



INTEGRATED PEST MANAGEMENT

2017 FINAL REPORT

TEAM LEADERS

Markus Min, Nathaniel Park

TEAM MEMBERS

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STAKEHOLDER

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INTEGRATED PEST MANAGEMENT

IPM is an ecosystem-based strategy that focuses on long-term prevention of pests or their damage through a combination of techniques such as biological control, habitat manipulation, modification of cultural practices, and use of resistant varieties. Pesticides are used only after monitoring indicates they are needed according to established guidelines, and treatments are made with the goal of removing only the target organism. Pest control materials are selected and applied in a manner that minimizes risks to human health, beneficial and non-target organisms, and the environment (What is IPM?).



LEADERS



Nathaniel Park is a fourth year Environmental Science major minoring in Atmospheric and Oceanic Science. He likes trees and rocks.



Markus Min is a second year Environmental Science major minoring in Conservation Biology and Geospatial Information Systems and Technology. He enjoys spending time with his dog, being out in nature, and identifying with his Myers-Briggs personality type

MEMBERS



Desmond Lim is a third year Geography Major who appreciates the beauty of nature but also the complexity of human behavior. He enjoys looking at maps of different kinds, planning future trips abroad and the gorgeous LA weather.



Carly Messex is a fourth year Environmental Science major minoring in Environmental Studies/Geography, Conservation Biology, and Classical Civilizations. She loves caring for her many plants and taking naps in nature. In her free time she enjoys dismantling the patriarchy.



Griffin Nicholson is a second year Biology major minoring in Environmental Systems and Society. He enjoys reading a good book, witnessing the majesticness of Earth, and eating the last snack at every team meeting.



Catherine Wu is a second year Ecology, Behavior, and Evolution major who enjoys being in nature, appreciating art, and going on adventures. While involved in SAR, she has become mildly obsessed about Myers-Briggs personality types and has tried to get everyone into it.



BACKGROUND

Successful pest management is an important part of maintaining a clean and healthy campus. Unfortunately, many of the practices involved in conventional pest management can lead to many problems for organisms that inhabit our campus. Many rodenticides can remain in the organism for several days, resulting in the poison entering the food chain and affecting many predators (NPIC). Integrated Pest Management (IPM) seeks to create a more measured approach that reduces our need for rodenticide. To do this, we focus on pest prevention through limiting factors that can attract rats to the campus. This includes securing trash, limiting entry points into buildings, and reducing favorable habitat (UC Davis). IPM also includes using ecological controls for pest removal such as using raptor boxes or cats to prey upon rodents.

