UCLA Sustainability Action Research

Conserving UCLA's Big-Eared Woodrats

Final Report

Sustainability Action Research 2025

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Abstract

The big-eared woodrat (*Neotoma macrotis*) is a nocturnal rodent species native to southern California. Closely related to the dusky-footed woodrat, this species constructs large, elaborate middens, or nests, with dry vegetation, which serve as their main form of habitat and protection. Though they are a key native mammal species, their populations are often threated by ongoing urban expansion, and it is imperative that UCLA prioritize their conservation to maintain native species biodiversity on campus. The UCLA Sustainability Action Research team, *Conserving UCLA's Big-Eared Woodrats,* conducted a field study and habitat analysis of the woodrat population at Sage Hill - the campus's last remaining area of primarily native vegetation - to assess the status of the population and recommend future strategies for the species's conservation.

Our overall goals were to estimate the current population size, find nest distributions across different areas on campus, identify nest microhabitats, and find where other potential woodrat habitats may be located across campus. By utilizing past research and collecting new data through a transect-monitoring strategy in the field, our team was able to gauge the population size while mapping the locations and surrounding vegetation conditions of nests. We visualized our findings using GIS mapping software and produced web apps such as an ArcGIS Story Map to convey our results in an accessible manner to a public audience. From our data, we calculated that there are approximately 54 woodrats in the population, and they have a notable preference for native vegetation, specifically laurel sumac and coast live oak. Ultimately, we concluded that protecting and prioritizing native plant species across campus, continuing to monitor for woodrat nests, and educating UCLA's community on woodrats, are crucial to ensuring the conservation of big-eared woodrats on UCLA's campus.

Introduction

Throughout the 2024-2025 academic year's winter and spring quarters, the Conserving UCLA's Big-Eared Woodrats Sustainability Action Research (SAR) team conducted a fieldwork-intensive study to assess the population, habitat expansion opportunities, and conservation strategies for the big-eared woodrat (*Neotoma macrotis*) population at UCLA's Sage Hill and surrounding vegetated areas. Sage Hill is a natural and undeveloped area located in UCLA's northwest campus amidst a dense urban landscape. Therefore, it is a significant, well-studied area that represents what a relatively untouched and native southern California ecosystem would look like. Although the areas surrounding Sage Hill have been developed throughout UCLA's history, native species have been able to persist in remaining undeveloped areas like Sage Hill, but not without effort. Our team has developed strategies UCLA may use to support native rodent species like big-eared woodrats, enhance natural ecosystems on campus, and bring awareness to native species conservation by investigating the following questions:

__How many__ big-eared woodrat nests are on campus, and __where__ are they located?

What __microhabitats__ are associated with big-eared woodrat nests, and where are these __other potential habitats__ on campus?

How can UCLA __improve its monitoring and conservation efforts__ for the existing big-eared woodrat population at Sage Hill and beyond?

Previously, UCLA's Institute of the Environment and Sustainability (IoES) conducted a field survey on the vegetation at Sage Hill as part of a 2024 student-led practicum project, which provided useful preliminary information on Sage Hill's habitat. Our team reused their established monitoring transect lines and accessed vegetation data that these students collected to obtain a wide overview of the habitat conditions. Local researchers have also conducted studies to measure population size and understand habitat needs for the species throughout California. In particular, a study by Friscia et al. (2023) discovered how big-eared woodrats in Los Angeles may depend on the presence of native

vegetation; another study by Abad et al. (2020) noted that there may be more nests than there are woodrats in a given area.

Our goal is for this research to ultimately foster awareness for the species throughout our UCLA community and inform future decisions on biodiversity and sustainability of native species on campus. Not only is conserving native species presence on campus integral for healthy ecosystems, but for bolstering student engagement with the environment and conservation. Sage Hill and its inhabitants offer an invaluable source of learning for UCLA students, allowing hands-on study of the natural Southern California environment. The final findings of this project will contribute to the current campus biodiversity goals, inform facilities workers and students about the species, and be used to understand how UCLA can best integrate natural landscapes into our urban campus, overall improving native species' habitat quality and viability.

Methods

Expert Interviews

Firstly, we chose to interview experts who had experience with either big-eared woodrats or similar rodents in urban environments. Firstly, we interviewed Tony Friscia, an associate teaching professor on campus who authored a research paper on rodents like woodrats in Los Angeles parks and natural areas. Next, we interviewed Janine Fischer, a graduate student in the Ecology and Evolutionary Biology department who has extensive experience studying rodents in urban environments. Lastly, we interviewed Tom Wake, an associate adjunct professor in Archaeology and Zooarchaeology who had previously mapped woodrat nests at Sage Hill and the Sycamore tennis courts. We conducted short, informative interviews with our first two interviewees, and then interviewed Tom Wake at Sage Hill, in the field. These interviews provided us with valuable insight into the behavior and management of the big-eared woodrat population on campus.

Field Data Collection

One of the main goals of our research was to examine the distribution of the big-eared woodrat nests on UCLA's campus in order to extrapolate population and habitat data. Our primary – and largest – area of study was Sage Hill. To assess population size and average habitat, we surveyed Sage Hill for woodrat nests using a belt-transect monitoring system. As previously mentioned, our team utilized 12 pre-established, equally spaced transect lines that run between the east-west borders of Sage Hill to conduct a thorough and unbiased land survey. Over the course of several weeks during spring quarter, team members surveyed transects in groups of two or three. Using measuring tape to provide a visual

Figure 1: Laying a transect line using measuring tape, along Transect 5

representation of the transect line they planned to survey, team members walked along the line and scanned for nests on both slides, as far as about twelve meters north and south of each line (*Figure 1*). To find nests, we looked for large piles of sticks or other organic materials and sometimes trash that appeared to be placed together non-coincidentally. Woodrat nests often have discernible features like openings near the ground and precisely, angular cut pieces of vegetation (*Figure 2*). Once we pinpointed a nest, we used the ArcGIS Field Maps application to input the GPS coordinates of the nest into a shared map containing the transect and contour lines of Sage Hill. In addition to its location, the team also recorded each nest's distance from the nearest transect, its width and height, canopy and adjacent shrub vegetation, likelihood of activity, and its composition. To identify plant species in and around the nests, we used iNaturalist's Seek application, which uses AI technology to recognize plant types with a photograph. Besides mapping nest locations, our stakeholder set up trail cameras beside an occupied nest to view woodrats during their active period at night. From the photos the game cameras captured, we were able to see our elusive subject up close as they occasionally left their nests (*Appendix A*).

Figure 2: Evidence of woodrat activity - angular cuts on vegetation with clear teeth markings.

To identify whether a woodrat nest was active or not, we looked for various environmental indicators. Primarily, active nests would have evidence of continued construction, meaning that there may be fresh vegetation with angular cuts (indicative of a woodrat's teeth marks) placed atop or beside the nest. Active nests would also have clear tunnels in and out of it. Additional signs of activity include nearby woodrat droppings, seed pods, and the presence of fleas in the nest, which can sometimes be detected by placing a hand inside a tunnel to feel if any fleas jump onto the skin.

Methods

In addition to Sage Hill, we surveyed for woodrat nests in three other areas: the Sycamore Tennis Courts just south of Sage Hill, the Sunset Canyon Recreation (Sunset Rec), and Stone Canyon Creek. These areas did not have pre-established transect lines, and were small enough that our team could holistically survey the area without them. In these areas, we used the same location and characteristic recording method in the ArcGIS Field Maps app.

GIS Mapping

To visualize our field findings, we used GIS software to map nest locations at Sage Hill and their surrounding vegetation. We first received historic Sage Hill mapping data from our stakeholder. This data includes satellite imagery, major boundaries, trails, and landmarks, previously collected vegetation data, pre-established transect lines, and land topography among other information.

