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The Changing Role of Herbaria in the Twenty-first Century and a Case Study of the University of California Los Angeles Herbarium

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The Changing Role of Herbaria in the Twenty-first Century and a Case Study of the University of California Los Angeles Herbarium

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by

Rachel Lian Poutasse

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ABSTRACT OF THE THESIS

The Changing Role of Herbaria in the Twenty-first Century
and a Case Study of the University of California Los Angeles Herbarium

by

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Master of Library and Information Science
University of California, Los Angeles 2019
Professor Leah A. Lievrouw, Chair

Once considered a central component of research in the plant sciences, herbaria are subject to changes in how biological research is conducted and the shifting priorities of the larger institutions they belong to. Especially in the context of higher education, herbaria have become increasingly vulnerable as public universities adopt a market-based approach to funding. Consequently, herbarium staff have had to look elsewhere for support. Through observations, interviews, and a review of archival materials, this thesis explores how the staff at five of the herbaria in the University of California system have adapted to these conditions and redefined their missions, with a closer look at the UCLA Herbarium. Despite the challenges, herbarium staff have remained resilient and strongly invested in their collections. Finally, I offer an

assessment of the strengths and weaknesses of the UCLA Herbarium as it enters a major transition period, and provide recommendations to staff.

The thesis of Rachel Lian Poutasse is approved.

Ellen J. Pearlstein

Gregory H. Leazer

Leah A. Lievrouw, Committee Chair

University of California, Los Angeles

2019

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I would like to thank the herbarium staff at UC Davis, UC Riverside, UC Berkeley, and UC Irvine, who generously gave me their time, answered my questions, and provided many valuable insights. I am especially grateful to the UCLA Herbarium and Mildred E. Mathias Botanical Garden staff, volunteers, student workers, and faculty. It has been a privilege to work with such a wonderful group of people during this very exciting time. Even though we don't know what the future has in store for this herbarium, I am glad it is in good hands.

Finally, words cannot express my gratitude towards my family, who have lifted me up time and time again. I love you.

Chapter 1. Introduction

Herbaria are collections of dried pressed plants used primarily for research and teaching in botany and related fields. The 2018 Index Herbariorum annual report counted a total of 659 herbaria run by nearly 1700 staff in the United States, containing some 76.5 million specimens in all. While some of these herbaria are large, such as the New York Botanical Garden [NYBG] (7.8 million specimens), the Missouri Botanical Garden [MO] (6.6 million specimens), and the Smithsonian [US] (5.1 million specimens), most herbaria are far smaller.[1] These herbaria may contain just a few hundred specimens housed in a single cabinet, or may number in the tens or hundreds of thousands of specimens. They typically exist within the context of a larger entity, such as a university, botanic garden, government agency, or museum. Because they require significant amounts of resources and specialized labor to maintain, they are therefore subject to changes in priorities and circumstances of their parent institution. Just as they are affected by changes within the parent institution, they are also impacted by wider trends in how biological research is conducted: although technological advances such as DNA extraction techniques and ability to share and analyze data on a broader scale have expanded the range of uses of herbarium specimens, herbaria themselves may be perceived as antiquated and not viewed as a core component of plant sciences research as much as they once were, especially as molecular biology has taken center stage. Furthermore, while all types of herbaria may be threatened by funding cuts, the shift towards privatization and market-based approaches at public universities in particular have affected how herbaria at these institutions are valued by administrators,

[1] Barbara M. Thiers, "The World's Herbaria 2018: A Summary Report Based on Data from Index Herbariorum," Index Herbariorum, January 10, 2019, http://sweetgum.nybg.org/science/docs/The_Worlds_Herbaria_2018.pdf: 6-7.

causing staff to increasingly focus their energies on proving the continued relevance and importance of their collections.

Given these changes in how plant science research is conducted and the continued effects of market-driven ideologies in public universities, in this thesis I consider the following questions: how have herbaria survived and adapted to change within the public university setting, and how are they redefining their missions and values in this new era? I begin first by exploring the two trends mentioned above, and by examining the practices and strategies of the staff of five herbaria in the University of California system (Berkeley, Davis, Riverside, Irvine, and Los Angeles). Although the five herbaria in this study range considerably in size and focus, I identify three common themes that emerged from interviews and site visits: the personal investment of herbarium staff and their affiliates, the relationships and networks these staff rely on for support inside and outside the university, and how, in turn, these staff make use of and negotiate for space, one of their most precious resources. Because university support alone is not sufficient for the continued survival and growth of herbaria in the UC system, herbarium staff have developed their own strategies to secure additional funding and demonstrate their value. These strategies may include taking on consulting work, outreach to communities beyond the usual circles of academic researchers, seeking grants for specific projects, or some combination of the three. This requires significant labor and dedication on the part of staff, and as well as the ability to form strong relationships for support. Especially for smaller herbaria, where a single staff member may wield outsized influence, the transition period after that individual leaves or retires can result in increased vulnerability of the collection to neglect or even disposal.