GEOGRAPHICAL INFORMATION SYSTEM (GIS) MAPPING

INTRODUCTION

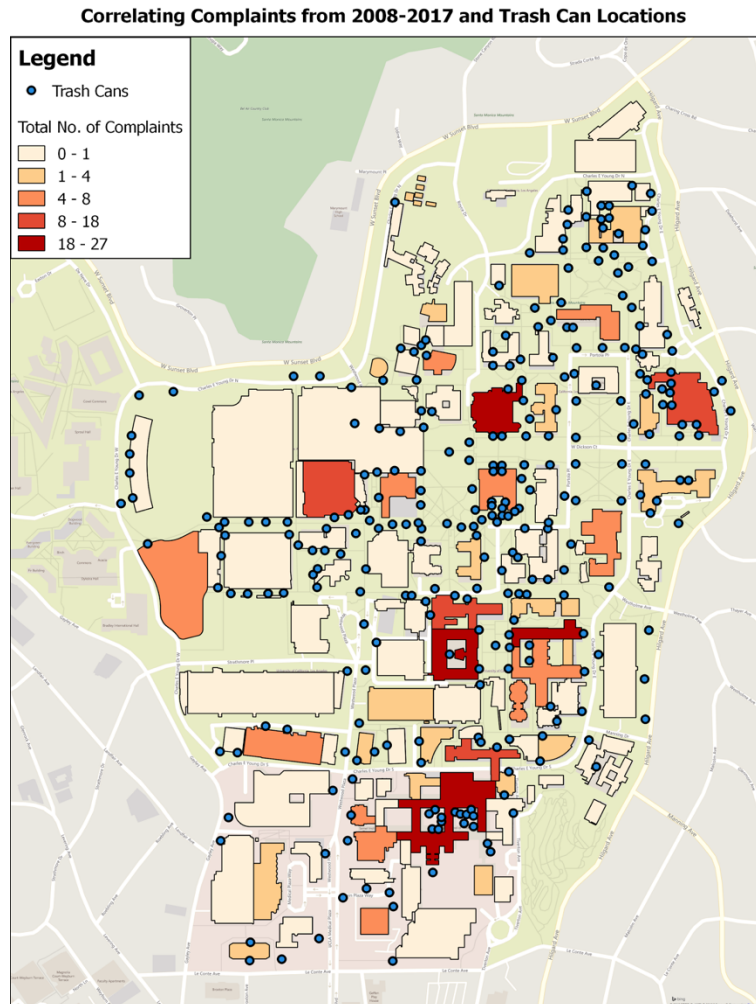
Geographical Information System Mapping, or GIS, is a system designed to manipulate, analyze, and present information and geographic data spatially. This allows for visualizing spatial data in an easily comprehensible way, and has many uses in representing geographic data. Our team believes that showing spatial data on rodents and other variable is important because it is a clear and concise method of sharing information in an easily digestible way. We also recognize the importance of assembling as much information as possible in one place in order to allow for better communication across departments throughout UCLA campus.

METHODS

We gathered a large portion of our data from UCLA's Department of Environment, Health and Safety (EHS). We received work orders spanning from 2008 to present from the EHS Department as well, and worked in concordance with Animal and Insect Pest Management (AIPM) - UCLA's contracted pest control provider- to find

information on current bait station locations. We also reached out to UCLA Facilities Management, UCLA Dining Services, and the Institute of the Environment and Sustainability at UCLA for other relevant spatial data. After gathering the information made available to us, we converted the data into Excel files as necessary and then uploaded our data onto a map of UCLA. We represented number of total work orders from 2008 by building color, and overlaid this data with spatial representations of trash cans and bait stations on campus. By overlaying these variables, we wanted to find if there was a correlation between work orders and the placement of trash cans and bait stations. An obstacle we faced when running this type of analysis was lack of rodent absence data. We used the work orders as a representation of rodent presence, but have no data on where rodents are not on campus. This could be a shortcoming because even if the work orders show exactly where they have been, it does not paint an accurate picture of everywhere rodents may be on campus. After representing spatially these different factors, we ran analyses to determine if there was any correlation.

RESULTS



Trash cans are widely distributed across the campus, but some are more clustered in areas than others. The Law Building possesses the highest number of trash cans (14) within its vicinity, followed closely by the Center for Health Sciences patio and Bruin Walk (both 13). One fundamental question we asked ourselves was the relationship between rodent activity and the presence of trash cans. Ideally, a greater number of trash cans would