After analyzing pre-existing and newly collected data, we created three types of maps: the first was a reference map highlighting nest locations, designed for Facilities Management or a general audience to help avoid maintenance activities that could disrupt woodrat habitats. The second is an interactive web-based map, housed in our ArcGIS Experience. Intended for stakeholders and future researchers, this map combines historical and current data and allows users to toggle layers of information, filter data, and analyze charts in real-time. Lastly, we produced an interactive ArcGIS Story Map to allow interested parties to learn more about big-eared woodrats on campus. Our ArcGIS Story Map serves as an accessible version of our final report, enabling everyone in the community to better understand our findings, regardless of whether they have a scientific background – this Story Map comprised a major portion of incorporating EDI principles into our work.

Challenges

Our team overcame numerous challenges throughout our research, both physically and digitally. During our field work, efficient data collection required two to three team members surveying at a time. Finding times where two or more members could meet proved to be challenging, and extended the time frame in which we measured the woodrat nests. Originally, we had planned to survey additional natural areas on campus such as the Chancellor's Residence and potential habitat corridors, but because of difficulties in schedule coordination, we did not have enough time to do so. Instead, we focused on gathering thorough and specific data for the areas we had time to access, and we hope that future researchers may survey the areas we did not reach. Additionally, we often found woodrat nests in inaccessible areas like cactus patches or dense, untraversable foliage. This situation prevented us from being close to the nest and affected our ability to determine a nest's width, height, and activity. To mitigate this, we often estimated size by using two members to string measuring tapes across a large area and measured the relative size to the tape's length. We then determined activity based on the evidence we could see from afar, which was most often evidence of continued construction.

A related challenge was cleaning our field data for visualization. During data collection, we had not standardized nomenclature for certain fields like nest activity designations, leading to differences in data entry. For example, To amend this, our team sorted through the data and standardized all measurements and entry data in QGIS. When creating our deliverables, we encountered challenges collaborating in ArcGIS applications, as only the item owner could edit certain files like our Experience and Story Map. This accessibility limitation made it difficult to delegate work evenly and collaborate easily. We ultimately mitigated this difficulty by having individual members of the team separately create layers for the data. The owner of the deliverable could then add individual layers to the file, ensuring that everyone on the team contributed equally.

Results

Expert Interview Insights

Janine Fischer is a Ph.D. candidate in the Ecology and Evolutionary Biology department. Her research is currently focused on the effects of interspecific competition among rodents. Our team was interested in interviewing her due to her expertise in rodent species, and the potential for their behaviors to provide insights into the behavioral ecology of Neotoma macrotis. When asked whether the behaviors she observed in other rodent species could similarly be associated with the behaviors of big-eared woodrats, Fischer hypothesized that the big-eared woodrats might similarly demonstrate urban adaptive traits, like preferring to settle in areas that avoided human disturbances and anthropogenic effects. This hypothesis suggested that there might be a correlation between higher woodrat nest density and lower human activity and noise or light pollution. Following the completion of our project, we observed patterns that support aspects of Fischer's hypothesis, as discussed in greater detail in the Habitat Analysis section.

We also interviewed **Dr. Tony Friscia**, an Associate Teaching Professor whose research has focused on the functional morphology and evolutionary history of carnivorous mammals. We were particularly interested in Dr. Friscia's insight because he has personally conducted research on rodents in natural green spaces around Los Angeles, including Sage Hill where he studied big-eared woodrats and other small rodents. Based on his deep understanding of ecological interactions and prior research, Dr. Friscia emphasized the importance of native vegetation and sufficient habitat area for the success of woodrat populations in urban areas. When asked about the correlation between native vegetation and the presence of big-eared woodrats, Dr. Friscia hypothesized that the native vegetation provides a source of cover and building materials necessary for woodrat populations. He also emphasized the importance of wildlife corridors, noting his discovery that small, disconnected parks – even some with native vegetation – do not support native rodents in urban areas. Looking ahead to future studies, Dr. Friscia suggested investigating the genetic diversity of Sage Hill's big-eared woodrats to identify potential connections between woodrat populations across Los Angeles.

Results

Dr. Tom Wake from UCLA's Department of Anthropology has extensive experience in animal behavior and ecological research methods. He joined us for a walk around Sage Hill and showed us several hands-on ways to tell whether a woodrat nest is active. One of the first things he highlighted was the condition of the nest material. If it looks fresh and recently added, that's usually a sign the nest is in use. He also encouraged us to check for signs of life inside or near the nest such as droppings or leftover seed pods. On the other hand, if spider webs covered most of the nest entrances, that's a good indication the nest hasn't been used in a while and is likely inactive. One especially helpful field technique he shared was inserting a hand into the nest entrance to check for fleas. According to Professor Wake, fleas tend to inhabit nests that are visited often. Therefore, if we begin to feel fleas jump onto our hand after reaching into one of the nest entrances, the nest is likely active. His practical advice was crucial in helping us better understand what to look for when determining nest activity and made our assessments much more reliable.

Field Findings

Our primary area of study was UCLA's Sage Hill, located at the northwest corner of the campus's residential hill, where we found 85 nests in total We also studied areas outside of Sage Hill to assess other potential woodrat habitats, including the vegetated area behind the Sycamore Tennis Courts just south of Sage Hill, Sunset Canyon Recreation Center (Sunset Rec), and Stone Canyon Creek. We found 27 extra nests at the Sycamore location, 3 deteriorated nests at Sunset Rec, and 0 nests at Stone Canyon Creek. See *Figure 3* below.

