors on campus, returning to people's desire for utility over aesthetics.

Map and Palette

Native Plant Palette

Often times there is a misconception that exotic plants are necessary to create a vibrant landscape. While exotic, non-native plants can add to landscaping projects in Southern California, they are by no means able to create a landscape vibrant with biodiversity endemic to the area. Southern California is a biodiversity hotspot with hundreds of native plant species, some of which are perfectly suited for the UCLA campus. The Westwood area alone has over 100 species of trees, shrubs, perennials, and annuals that are considered endemic and once filled the chaparral hillsides, arroyos, and meadows of the area. The SAR Native Landscaping put together a native palette that includes all of the low water usage shrubs, annuals, and perennials of the UCLA area.

Utilizing information from the California Native Plant society, a native plant palette was assembled, and includes the best fit trees, shrubs, annuals, and perennials for the UCLA campus. The plants included in this palette are endemic to the Westwood area, many of which were once a part of the UCLA landscape. Additionally, these plants were picked for their low water usage and promotion of biodiversity. However, the list of trees is slightly different as trees, even in Southern California, tend to be more dependent on water. In total, there are 240 choices of different species of native plants that can be implemented in UCLA landscaping–almost all of which are low water usage. The links to the different lists are provided below:

- California Native Trees
- California Native Shrubs
- California Native Perennials
- California Native Annuals

A variety of information is listed for each species that can help ensure success when incorporating them into campus landscaping. Despite the large variety of native plant options, some are naturally going to be more suited for general landscaping than others. Additionally, certain areas on campus will be better fits for certain plants. Below are several recommendations for California Natives from each category: trees, shrubs, perennials, annuals.

Trees

Coast Live Oak	
The Coast Live Oak is a living symbol of California. Ranging from Mendocino County to Baja California, this tree can be found in a wide variety of places. It is one of the only California native oaks that thrives in coastal environments. Although it typically does not grow on the immediate shoreline, it benefits from close proximity to the ocean. This makes the Coast Live Oak a perfect fit for the UCLA campus. Live Oak's are endemic to the Westwood area, with natural specimens located at Sage Hill and Stone Canyon Creek. Although these oaks tend to grow naturally and are slow growers, their reduction in population numbers are a prime reason to intentionally include more in campus landscaping practices. Additionally, the biodiversity benefits provided by these oaks are too extraordinary to ignore—over one thousand species benefit from a single oak tree and humans too can benefit from the aesthetic qualities and shade the coast live oak provides.	 **Figure 14.** Coast Live Oak "Coast Live Oak ." *Calscape*, California Native Plant Society , calscape.org/loc-34.0634, -118.4449 /cat-Trees/ord-popular?srchcr=sc5b2480c13982e.

Big Leaf Maple	
Native to a large swath of western North America, the Big Leaf Maple is mostly found near the Pacific coast from southern Alaska to southern California. It is an easy to grow deciduous tree that requires a moderate amount of water. The greatest attribute of the Maple that has the ability to greatly benefit the UCLA campus is that it is a fast grower. Often times, planting large trees is a long-term investment because many trees are slow growing and will not reach their full beneficial capacity for many years. This is especially true at UCLA where aesthetics are important especially with the	 **Figure 15.** Big Leaf Maple

quick turnover of students and visitors. However, the Big Leaf Maple offers a large and fast-growing tree that commonly reaches 15-20 meters in height. Additionally, the Maple attracts birds and butterflies which will only help to efforts to increase campus biodiversity.	"Big Leaf Maple ." *Calscape*, California Native Plant Society , calscape.org/loc-34.0634, -118.4449 /cat-Trees/ord-popular?srchcr=sc5b2480c 13982e.

Box Elder	
The Box Elder is a tree commonly found throughout North America but is endemic to coastal mountain ranges all along California. Like many trees in California, it is commonly found along streams but has the ability to become drought tolerant once it is established and mature. It requires a moderate amount of water and can be placed in a variety of sunny/partly sunny locations around the UCLA campus. Additionally, like the Big Leaf Maple, it is an extremely fast grower which makes it a perfect option to provide more shade around the campus.	 **Figure 16.** Box Elder "Box Elder ." *Calscape*, California Native Plant Society , calscape.org/loc-34.0634, -118.4449 /cat-Trees/ord-popular?srchcr=sc5b2480c 13982e.