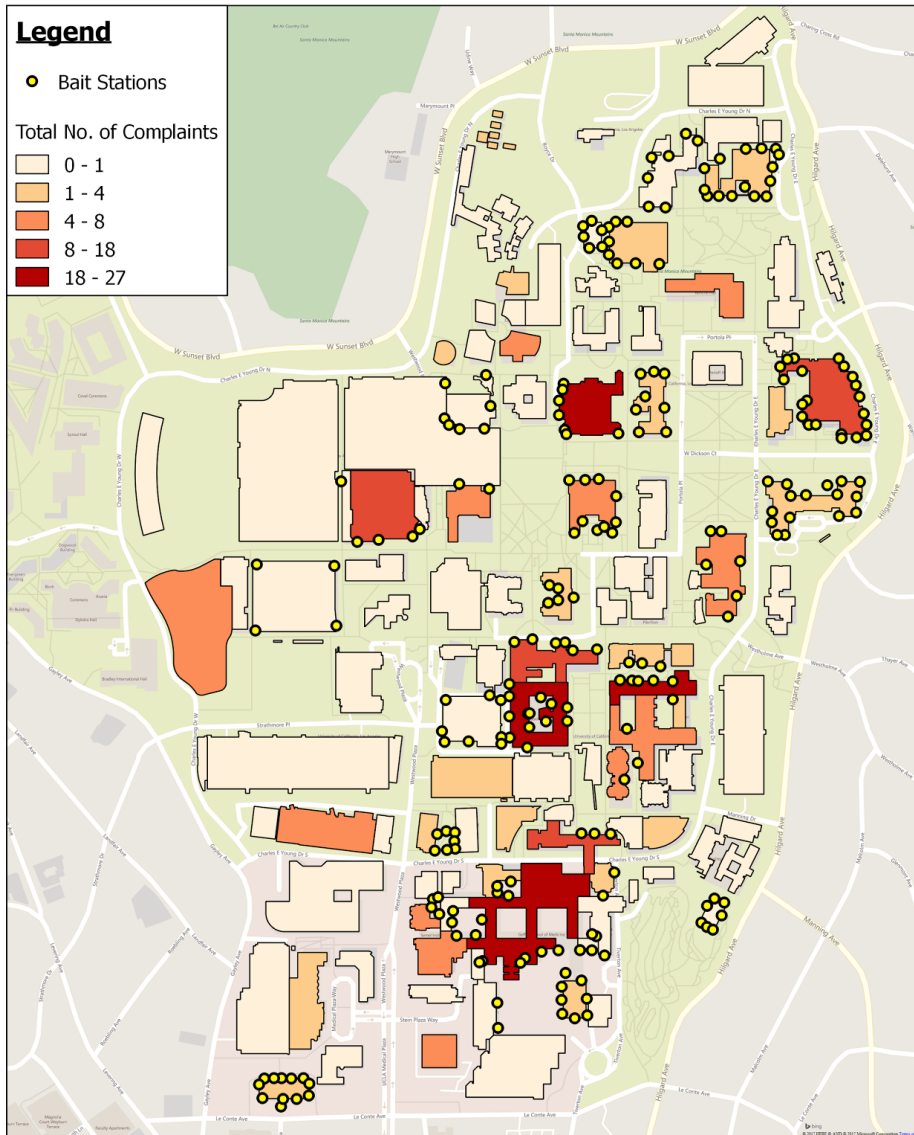
help reduce the occurrence of overflowing trash, thereby creating an environment that is less attractive to rodent activity. Conversely, having a larger number of trash cans in an area might increase the probability of rodent infestations. With more sources of food available, more rodents may be attracted. This may be a possible scenario for locations such as CHS and the Law Building, which both have a high number of trash cans and reported rodent incidents.

Location	Total No. of Work Orders 2008-2017
Center for Health Sciences	27
Royce Hall	25
Geology	24
Boelter Hall	24
Wooden Center	18
Law Building	15
Life Sciences Building	15

Table 1: Tabulating the total Number of Work Orders from 2008-2017

One of the aims of our GIS project was to find out if bait stations were appropriately placed at locations which received rodent complaints. We conclude that there is a positive correlation between the number of incidents and the number of bait boxes at an area. The CHS cluster, law building and Boelter hall exhibit these characteristics.