I also take a closer look at the UCLA Herbarium, a collection that has suffered from decreased use in past decades as the faculty that formerly made up its main user base left the

university and were not replaced. The herbarium is now in the midst of a major transformation as its staff prepare for a renovation. While the renovation offers a major opportunity for renewal, a remodeled space alone is not enough to guarantee sustainability and increased use, and the herbarium cannot expect the university alone to provide the necessary infrastructure and support. Through observations and interviews with staff, faculty, student workers, and volunteers, I examine the history and current status of the herbarium, and set forth possible futures for the collections, ending with a series of recommendations for this herbarium.

Botanical research and herbaria in the United States

Although plant collecting itself is a very old practice, herbaria as institutions are much more recent. In his 1969 survey of herbaria, Stanwyn Shetler identifies the herbarium at the University of Padua (established in 1545) as the earliest institutionalized herbarium. He notes that herbaria grew slowly in number until the second half of the eighteenth century. The first herbaria in the North American colonies was established during this period, although most of these collections were short-lived. The creation of new herbaria then accelerated during the second half of the nineteenth century up through the mid-twentieth century and peaked in the 1920s, when over 90 herbaria were founded in that decade alone, and then dropped off. Shetler connects the rise of herbaria in this period to corresponding activity in the field of plant systematics and the establishment of land grant universities in the United States and strong support for agricultural sciences.[2]

However, even as the number of herbaria grew rapidly during this period, the nature of botanical research itself was changing. According to Keeney, during the second half of the

[2] Stanwyn G. Shetler, "The herbarium: past, present and future," Proceedings of the Biological Society of Washington, 82, no. 2 (1969): 695-698, https://www.biodiversitylibrary.org/item/107490#page/311/mode/1up.

nineteenth century, botany transformed from an activity where amateurs and professionals could collaborate as equals into a more exclusively professional discipline which emphasized a narrower biological approach over its traditional focus on natural history. While earlier botanists had primarily studied taxonomy and floristics, the "New Botany" that emerged was based on experimental laboratory work rather than field collecting and plant identification.[3] Herbarium specimens were clearly essential for taxonomic work, but their uses in laboratory-based biological science were less clear-cut, particularly in light of new developments in cellular and molecular biology. While Laurence Vail Coleman, Director of the American Association of Museums, briefly noted this trend in a 1942 report on the status of college and university museums, he nevertheless confidently stated that "creditable museums are needed on every campus. In the fields of art and of biological and geological science…museum material is the only ground on which a large part of teaching and research can rest."[4] But less than thirty years later, Stanwyn Shetler described the profound sense of unease over the future of herbaria: "The university herbarium today (indeed the herbarium in general) seems at best to lead a fragile existence, and no amount of leadership and activity can cover up the ever-present stresses and strains that threaten this existence constantly."[5] Shetler argued that because of the increased emphasis on molecular biology and decline of classic botany, there was a danger that university administrators would be more likely to view herbaria as outdated and too expensive to maintain,

[3] Elizabeth Keeney, *The Botanizers: Amateur Scientists in Nineteenth-Century America* (Chapel Hill: University of North Carolina Press, 1992), 146-149.

[4] Laurence Vail Coleman, *College and University Museums: A Message for College and University Presidents* (Washington, D.C: The American Association of Museums, 1942), 3.

[5] Shetler, 715.

and curators needed to consider new strategies to ensure the survival of collections—an insight that would undoubtedly be familiar to contemporary curators.

At the same time, while the evolution of the field has resulted in changes in the perceived and actual relevance of herbaria, technological advances have allowed for new uses of specimens beyond traditional taxonomy and floristics. Techniques to extract DNA from specimens were pioneered in the 1980s and refined over the following decades, transforming the ways in which evolutionary biology research is performed.[6] The Internet has vastly expanded the ability of herbaria to share specimen data, which in turn permits spatial and temporal analysis of plant populations on a large scale.[7] Improvements in imaging technology have spurred mass specimen digitization projects, which not only reduce the need in some cases for herbaria to send specimens on loan or require researchers to visit in person, but have also led to new methods for morphological analysis. Therefore, although the trends in biological sciences that began in the late 19th century show no signs of reversing and the challenges that Shetler wrote about nearly fifty years ago remain relevant today, it is also the case that herbaria are being used by researchers in more diverse and innovative ways.