Results

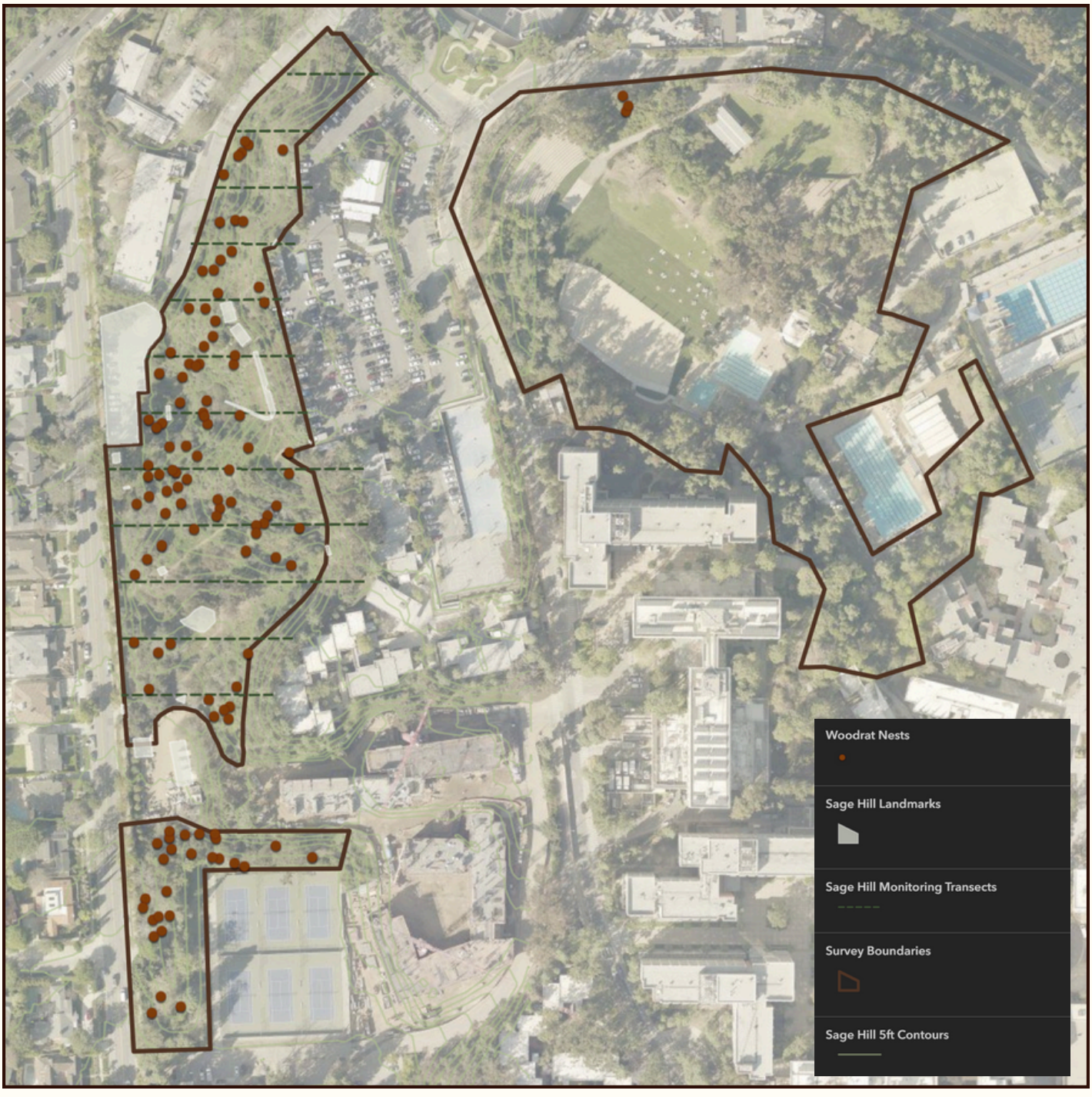


Figure 3: Woodrat nest locations at Sage Hill (top left boundary), the Sycamore Tennis Courts (bottom left boundary), and Sunset Canyon Recreation Center (right boundary). Image taken from web map.

Results

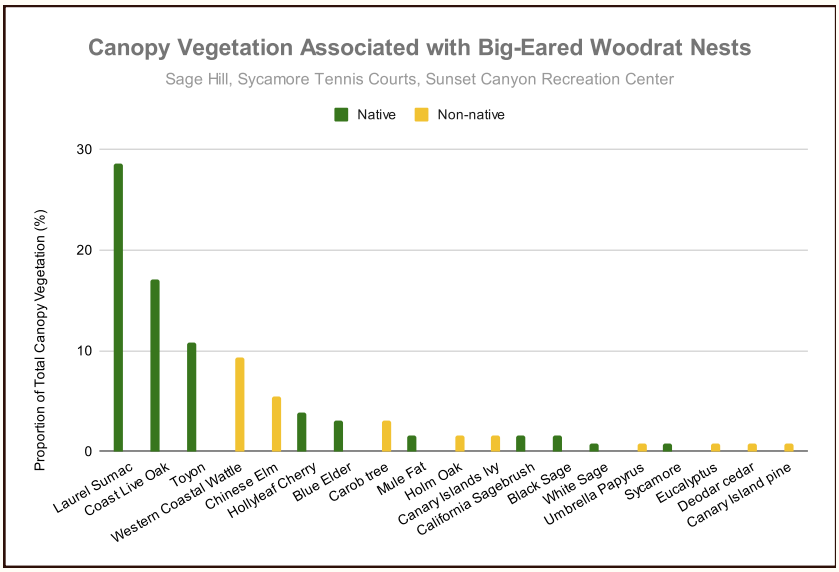


Figure 4: Canopy vegetation associated with nests at Sage Hill, Sunset Rec, and the Sycamore Tennis Courts

Overall, these nests were primarily made out of sticks (82.4%), leaves (13.0%), and grass (4.3%) (*Appendix B*). Woodrats nested primarily under native vegetation, at a rate of 70%. Out of the primary canopy cover, laurel sumac, a southern California native, comprised just under 30% of nest coverage and coast live oak, another native, comprised around 18% (*Figure 4*).

The nests had an average width of 140.9 cm and an average height of 91.7 cm. In all three areas, we found nests in primarily dark, quiet, brushy areas that were well-concealed by branches and canopy cover.

At Sage Hill, woodrats nested in native vegetation the majority of the time, and were often under the canopy of laurel sumac (40.96%) or coast live oak (16.87%) (*Appendix C*). Out of non-nest-covering shrubs associated with nests at Sage Hill, laurel sumac comprised around 12%, giant wild rye grass comprised around 9.6%, and prickly pear cactus comprised around 7.2% (*Appendix D*). However, most nests – around 31% – had no associated shrubs. Woodrats also avoided nesting in areas close to trails. They mainly nested along the center of Sage Hill, on transects 4, 5, and 6 (*Appendix E*). These transects are some of the longest at Sage Hill, but also have some of the densest vegetation.

At the Sycamore Tennis Courts, the vegetation is mainly non-native. Woodrats nested far from the grassy lawn and primarily under the canopy of western coastal wattle, a non-native plant, at a rate of 48% . They also frequently nested alongside Canary Island ivy.

Results

The nests at Sunset Rec were all heavily deteriorated with no signs of activity. We found these three nests under the canopy of hollyleaf cherry, a native plant that we did not find in abundance anywhere at Sunset Rec but the small, dense, dark, and secluded area where the nests were located.

Population Extrapolation

Using methods established by past researchers Linsdale and Tevis (1956) via an article authored by Abad et al. (2020), we extrapolated estimates for the total big-eared woodrat populations across our three studied areas. The researchers postulated that woodrat abundance is proportional to the amount of “usable” nests, calculated by dividing the number of usable nests by the total nests on site. In their paper, “usable” nests were defined as being in “good condition” with evidence of continued construction, insulation, and clear tunnels.

We designated nest activity, or inhabitance, as “Highly likely”, “Likely”, “Unlikely”, “Highly unlikely”, or “Unknown” based on a nest’s characteristics. “Highly likely” means that a nest has three or more pieces of activity evidence – for example, evidence of continued construction, clear tunnels, and seed pods nearby. “Likely” means that a nest has one or more pieces of activity evidence. “Unlikely” means that we found no evidence of activity, and “Highly unlikely” means that we found no evidence of activity, and the nests were extremely small or heavily deteriorated. Here, our “Likely” and “Highly likely” sections align with Linsdale and Tevis’s “usable” designations, and for the purpose of our population estimation, we equated them.

In total, we found 115 nests at Sage Hill, the Sycamore Tennis Courts, and Sunset Rec. Out of 115 nests, 11 were highly likely to be active, 43 were likely to be active, 36 were unlikely to be active, 18 were highly unlikely to be active, and 7 were indeterminable, or unknown (*Appendix F*). For all three areas, our combined abundance proportion was around 47% (*Figure 5*). Assuming there is one big-eared woodrat per usable nest as established by Linsdale and Tevis, there would be roughly **54 woodrats in the total population**.

Results

$$\text{Total area abundance proportion: } \frac{(TOTAL\ Number\ of\ Highly\ likely + Likely\ Active)}{Total\ number\ of\ nests\ found}$$

$$\text{Total abundance proportion: } \frac{(11+43)}{115} = 0.469 \sim \mathbf{47\%}$$

Figure 5: Calculating the total area abundance proportion for overall areas surveyed: Sage Hill, Sunset Rec, Sycamore Tennis Courts. The total area abundance proportion was 47% of nests, meaning that for every 100 nests, one may estimate that there are 47 woodrats in the population.