Correlating Complaints from 2008-2017 and Bait Station Locations



BIGBELLY SOLAR TRASH COMPACTORS ON THE UCLA CAMPUS

A major component of our work is our project to install Bigbelly Waste and Recycling Stations on the UCLA campus. The idea for our Bigbelly project stemmed from meetings we had with different people involved with pest management on campus, including people from EH&S, Dining Services, and our current pest management contractor. Throughout our discussions, a recurring theme was that a major contributing factor to rodent issues on campus is the improper storage of food waste. The staff we talked to referred Bigbelly Waste and Recycling Stations as a possible solution, as they have been proven to reduce pest problems on the campuses and in the cities where they have been implemented, at locations such as UCSD and UCSB. After further research into Bigbelly, we decided to apply for a grant from The Green Initiative Fund (TGIF) at UCLA for a pilot program of Bigbelly units. For our TGIF hearing, we provided the committee with a handout explaining the benefits of our project, as seen in Appendix A.

Our grant proposal was ultimately approved and we were awarded \$13,710 for a pilot unit with three separate streams for landfill, recycling,

and compost. Although we recognize that on its own, our one Bigbelly unit will not make a big impact, our hope is that by getting the first Bigbelly unit installed on campus we can move UCLA to adopt these more sustainable and efficient waste collection systems on a greater part of campus. Once we received our grant, we then had to coordinate between Bigbelly, Waxie Sanitary Supply (the distributor for the Bigbelly units in Southern California), Sunset Canyon Recreation Center, and our stakeholder Bonny to determine the exact graphics and specifications for the unit we were purchasing. Once we had the specifications down, we then had to have Student Government Accounting generate a purchase order to Waxie Sanitary Supply, which required much more paperwork and took much more time than we had originally anticipated. Also, we had initially planned on placing our pilot unit at Sunset Village on the Hill or at Ackerman Union, but unfortunately both options fell through. However, we were able to find a suitable alternate location in Sunset Canyon Recreation Center, where the staff was very eager about trying out our pilot program, and our unit is slated to be installed there sometime in summer 2017.

CAMERA TRAPPING

INTRODUCTION

One of the main goals of our project was to determine the factors attracting rodents. We wanted to understand why the rats were being found in certain locations more frequently. Furthermore, once we had knowledge of the factors attracting rats and the locations rodents were more common, we would be able to investigate new methods of rodent prevention by focusing on what the source of the problem was. In order to find what was attracting rodents, we decided to utilize field motion cameras.

METHODS

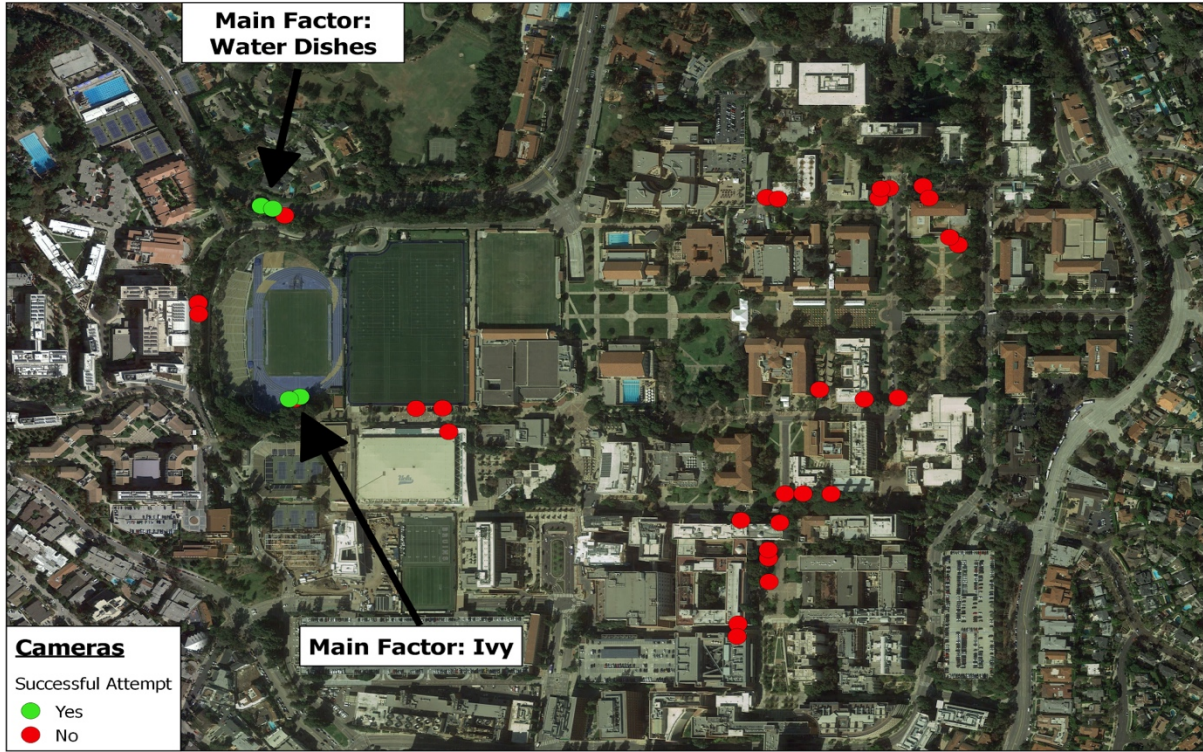
Over the course of a quarter at UCLA, we set up camera traps to locate rodent hotspots and determine what habitat factors were attracting the rodents. We set up our motion cameras at night from 12pm to 6pm. Initially, our focus was on trash cans and trash overflow throughout campus and we positioned our cameras to see if rodents could get through the tops of the trash cans which are open. We then investigated other factors