Market-based ideology, higher education, and cultural heritage institutions

Beyond changes in how biological research is performed, herbaria are also subject to the needs and priorities of the larger institutions they are a part of, whether those are nonprofit

[6] Rogers and Bendich, for instance, successfully developed methods to extract DNA from herbarium specimens in 1985: see Scott O. Rogers and Arnold J. Bendich, "Extraction of DNA from Milligram Amounts of Fresh, Herbarium and Mummified Plant Tissues," *Plant Molecular Biology* 5, no. 2 (March 1, 1985): 69–76, https://doi.org/10.1007/BF00020088.

[7] One example of this is SEINet, which describes itself as "a suite of data access technologies and a distributed network of collections, museums and agencies that provide environmental information." "Welcome to SEINet," SEINet Arizona-New Mexico Chapter, accessed March 7, 2019, http://swbiodiversity.org/seinet/.

botanical gardens, museums, government agencies, or public or private universities. In the university context, herbaria, like other types of cultural heritage institutions, are increasingly scrutinized within a market-driven framework, in which the market is considered the most rational and effective means to distribute resources. Furthermore, public universities face additional political pressure to shift the costs from taxpayers to students and prove that public funds are being used in ways that provide the maximum return on investment. In California, the share of the budget allocated for higher education has declined from 18% to 12% from 1976-77 to 2016-17, resulting in significant tuition and fee hikes in the University of California and California State University systems.[8] Among the UCs, as of 2019, only 10.3% of the budget is provided by the state general funds, and the average expenditure per student from the state general funds (adjusted for inflation) declined from $19,920 in the 1990-91 fiscal year to just $7, 730 for 2016-17. Gaps in state funding are filled by a combination of tuition and fees, private funds, sales and services, grants, and revenue from medical centers.[9] In this environment, units within the university must compete for shrinking resources or seek funding elsewhere. This is often done by applying for grants or seeking private donations—solutions that tend provide temporary support for specific projects, as opposed to long term stability.

Apart from the loss of public funding, neoliberal ideologies have had other effects on higher education. According to Wendy Brown, neoliberalism is not just a set of economic

[8] Kevin Cook, "Just the Facts: Higher Education Funding in California," Public Policy Institute of California, accessed March 8, 2019, https://www.ppic.org/publication/higher-education-funding-in-california/.

[9] "Budget for Current Operations: A Summary of the Budget Request As Presented to the Regents for Approval, 2019-20," University of California, 6-9, https://www.ucop.edu/operating-budget/_files/rbudget/2019-20-budget-summary.pdf.

policies but a "governing rationality" that targets liberal arts education. She traces the post-World War II transformation of public universities from institutions that promoted social mobility and the public good into institutions dedicated to building human capital and consolidating elite power. In this view, the primary purpose of education is to gain the skills and knowledge necessary to obtain capital.[10] One manifestation of this is the means by which knowledge itself is produced. Rebecca Lave examines how market-driven ideologies in the sciences create an environment where research is favored over teaching, costs are transferred from the public to private sector, the peer review process is commercialized, and where research emphases are driven by "relevance"—in other words, by their market potential.[11] In a climate in which the ability to win grants is a determining factor in whether faculty can gain tenure and support their labs, it is perhaps not surprising that basic taxonomic research has less appeal to administrators, let alone the unglamorous and expensive work of day-to-day collections maintenance.

The effects of market-driven ideologies on other types of cultural institutions in academic settings have also been studied, especially libraries. Brian Quinn, for example, applies George Ritzer's concept of "McDonaldization" to academic libraries, naming practices such as gathering statistics to justify costs and tracking response times for certain services to measure efficiency as evidence of this trend.[12] John Buschman has also written on numerous aspects of this issue. He

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[10] Wendy Brown, *Undoing the Demos: Neoliberalism's Stealth Revolution* (New York: Zone Books, 2015), 174-188.

[11] Rebecca Lave, "Neoliberalism and the Production of Environmental Knowledge," *Environment and Society: Advances in Research* 3 (2012), 22-23.