We may further assess the nest activity and population by area (*Figure* 6). At Sage Hill, we found 85 nests in total. **Sage Hill's** abundance proportion is around 42.4%, meaning that there are an estimated **36 woodrats** in the population (*Appendix G*). At the **Sycamore Tennis Courts**, we found 27 nests in total, and most of them were designated as likely to be active with an abundance proportion of 66.7% yielding **18 woodrats** in the population (*Appendix H*). At Sunset Rec, the three nests we found were all heavily deteriorated and highly unlikely to be active, meaning that we could not calculate the abundance proportion and the population is likely to be 0.

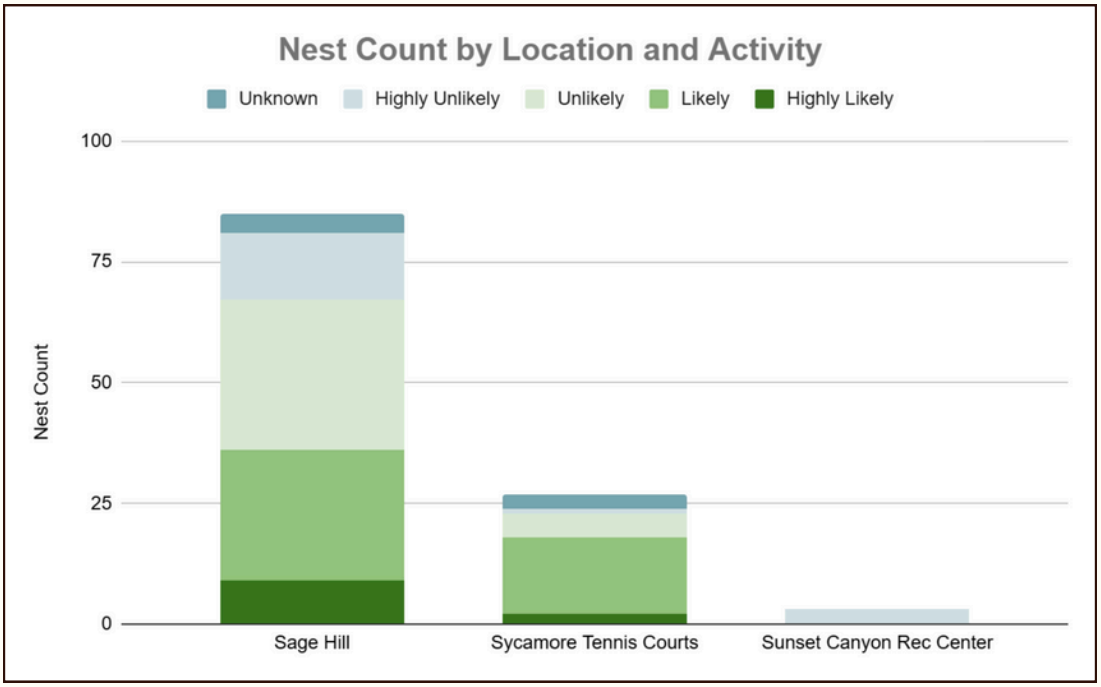


Figure 6: Count of big-eared woodrat nests by activity designation and location.

Data Mapping and Deliverables

ArcGIS Experience Builder

ArcGIS Experience Builder is a web application builder that is a part of ArcGIS Online. Our team developed a web experience using this application to make our data and findings accessible to the public. First, we created a web map on ArcGIS Online where we included the nest location data collected in the field, area boundaries, trails, contours, and imagery. Here, customized and cleaned the pop-ups users will see when they interact with the web map by clicking on nest sites. These pop-ups allow users to see all data associated with each nest, such as width, height, transect, and associated vegetation. Our web map is one of the main focuses of the web experience; users can interact with it by panning, zooming, and selecting data. This web map is also connected to filters, feature information, and charts. When a user selects nests on the web map, the charts and the feature information update, and anytime the user interacts with filters, the web map and the charts update.

The filters we created filter the map by transect number, associated vegetation, canopy vegetation, and area. We also created specific charts, namely a scatter plot of nest dimensions using the width and height data, a nest activity pie chart, and a bar chart of nests per transect at Sage Hill. This web experience is a tangible way for users to explore our findings for themselves rather than relying solely on static charts we have produced in this report. The experience has been configured for desktop, tablet, and mobile devices, making it accessible on any platform. Not only does the web experience display our web map and data, but it also houses our story map, allowing users to explore our methods and findings even further. See Appendix I for a link to the experience.

ArcGIS StoryMap

ArcGIS StoryMaps is an online platform that allows users to create interactive and narrative-based stories. For the purposes of this project, our team developed a story map to communicate the scope, methods, and significance of our research on the big-eared woodrat population at Sage Hill and surrounding

natural areas on the UCLA campus. The StoryMap is an accessible extension of our formal research report that integrates spatial data, maps, photographs, and narrative text to better encapsulate the woodrats' habitat conditions and the conservation challenges they face. From the questions that guided our work and research methodology to our ecological findings and conservation recommendations, the StoryMap walks viewers through our research journey.

The StoryMap was ultimately designed for the purpose of expanding the access to our research in hopes of promoting equity, diversity, and inclusion in science communication. It adjusts the more complex parts of our research and presents them in a way that's easy to follow and visually engaging. This helps us connect with people like local community members and UCLA staff and students who aren't directly involved in academic research. By explaining the importance of urban biodiversity and habitat protection in a clear way, the StoryMap will raise awareness and foster broader support for conservation efforts in urban environments. See Appendix I for a link to the map.

Reference Map and Educational Poster

Finally, we created a reference map with locations of woodrat nests at Sage Hill, along with a short educational poster that informs the public about woodrat habitat and conservation. Both of these deliverables provide at-a-glance information and can be printed out for easy dissemination. They were specifically designed with UCLA Facilities Management staff in mind to help prevent the accidental destruction of nests during routine maintenance and landscaping activities. See Appendix J for the Reference Map, and Appendix K for the poster.

Discussion

Population

We estimated that the total woodrat population across Sage Hill, the Sycamore Tennis Courts, and Sunset Rec is around 54 woodrats. However, it is important to note that estimating rodent populations is difficult due to their behavior. In some cases, many woodrats may live in one nest, woodrats may build and subsequently abandon nests, and one woodrat could inhabit multiple nests. We used a 95% confidence interval to estimate the range of woodrats in the population. Using a z-table and our overall woodrat abundance proportion, we established a range of 44 - 65 woodrats in the total population (*Appendix L*). This interval may account for these varied behaviors.

Habitat Analysis

Based on the locations where we found woodrat nests, we first concluded that there may be a correlation between darkness or shaded areas and woodrat nest locations. This finding corresponds with Janine Fischer's interview, where she noted that the rodent populations she studies tend to stay away from urban activity and from noisy, bright areas with less vegetation. On Sage Hill, woodrats' nests were frequently found away from trails and brightly lit areas. The woodrat nests we located at Sunset Rec particularly assist this theory, as the only nests we found were located along the border of the facility and away from areas of popular human activity, in dark and dense shrubbery.

We also noted that woodrats seemed to have a preference for native vegetation, specifically laurel sumac and coast live oak. On Sage Hill where laurel sumac comprises 11% of the vegetation according to the 2024 IoES Sage Hill Practicum project (*Appendix* C), it contributed to woodrat nest canopy 40% of the time. When we conducted a z-test of the difference between laurel sumac nest canopy proportion and laurel sumac's overall proportion of vegetation at Sage Hill, our z score was 9.57, yielding a p-value of less than 0.0001 (*Appendix M*). These findings correspond with our interview with Tony Friscia, who postulated that woodrat populations might prefer native vegetation. In our field work, we noticed that laurel sumac could provide good shelter and structure for woodrat nests, as they provide ample shade, have a narrower trunk, and low

branches that allows the woodrat nest to be built upon, and they have seed pods that woodrats may use as a food source. Furthermore, the few nests we found at Sunset Rec were all under the canopy cover of hollyleaf cherry, another southern California native tree, potentially suggesting that the woodrats who populated the area long ago preferred native plants.