Valley Oak	
Like the Coast Live Oak, the Valley Oak is an extreme boon for biodiversity. However, unlike the Coast Live Oak, the Valley Oak is a fast grower, able to reach over 20 feet in 5 years. Extremely long lived—some can live over 600 years—this oak is unfortunately messy with its leaf litter and acorns, but adds to the biodiversity of its area. Too much water can actually be a harm for this oak so it is best to keep it away from regular irrigation. While it might not be the best option for a heavily trafficked or recreational areas, the Valley	 **Figure 17.** Valley Oak

Oak can be included in certain landscaped areas that are not meant for human recreation. This oak would be a choice for aesthetics and improving wildlife around campus.	"Valley Oak ." *Calscape*, California Native Plant Society , calscape.org/loc-34.0634, -118.4449 /cat-Trees/ord-popular?srchcr=sc5b2480c13982e.

Hollyleaf Cherry	
Native to coastal California, the Hollyleaf Cherry is a perfect choice for UCLA landscaping due to its history and characteristics as a plant. Holly's were once abundant throughout the hills of Los Angeles, especially in an area that would become known as Hollywood. The plant is where Hollywood got its name. In addition to its interesting history, the Hollyleaf Cherry is a fast growing, has low water usage once established , and is easy to care for. It is also a fruiting tree that has beautiful red gem berries that attract a variety of birds and small mammals. As an extremely hardy plant, the Hollyleaf Cherry can be placed around campus in even the most sunny and arid places.	 **Figure 18.** Hollyleaf Cherry "Hollyleaf Cherry ." *Calscape*, California Native Plant Society , calscape.org/loc-34.0634, -118.4449 /cat-Trees/ord-popular?srchcr=sc5b2480c13982e.

Shrubs

Toyon	
Toyon is an aesthetic perennial shrub endemic to the western parts of California, especially the coastal sage scrub community. This shrub can also be found in drought-adapted chaparral and mixed oak woodland habitats—it can even currently be found at UCLA on Sage Hill. Like the Hollyleaf Cherry, Toyon produces beautiful bright red berries that attract a variety of small mammals, birds, and insects. A hardy and easy to care for native, Toyon can tolerate a variety of conditions and requires little water once established.	 **Figure 19.** Toyon "Toyon." *Calscape*, California Native Plant Society , calscape.org/loc-34.0634, -118.4449

	/cat-Shrubs/ord-popular?srchcr=sc5b248131104a0.

White Sage	
A pivotal ecosystem in the area around UCLA is the coastal sage scrub habitat. This type of habitat commonly occurs in western Southern California in coastal areas. One of the primary species in this habitat is the White Sage. A perfect fit for the UCLA campus, this sage is commonly thought of as the cornerstone species of the coastal sage scrub community and the native peoples who once inhabited the area. Rapidly growing 3-4 feet, the White Sage is strongly aromatic, extremely easy to care for, and requires remarkably little water once established. Additionally, this sage will attract a variety of birds and insects.	 **Figure 20.** White Sage "White Sage." *Calscape*, California Native Plant Society , calscape.org/loc-34.0634, -118.4449 /cat-Shrubs/ord-popular?srchcr=sc5b248131104a0.

California Sagebrush	
California Sagebrush is among the most well suited for the UCLA campus because it can already be found covering Sage Hill (where the area gets its name). A member of the coastal sage scrub, chaparral, and dry foothill communities, California Sagebrush is a bushy and extremely hardy California native. Like White Sage, the California Sagebrush is another cornerstone species of its habitats. This plant will often grow in hot, arid places where most other plants cannot as it requires virtually no regular watering once established. A highlight of this species is that it is the preferred plant of the endangered California gnatcatcher.	 **Figure 21.** California Sagebrush "California Sagebrush." *Calscape*, California Native Plant Society , calscape.org/loc-34.0634, -118.4449 /cat-Shrubs/ord-popular?srchcr=sc5b248131104a0.

Eastwood Manzanita	
The Eastwood Manzanita is native to much of western North America, but is endemic to coastal slopes and granite peaks in Southern California. A low growing shrub, the Manzanita has beautiful flowers that give way to small fruits that attract a variety of birds. It has very low water usage once established and is moderately easy to care for.	 **Figure 22.** Eastwood Manzanita "Eastwood Manzanita." *Calscape*, California Native Plant Society , calscape.org/loc-34.0634, -118.4449 /cat-Shrubs/ord-popular?srchcr=sc5b248131104a0.