including ivy and vegetation on campus. The final factor we set up our cameras to obtain evidence for was water sources. After hearing reports of irrigation lines being chewed on by rats, we set up cameras to attempt to find evidence for rodents chewing on the lines. In addition, we set up our own water source, water dishes, to see if they would attract rodents and if they would result in a decreased number of reports of rodents chewing on irrigation lines.

RESULTS

Our camera traps registered several hits on campus. We did not obtain any evidence of rodents entering the tops of the trash cans on campus but we did capture several videos of rodents in ivy in several places. We also had video of rodents attracted to water dishes that we placed near irrigation lines. These results indicate that rodents inhabit areas with sufficient vegetation coverage and can be attracted to food or water sources. More research needs to be done, however, to make any conclusive statements regarding rodent habitat factors on UCLA.

Overview of Camera Locations



DISCOURSE WITH OTHER PEST MANAGEMENT DEPARTMENTS

An important aspect of our project this year was reaching out to other campuses, cities, and organizations who have been able to successfully reduce or eliminate rodenticide use. We talked to people involved in pest management at Pepperdine University, Poison Free Malibu, UCSF, (insert who you talked to here!). By talking to other people involved in pest management, we were able to gain vital practical knowledge on how they were able to reduce or eliminate rodenticide use, and hope that UCLA will be able to learn from other entities so as to take steps to reduce our own rodenticide use.

PEPPERDINE UNIVERSITY

We reached out to Pepperdine University's sustainability department, who was instrumental in helping them eliminate rodenticide use on their campus in 2014. In particular, we corresponded with Emily Mead, who is the Coordinator for the Center for Sustainability, Governmental & Regulatory Affairs at Pepperdine. She outlined how Pepperdine was able to eliminate rodenticide using a three pronged approach, which consisted of 1) Reducing rodent populations by reducing access and food sources, 2) Replacing bait boxes with live traps, and 3) Encouraging natural predation with the implementation of raptor perches. She informed us that their vendor for the live traps is Ecolab, and that they were able to do a 1:1 replacement of bait boxes with live traps by strategically placing the live traps along paths that rodents would use. In addition, she mentioned that they saved \$14,000 a year just by

making the switch to Ecolab. In terms of raptor perches, she informed us that they consulted with biologists to determine the best locations to place perches for the birds of prey to use. However, we believe that UCLA is not yet ready to implement raptor perches on campus due to our continued use of rodenticides, which could be deadly to these birds. She advised us to talk with Chip Osborne, an organic landscaping contractor who helped Pepperdine determine how to improve their pest management on campus without relying on the use of rodenticides. Finally, she also mentioned that integrated pest management at UCLA would be trickier than it was at Pepperdine, due to the fact that UCLA is far more urban, a much larger campus, and does not have a functioning ecosystem with birds of prey that we could utilize in our pest management strategy.