Interestingly, the woodrat population at the Sycamore Tennis Courts mainly nested under the canopy of the non-native Western Coastal Wattle. At a glance, these bushes have similar characteristics. Both grow to 15 to 20 feet in height, have long leaves, a dense canopy, seed pods which may serve as a readily available food source, and a sturdy, woody base upon which woodrats can effectively build their nests. Woodrats present at Sage Hill may have migrated to Sycamore through a small vegetated corridor located at the south end of Sage Hill. We hypothesize that there is a relatively large woodrat population there because of the dense foliage – so dense at times that our researchers could not walk through – low light level, and less frequent disturbances. While Sage Hill is a well-established and heavily researched area, the Sycamore area is quiet and rarely has humans walking through the vegetation. Although there are few native plants present, woodrats may have found the wattle bush suitable because of its similar characteristics to bushes like Laurel Sumac. This suggests that while native plants may be preferred, woodrats may be able to survive if other preferable conditions, such as high foliage density, low light levels, and low disturbance levels are concurrently met, though further research would be required to prove this.

Conservation Strategies

Our team proposes to increase native vegetation across UCLA's campus, which we found to be a key factor in supporting the big-eared woodrat's population. After our analysis, we concluded that the population particularly prefers to nest in proximity to laurel sumac and coast live oak, which are both woody native plants with denser canopy, ample shade, and a strong base. This implementation would be especially effective in locations with minimal human

disturbances, as our team also observed a correlation between woodrat nests and locations distant from frequently used trails. Potential areas that we have identified as being preferable to implement these suggestions include Sunset Canyon Recreation Center, Stone Canyon Creek, and behind the Sycamore Tennis Courts. This will allow for a greater amount of suitable habitat for woodrats throughout campus which would increase population size, and make the woodrats resilient to environmental disturbances. However before this implementation, it would also be important to consider the impact of changing vegetation on species other than the big-eared woodrat.

We also recommend continuing to monitor nesting activity over time. This sustained effort is essential in order to detect changes in the population, evaluate the effectiveness of conservation measures, and to support ongoing efforts to ensure the long-term protection and survival of the woodrat population. Future researchers could utilize our same woodrat abundance proportion(s), similar to research conducted by Abad et al. (2020), to estimate changes in the population throughout time.

Finally, it would be highly beneficial to inform more members of the campus community about the woodrat population in order to raise a greater awareness of their ecological needs, and to make sure that their nests are easily identifiable to prevent disturbances.

Implications of Research

Our research on big-eared woodrat nesting habits and vegetation preferences helps promote campus sustainability by highlighting the importance of native plants in supporting local wildlife. By identifying the native vegetation that woodrats favor, our findings provide valuable guidance for habitat restoration efforts aimed at promoting these plant species. This approach fosters healthier ecosystems that benefit native species. Our team's findings further complement ongoing initiatives to control and replace invasive species, offering a framework to enhance biodiversity and ecosystem resilience.

Conclusions

Future Research Capabilities

We are confident that our research and deliverables will serve as a useful foundation for future researchers studying N. macrotis, Sage Hill, or, broadly, native species in urban environments. Our research will ultimately help educate our community and further UCLA's biodiversity-specific sustainability goals by assessing the state of the big-eared woodrats subpopulation on campus and recommending conservation strategies to protect this native species.

Based on our research, we would also recommend further exploration of habitat corridors to support population connectivity and genetic diversity among fragmented woodrat territories. These corridors could be identified in the field or by using advanced drone footage or mapping software to assess habitat suitability and potential routes. The effectiveness of these corridors could be evaluated through the use of trail cameras to monitor current wildlife movement.

In our quest to assess the big-eared woodrat population, we were able to gauge their population size, nest locations, and relevant microhabitats across vegetated areas in UCLA's northwest campus. We ultimately compiled enough data on habitat preferences to produce thoughtful recommendations on how UCLA can best improve monitoring and conservation efforts for the species to support their success even when threated by ongoing development. Although our research cannot be extrapolated to the entirety of the region in which big-eared woodrats can be found, we hope that it will still provide valuable insights, especially regarding woodrat populations in urban areas. Big-eared woodrats are a vital native species that inhabit our campus, and through our research and recommendations, will continue to thrive in the future.

Acknowledgements

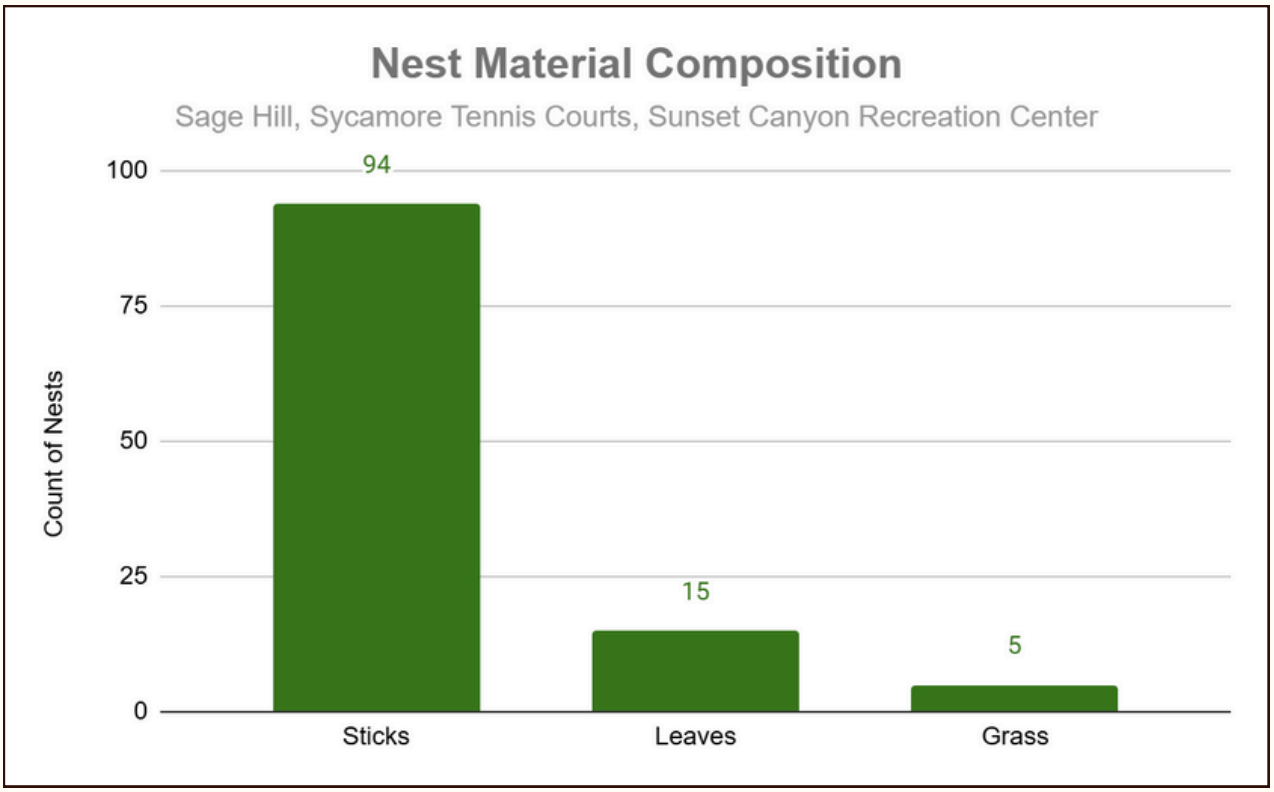
We would like to thank everyone who helped support our project. We would especially like to thank our stakeholder, Dr. Andy Kleinhesselink, for providing guidance and resources as we learned the ropes of field research and analysis. We would also like to thank our interviewees - Janine Fischer, Dr. Tony Friscia, and Dr. Tom Wake - for providing valuable insight on rodents, Sage Hill, and more. Our campus advisors Bonny Bentzin and Nurit Katz were also especially helpful in guiding us through the structure of UCLA and connecting our project with UCLA's wider environmental network. Finally, we would like to thank everyone in the SAR program: Audrey Jason, Gabrielle Biederman, Dr. Cully Nordby, and Professor Carl Maida. Without them, this project would not have come to fruition. Thank you again to all!