Bush Poppy	
The Bush Poppy is a hardy flowering shrub that thrives with low water once established and full sun. It does not grow up, but rather horizontally and is, in addition, a fast grower. It is found throughout California and northern Baja California and is a great choice when trying to add native color to a landscape.	 **Figure 23.** Bush Poppy "Bush Poppy." *Calscape*, California Native Plant Society , calscape.org/loc-34.0634, -118.4449 /cat-Shrubs/ord-popular?srchcr=sc5b248131104a0.

Perennials

Bristly Matilija Poppy	
Native to small areas near Southern California's coast, the Coulter's Matilija Poppy is likely to be found in dry canyons, coastal sage scrub, and chaparral - areas similar to the ecosystems surrounding the UCLA campus. This Matilija Poppy is a shrub that grows to between six and ten feet tall; the plant has long green leaves on its stalks, each with a single white flower with yellow center at the top. The Coulter's Matilija Poppy is the largest flower of any native California plant, and it is often used in gardens and landscaping. Although a rare, native plant, the Matilija Poppy is commonly available at plant nurseries. This plant grows well with the other plants suggested, including Toyon, Coyote Bush, and Laurel Sumacs. The Matilija Poppy is best for sunny areas. It requires low water, with no water needed in the summer. The flower is in bloom during spring and summer and has a pleasant fragrance that attracts pollinators such as bees and butterflies.	 **Figure 24.** Bristly Matilija Poppy "Bristly Matilija Poppy ." *Calscape*, California Native Plant Society , calscape.org/loc-34.0634, -118.4449 /cat-Perennials/ord-popular?srchcr=sc5b2 4818175cfc.

Chalk Dudleya	
The Chalk Dudleya is a low-lying succulent plant that is shaped like a rosette, which grows up to one foot across. It is native to the southwestern United States. The flowers of the Chalk Dudleya range from orange to red and pink, and they are in bloom in the spring and summer. This succulent is a good choice for landscaping because it is hardy and can survive well in most types of soil and requires very little water; it is also commonly available for purchase.	 **Figure 25.** Chalk Dudleya "Chalk Dudleya ." *Calscape*, California Native Plant Society , calscape.org/loc-34.0634, -118.4449 /cat-Perennials/ord-popular?srchcr=sc5b2 4818175cfc.

California Poppies	
California Poppies are the California state flower, and they are found throughout the state. The plant has pale blue-green foliage with bright orange to yellow flowers. As a perennial, the California Poppy will return year after year, though as the plant is very fast growing and easily grown from seeds, it can be treated as an annual and seeds can be spread each year. Because growing from seed is very easy, the seeds can be collected annually and used to re-seed the following year, allowing for easy propagation. Seeds and plants are commonly available in nurseries. The poppy requires low to very low water; it does best in sunny areas. It attracts pollinators such as bees and butterflies, as well as small birds. The California Poppy has a year-round flowering season, and as such can be an attractive, colorful flower as part of landscaping.	 **Figure 26.** California Poppies "California Poppies ." *Calscape*, California Native Plant Society , calscape.org/loc-34.0634, -118.4449 /cat-Perennials/ord-popular?srchcr=sc5b2 4818175cfc.

Bush Sunflower	
The Bush Sunflower is also commonly known as California Brittlebush. A favorite plant at Sage Hill, as the name suggests, the Bush Sunflower is a large bush that grows up to five feet high and seven feet wide. Its branches are covered in green leaves, and they have daisy-like bright yellow flowers. The Bush Sunflower is native to Southern and Baja California, and it is usually found in the coastal sage scrub. It is an easy to grow, fast-growing bush that will bloom year-round if given enough water, although it typically blooms in the spring and winter from February to June. As such, incorporating this plant into landscaping can ensure that attractive, flowering plants are present year-round. Additionally, it attracts bees and butterflies, as well as small birds like goldfinches. It also has very low water usage.	 **Figure 27..** Bush Sunflower "Bush Sunflower ." *Calscape*, California Native Plant Society , calscape.org/loc-34.0634, -118.4449 /cat-Perennials/ord-popular?srchcr=sc5b2 4818175cfc.