SUGGESTIONS FOR UCLA AND FUTURE RESEARCH

GIS MAPPING OF OTHER RELEVANT FACTORS

Based on the existing data obtained from EH&S, we were able to synthesize a number of maps that combined possible factors that contributed to the presence of rodents on campus. As we progressed through the quarter, the team identified more environmental conditions that were favorable to attracting rodents. For example, successful acquisition of video evidence of rodent activity were located in areas which were densely vegetated. Hedera, commonly known as Ivy, is a species of ground-creeping plants that could provide excellent conditions for harboring rodent populations. For future projects, the team suggests conducting a survey of the campus and establishing a map of Ivy ground-cover. Relevant stakeholders may look into the possibility of replacing Ivy with other vegetative cover.

ACTUAL SITE VISITS

Although we were able to create maps that visualized the spatial distribution of rodent reports, more specific contributing factors may be identified by visiting the actual sites of reported incidents. We suggest that work orders undertaken by pest contractors be more specific in their descriptions. For example, one work order simply stated "Mouse in the office". With more qualitative data available, future teams would have a better understanding of the factors that attract rodents. The presence of food, holes and cracks in walls and moisture are possible examples.

LIVE TRAPPING

We recommend that UCLA look into replacing conventional bait boxes that use rodenticide to kill rats with live traps, which would eliminate rodenticide use. Based on our conversation with Pepperdine University, who was able to go rodenticide-free by replacing all bait boxes with live traps at a 1:1 replacement ratio, we believe that this would be a huge step in improving IPM at UCLA. In addition, Pepperdine was able to save \$14,000 per year by making the switch to live trapping due to savings on rodenticide costs. A particular brand that was recommended to us was Ecolab, which should be one of the first brands looked into for live traps.

CONDUCT CONTROLLED EXPERIMENTS ON POSSIBLE NATURAL DETERRENTS

Although we did some preliminary research on the use of natural deterrents to reduce rodent incidents at UCLA, we believe that a more robust study that controlled for confounding factors as much as possible could yield information on what natural deterrents work the best. In particular, we suggest looking at mint oil, lavender, and basil as potential deterrents, although there are many more natural substances that have potential as rodent-deterrents. In the study, we suggest running the study for a minimum of two weeks and using a control group and a group using the deterrent to determine whether or not the deterrent has a statistically significant impact. If we were able to determine that a particular deterrent is effective in reducing rodent incidents, it could be used as an environmentally-friendly method of reducing rodent hits on irrigation lines and other costly impacts by either applying the substance directly to the lines or nearby.

ASSESS IMPACT OF BIGBELLY PILOT UNIT

Once our Bigbelly pilot unit is installed at Sunset Canyon Recreation Center, we suggest that it be evaluated for return on investment and potential for reducing rodent incidents to determine if the pilot program should be expanded to more of UCLA. This assessment should be conducted by talking to staff at Sunset Rec who interact with the unit often to talk to them about their experience with the unit, and to collect data on number of waste collections from the BigBelly unit compared to conventional unit to determine return on investment.

COOPERATE BETWEEN DEPARTMENTS INVOLVED WITH PEST MANAGEMENT

A common issue that we found in attempting to determine factors that may be contributing to rodent incidents on campus was that data on rodent incidents is not consolidated in one place and control over pest management is decentralized. This leads to issues, as there is no comprehensive data set on all rodent-related incidents, so we were unable to piece together a complete picture of all rodent incidents and as such were not able to conduct a robust GIS study on possible factors that contribute to the presence of rodents. We encourage EH&S and different people within Facilities Management to coordinate and establish a system for logging rodent incidents so that it is possible to get a complete picture of all rodent incidents on campus, which is essential for the establishment of a successful integrated pest management program at UCLA.