Appendix

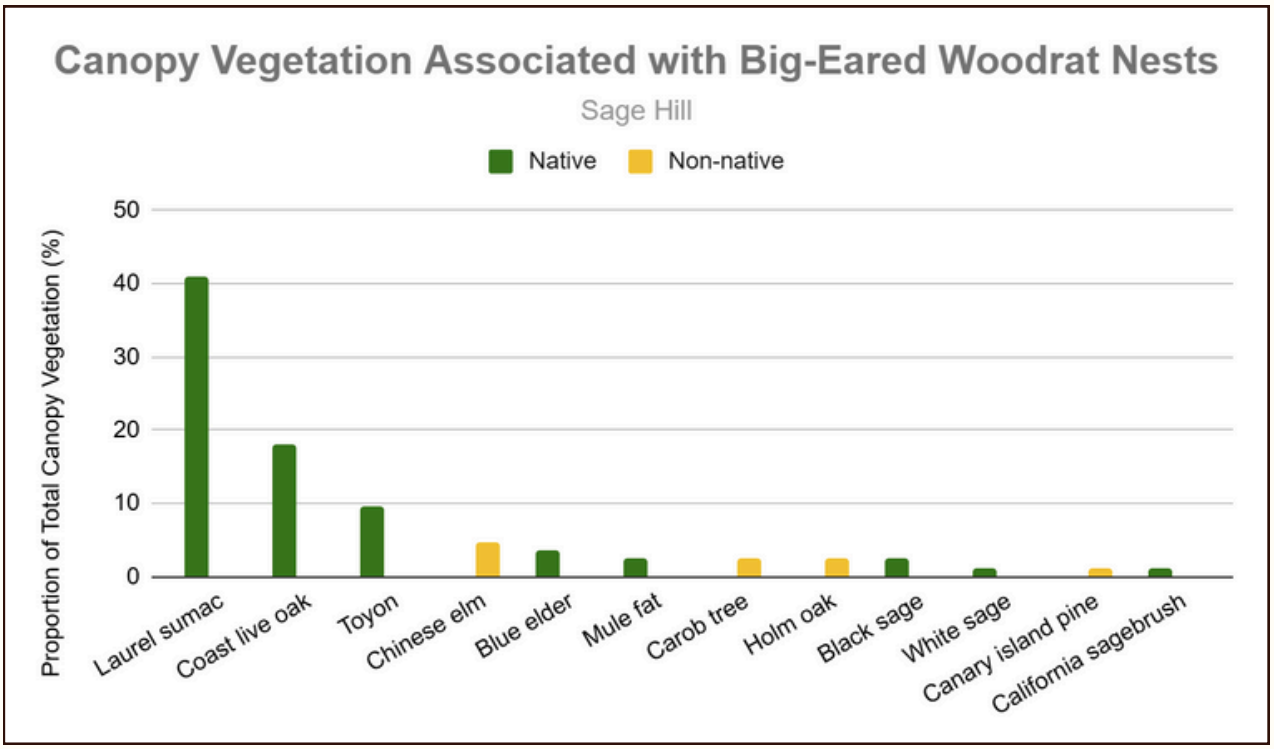
Appendix A - Game Camera Woodrat Images

Appendix

Appendix B - Nest Material Composition Chart

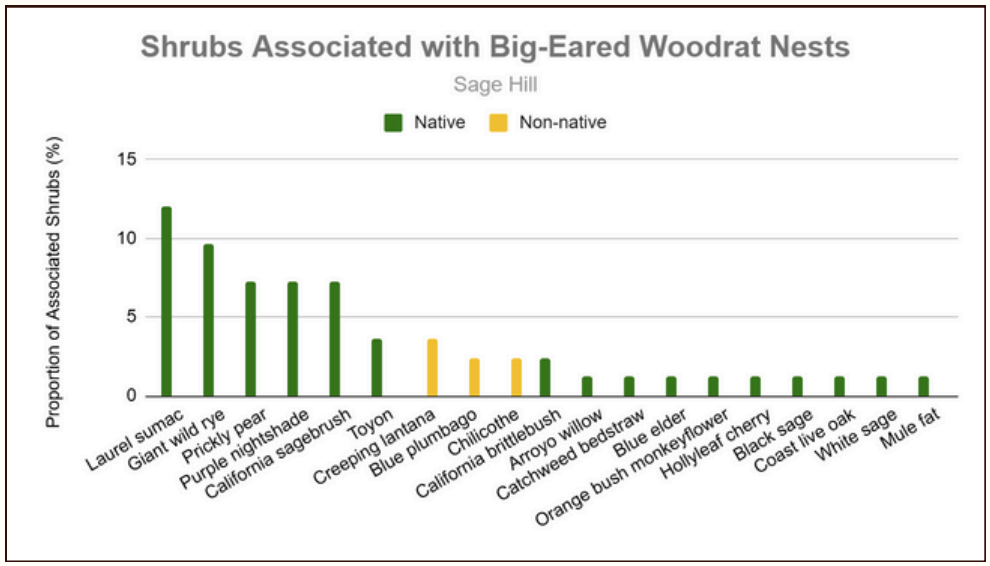


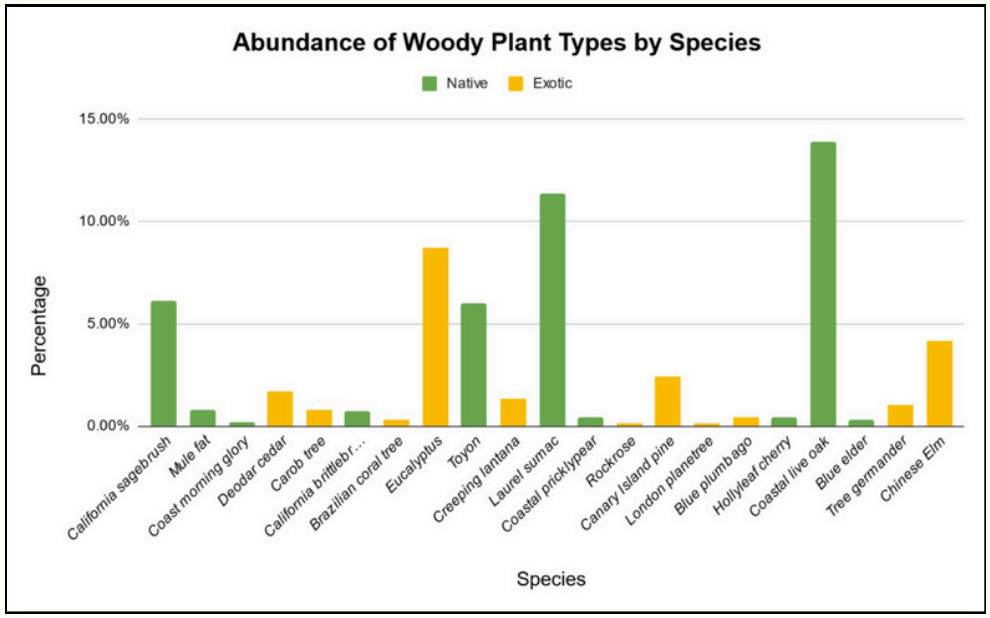
Appendix C - Associated Nest Canopy Vegetation at Sage Hill