Bush Monkeyflower	
Another plant found at Sage Hill, the Bush Monkeyflower (or Sticky Monkeyflower) is an evergreen shrub that grows to about five feet tall and five feet wide. It is native to the coast of much of California, and is found within canyons, coastal scrub, and chaparral. The flowers range from white to red, depending on the variety, though they are usually pale orange. Flowers are in bloom in spring, summer, and winter, and the bush is always green, so the plant is very attractive in landscaping. The Bush Monkeyflower attracts hummingbirds and insects, as the flowers are pollinated by bees and hummingbirds. It also has very low water usage once established.	 **Figure 28.** Bush Monkeyflower "Bush Monkeyflower ." *Calscape*, California Native Plant Society , calscape.org/loc-34.0634, -118.4449 /cat-Perennials/ord-popular?srchcr=sc5b24818175cfc. Annuals

Annuals

Succulent Lupine	
Native to much of California, the Succulent Lupine goes by many common names including Arroyo Lupine and Hollowleaf Annual Lupine. It has pale green palmate leaves (in a circular pattern) and dark purple or blue flowers with some pink and white. The flowering season is from April to May. This is a plant that prefers to be in very sunny areas. Succulent Lupine is commonly used in landscaping as it is water tolerant and requires low water. It grows up to four feet tall and three feet wide, and does well when planted in groups. As part of the pea family, the Succulent Lupine is a nitrogen-fixer and can help enrich the soil without the need for fertilizers.	 **Figure 29.** Succulent Lupine "Succulent Lupine." *Calscape*, California Native Plant Society , calscape.org/loc-34.0634, -118.4449 /cat-Annuals/ord-popular?srchcr=sc5b24820769687.

California Goldfields	
California Goldfields are part of the sunflower family. They are common, have a wide range, and are native to much of California and Oregon. California Goldfields are characterized by dense clusters of yellow flower heads. When they bloom, they create carpets of yellow flowers; the flowering season is from winter to spring. This plant does well paired with others (including Baby Blue Eyes and Chalk Dudleyas) in a dense patch. It also can be used as a groundcover.	 **Figure 30.** California Goldfields "California Goldfields." *Calscape*, California Native Plant Society , calscape.org/loc-34.0634, -118.4449 /cat-Annuals/ord-popular?srchcr=sc5b248 20769687.

Baby Blue Eyes	
Baby Blue Eyes are common in California and Oregon. They often grow in meadows, grassy areas, and canyons. They thrive in sunny and partly shady locations. A popular garden plant, they bloom in spring with bright blue flowers and white centers. They are easy to grow from seed and do well with other annuals and with the California Poppy. As a blue flower, they add nice color to landscaping projects, especially at UCLA.	 **Figure 31.** Baby Blue Eyes "Baby Blue Eyes." *Calscape*, California Native Plant Society , calscape.org/loc-34.0634, -118.4449 /cat-Annuals/ord-popular?srchcr=sc5b248 20769687.

California Cudweed	
California Cudweed is also known as ladies' tobacco, California rabbit tobacco, and California everlasting. It is distributed along the California Coast and along the foothills of the Sierra Nevada Mountains. California Cudweed grows to nearly three feet tall and two feet wide. It has green foliage that has a pleasant, fragrant scent. It is topped with clusters of small white flowers. This plant is self re-seeding, and prolifically spreads. It thrives in sun and in many soil types. The most notable and exciting thing about California Cudweed is that it is the larval host plant for the beautiful Painted Lady Butterfly, and as such attracts many of these bright orange butterflies. It also requires minimal water.	 **Figure 32.** California Cudweed "California Cudweed." *Calscape*, California Native Plant Society , calscape.org/loc-34.0634, -118.4449 /cat-Annuals/ord-popular?srchcr=sc5b248 20769687.

Map

The UCLA campus covers 419 acres, making it one of the smallest, and most dense of all UC campuses. While world-renowned for its architecture, with buildings such as Royce Hall and Kerkhoff being featured in numerous movies and television shows, a key goal of our team was to produce a map of the green-spaces to showcase just how prominent landscaping is on this campus. Using files from UCLA Facilities in AutoCAD and ArcMap, we were able to remove paved spaces, buildings, and sports facilities in a way that brings focus to the variety and abundance of locations that have been planted and shows just why UCLA is so important as a functional ecological and biodiverse landscape. The map provides a visualization of the large amount of unproductive, underutilized grass space on a frequently space-restricted campus that could pose an opportunity to support a large ecosystem if repurposed with plants that encourage ecological productivity.