COORDINATE WITH OTHER ENTITIES

We encourage UCLA to continue coordinating with other campuses, cities, and organizations that have been able to reduce or eliminate rodenticide use to learn what strategies could be applied to UCLA. In particular, we encourage UCLA to continue communicating with Pepperdine University, as they have been incredibly helpful in providing guidance. They also advised us to speak with Chip Osborne, an organic landscaping consultant who was instrumental in helping them eliminate their reliance on rodenticide.

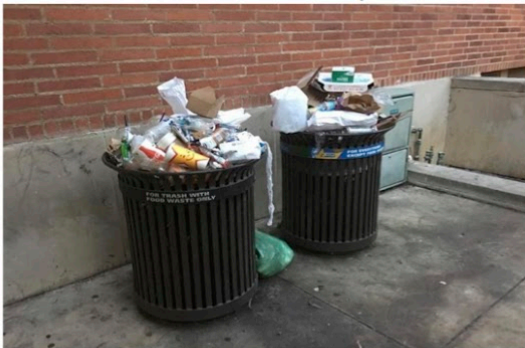
APPENDIX A

Reducing harmful rodenticide use through the implementation of a multi-benefit waste collection system

2017 Sustainability Action Research Integrated Pest Management Team

Project Goal: Our team is committed to finding green solutions to UCLA's pest problem. Highly recommended as one of the most significant steps UCLA can take to reducing pesticides on campus by pest management officers, the Bigbelly Solar trash compactors offer varied benefits that go beyond pest prevention.

Current UCLA Trash Collection System



Bigbelly Waste and Recycling Stations



Drawbacks:

- Unightly waste overflow
- Attracts rodents and other pests to UCLA campus, increasing the need for pesticides.
- Low capacity and requires frequent collection trips

Possible Locations for Bigbelly Units

Two options:

- 1) On campus – Ackerman Union
 - High traffic
 - Student groups (USAC and ASUCLA) have more sway here, and have expressed interest in getting Bigbelly waste collection units
 - Clearer path to full campus adoption
- 2) On The Hill
 - Fairly easy approval process
 - High traffic

Cost for Compost, Landfill, and Recycling Stations (Pictured above right)

\$13,110 - \$14,310

Exact cost will depend on customization options

Benefits:

- Eliminates waste overflow and unsanitary conditions
- Rodent-proof design can help reduce the needs for bioaccumulating pesticides
- High capacity from on-site compaction
- Streamlined collection process lowers number of trips and costs, reducing emissions and saving time.

Case Studies

- Raleigh, NC - 32 open-top trash cans replaced by 10 BigBelly stations with costs reduced from \$40,903 to \$1,607
- Philadelphia, PA - 900 BigBelly stations replaced wire cans with 17 trash collections a week and 3 crew shifts reduced to 3 collections a week and 1 crew shift. Over \$800,000 per year in savings.
- UCSD, UCSB, and many other universities have implemented the Bigbelly trash compactors on their campuses with great results.

ACKNOWLEDGEMENTS

We could not have accomplished all we did this year without the help of many people. In particular, we would like to thank our stakeholder Bonny Bentzin, who was incredible this year in always being willing to set aside time for us, reaching out to people for us and setting up meetings with people involved with pest management, and being willing to take action when others wouldn't. We would also like to thank our faculty advisors Cully Nordby and Carl Maida for their advice and guidance, Joshua Witt from UCLA Dining Services for helping us get started with our project, Jenny Wung and Paul Townsend for supplying us with crucial data spatial data, Katie Zeller for helping us get our Bigbelly project rolling, Emily Mead from Pepperdine University for being so helpful and insightful and giving us advice on how to move integrated pest management forward at UCLA, and The Green Initiative Fund at UCLA for supplying funding for our Bigbelly project.

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