Appendix

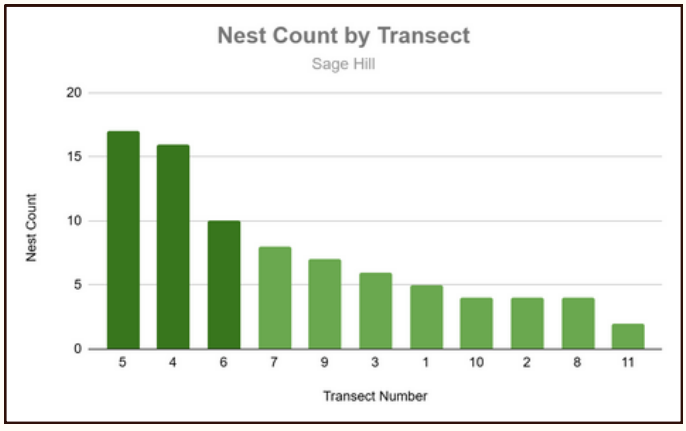
Appendix D - Associated Nest Shrubs at Sage Hill





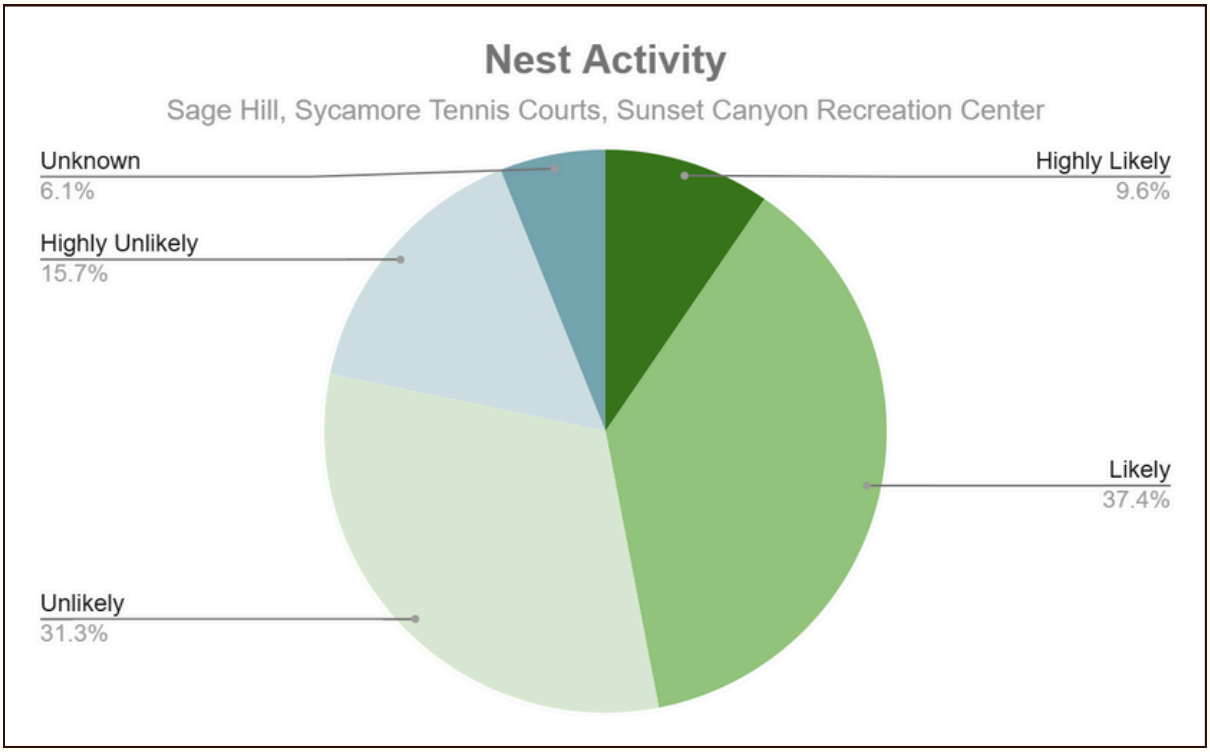
(Second chart via Sage Hill 2024 Practicum ArcGIS StoryMap)

Appendix E - Nest Count by Transect at Sage Hill



Appendix

Appendix F - Overall Nest Activity



Appendix G - Sage Hill Abundance Proportion

$$\textit{Sage Hill abundance proportion: } \frac{(\textit{Number of Highly likely + Likely Active})}{\textit{Total number of nests found}}$$

$$\textit{Sage Hill abundance proportion: } \frac{(9+27)}{85} = 0.4235 \sim \mathbf{42.4\%}$$

Appendix H - Sycamore Abundance Proportion

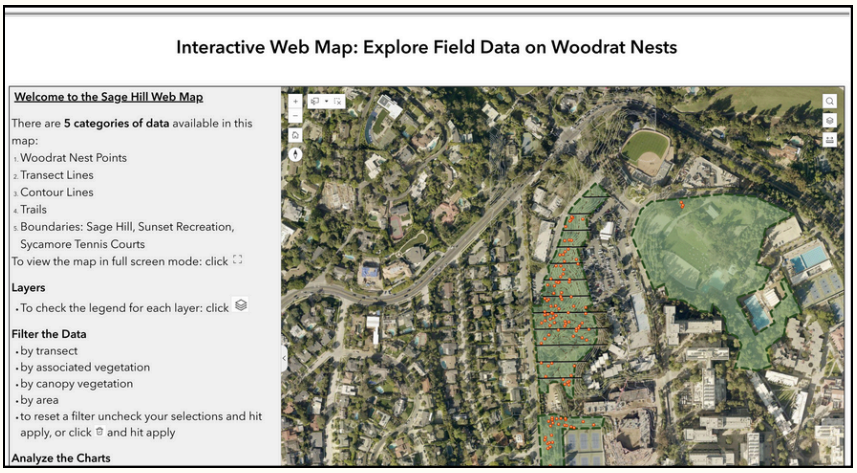
$$\textit{Sycamore abundance proportion: } \frac{(\textit{Number of Highly likely + Likely Active})}{\textit{Total number of nests found}}$$

$$\textit{Sycamore abundance proportion: } \frac{(2+16)}{27} = 0.6666 \sim \mathbf{66.7\%}$$