Figure 33. Map of All Green Spaces on the UCLA Campus

Conclusion

To create recommendations that are useful to UCLA's campus in particular, our project aims to provide a comprehensive, evidence-based proposal for prioritizing native and ecologically-appropriate landscaping. These recommendations have been built upon an earlier set of sustainable landscaping recommendations developed by a student in the UCLA Extension Sustainability Certificate through an internship with the Office of Sustainability. We gathered our data by reaching out to other universities and institutions with successful landscaping programs, conducting a survey to gauge student opinion on native landscaping preferences, utilizing AutoCAD and GIS map-based analysis of green-spaces on campus to produce quantitative data, and assembling a palette of native plants. Outreach to other institutions was used to evaluate their progress and challenges with incorporating native landscaping practices into their campuses. The survey identified a diverse array (over 33 UCLA majors) of UCLA students' plant preferences, primary values in urban landscaping, and ability to identify native plants. Our plant palettes and map were used to identify underutilized spaces on campus that UCLA Facilities plans to redesign as biophilic study spaces and to recommend native and ecologically-appropriate plants that support the construction of self-sustaining ecosystems in these spaces. Overall, these three data-collection approaches were used to comprehensively assess UCLA's attitude, progress, and potential in regards to incorporating more native plants and biomass into the current campus landscape. Campus green spaces are one of the university's greatest assets, and have the capability to become a paragon of sustainability and biodiversity-conscious landscaping and space usage. Creating an ecologically sound and aesthetic landscape on UCLA's campus has the potential to transform the community, instilling knowledge of and love for biodiversity in urban spaces into future generations of Bruins. We hope that the insight and recommendations provided throughout this report will be used to generate an official UCLA native landscaping policy in the future.

Recommendations

Our study ultimately found that UCLA values and looks forward to incorporating more native and ecologically appropriate plants and biomass to the campus landscape. Until an official UCLA Native Landscaping Policy is generated at an administrative level, our team would

recommend that the following actions are taken to maximize UCLA's potential to create a fully-functioning, ecologically-productive campus landscape:

- Strictly enforce the Theodore Payne **50% native biomass** principle on future landscaping projects to ensure that the minimum threshold required to foster ecological productivity is met by all future campus landscaping projects.

- Proceed with consistent **landscape architect/landscaping task-force** committee meetings and review (Kouzeh). UCLA informed our team that it will be reconvening a sustainable landscaping task force to look at developing a drought-tolerant palette and assess other sustainable landscaping issues. The Office of Sustainability and the Campus Architect have also been discussing the need for a master landscaping plan for the campus, and the need to hire a head landscape architect to oversee all campus plans. These entities should meet regularly to assess and monitor campus landscaping projects.

- **Grounds crew** members who maintain the campus landscape should be involved in landscape task-force committee review processes and decisions, and should receive formal landscaping education and training either through the Theodore Payne Foundation or through the UCLA Extension School of Landscape and Architecture Program to equip with the education necessary to tend to landscapes with the goal of creating a thriving, productive campus ecosystem in mind.

We also believe that future SAR teams should conduct studies to show the benefits of incorporating native biomass into urban, institution-sized landscapes like that of UCLA's to encourage other other institutions to adopt similar practices. The Native Landscaping Team was an entirely new team for this year's Sustainability Action Research program. While past teams have targeted biodiversity and drought tolerant landscaping, this was the first team to focus on California native plants and the benefits they can provide for biodiversity, water savings, and less maintenance. The reduction in maintenance costs, time, and hours spent on landscaping that comes with native plants is one of the most significant findings of this new team, especially given the findings about maintenance and UCLA facilities. However, it was not possible for this years team to get specifics on water and maintenance savings for native areas versus non-native areas. For this reason, this year's Native Landscaping Team recommends the continuation of the project for next year's Sustainability Action Research.

In addition to continuing the SAR Native Landscaping Team, the following landscaping aspects are recommended for next year's SAR team to observe and quantify to understand the benefit of incorporating more native and ecologically-appropriate landscaping onto the UCLA campus:

- Specific water usage for areas on the UCLA campus including native landscaping versus areas with no native landscaping

- Water usage for underutilized areas on campus—this should include unnecessary areas of grass, ivy, high water usage, and high maintenance costs

- Manual labor hours and costs to maintain these underutilized areas and how much could be saved if they were converted to native landscapes with at least the 50%/50% criteria

- Additionally, we would advise the team to work closely with the various actors in facilities, and make sure to work with those who directly tend to the landscapes

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