Appendix

Appendix I - Web Deliverables

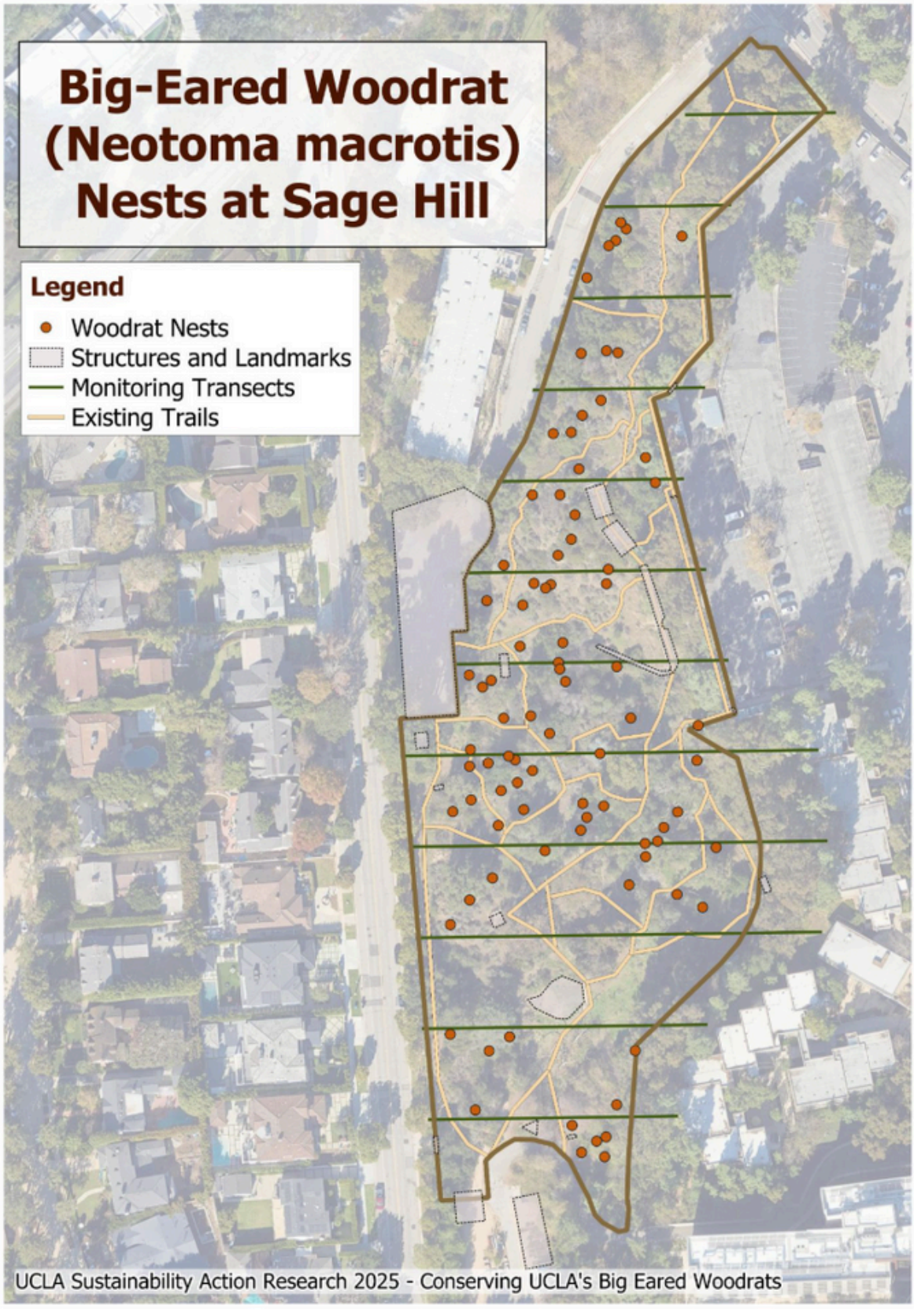
ArcGIS Experience



ArcGIS Storymap

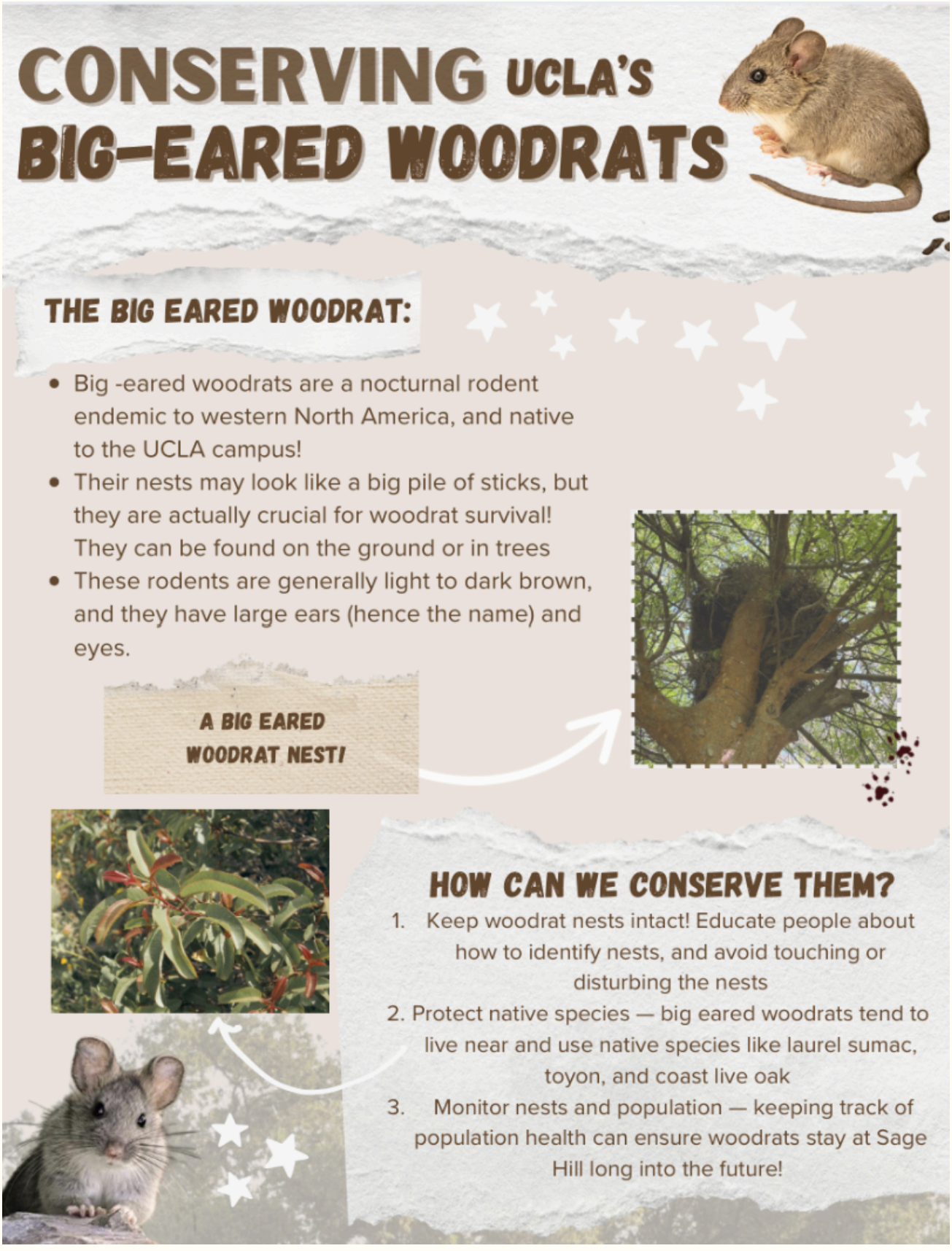
Appendix

Appendix J - Reference Map



Appendix

Appendix K - Educational Poster



Appendix

Appendix L - Population 95% Confidence Intervall

$$\hat{p} = \frac{(Number\ of\ Highly\ likely + Likely\ Active)}{Total\ number\ of\ nests\ found} = \frac{54}{115} = 0.4696$$

$$CI = \hat{p} + z \cdot \sqrt{\frac{\hat{p}(1-\hat{p})}{n}} = 0.4696 \pm 1.96 \cdot 0.0466$$

$$CI = 0.4696 \pm 0.0913$$

$$\textbf{\textit{Lower bound}} = 0.3783, \textbf{\textit{Upper bound}} = 0.5609$$

$$\boldsymbol{L}: 0.3783\ x\ 115 = 43.5 \sim \mathbf{44}, \boldsymbol{U}: 0.5609\ x\ 115 = 64.5 \sim \mathbf{65}$$

Appendix M - Laurel Sumac Abundance Z-test

$$z = \frac{\hat{p} - p_0}{\sqrt{\frac{p_0(1-p_0)}{n}}} = \frac{0.40 - 0.11}{\sqrt{\frac{0.11(1-0.11)}{100}}} = \frac{0.2996}{\sqrt{\frac{0.0979}{100}}} = \sim 9.57$$

$$p < 0.0001$$

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