[12] Brian A. Quinn, "The McDonaldization of Academic Libraries?" *College & Research Libraries* 61, no. 3 (May 2000), 341-342.

describes five ways in which neoliberalism manifests in libraries: through a new emphasis on marketing and individualized customer service, a focus on return on investment and documentation of spending, intrapreneurialism or competition within libraries to raise funds, managerialism and the use of quantitative metrics to measure "quality", and the push for technological innovation.[13] Jeff Lilburn critiques audit culture and the widespread adoption of the standardized LibQUAL+ survey by libraries, which he claims reduces students and other patrons to consumers and customers while ignoring local differences and needs.[14] Finally, librarians (academic and otherwise) have had to contend with questions surrounding the de-professionalization of the field and challenges to the underlying values of the profession, which are not always easy to document or demonstrate worth in ways that many administrators have come to expect. Bill Crowley and Deborah Ginsburg, for instance, suggest that the increased dominance of these market-based ideologies have tended to push paraprofessionals into taking on duties that had previously belonged to professional librarians and have forced librarians to constantly defend their roles. They even suggest that the success of academic librarians in increasing access to electronic sources has backfired by fueling perceptions that librarians themselves are no longer needed.[15]

However, little existing literature specifically explores the impacts of these market-driven policies on herbaria and other types of natural history collections in the context of higher

[13] John Buschman, "Doing Neoliberal Things with Words in Libraries," *Journal of Documentation* 73, no. 4 (2017), 597-598.

[14] Jeff Lilburn, "Ideology and Audit Culture: Standardized Service Quality Surveys in Academic Libraries," *Portal : Libraries and the Academy* 17, no. 1 (January 2017): 100. http://dx.doi.org/10.1353/pla.2017.0006.

[15] Bill Crowley and Deborah Ginsberg, "Professional Values: Priceless," *American Libraries* 36, no. 1 (January 2005), 52–53.

education. This may be because many of these collections—with some notable exceptions such as the Berkeley herbaria—tend to be relatively small, highly specialized, and embedded within particular departments. Furthermore, another key difference between academic libraries and herbaria lies in the issue of staffing and organization, as herbaria are typically led by curators with advanced degrees in botany or related fields. While these curators have deep knowledge of the subject and experience conducting research, they may have less familiarity with other areas that tend to be the focus of librarians, such as outreach or improving access to their collections.

Crisis narratives and demonstrations of value

How, then, have these trends affected herbaria and their staff? The anxiety described by Shetler in 1969 is palpable. Even a brief survey of herbaria and natural history collections in the news reveals an array of dramatic and dire headlines: "Plant collections left in the cold by cuts,"[16] "Nation's botanical treasure troves 'under huge threat,'"[17] "Museums: the endangered dead."[18] These articles paint a bleak picture of the future of collections, frequently by pointing to specific instances of funding cuts and closures and through interviews with collections staff detailing the types of knowledge that are lost when collections are neglected or destroyed. However, while the overall narrative tends to suggest the ultimate disappearance of herbaria, the reality may be more complicated. It is certainly the case that closures receive more publicity, especially for larger collections, such as in the 2017 shuttering of the natural history collections

[16] Boer Deng, "Plant Collections Left in the Cold by Cuts," *Nature News* 523, no. 7558 (July 2, 2015): 16, https://doi.org/10.1038/523016a.

[17] Helen Briggs, "Nation's botanical treasure troves 'under huge threat,' BBC News, December 1, 2018, https://www.bbc.com/news/science-environment-46374291.

[18] Christopher Kemp, "Museums: The Endangered Dead," *Nature News* 518, no. 7539 (February 19, 2015): 292, https://doi.org/10.1038/518292a.

at the University of Louisiana Monroe in order to renovate a running track.[19] Yet Index Herbariorum shows an increase in the number of registered active herbaria worldwide from 1960 (1850 herbaria) to 2018 (3095 herbaria), rather than a decline. Similarly, the reported number of specimens worldwide has jumped from 149 million in 1960 to over 387.5 million in 2018.[20] While the raw numbers do not address the health of individual herbaria and Index Herbariorum data may not be completely accurate because it is self-reported and only includes registered herbaria, this does not exactly square with the notion that collections will inevitably vanish. An interesting parallel to the steady (if slowed) growth of herbaria during the second half of the twentieth century is the rise of seed banks, which arose in response to concerns about the loss of genetic diversity in crops due to advanced breeding techniques: a very similar argument to the one often advanced by herbarium curators that their collections provide a valuable record of threatened biodiversity.[21]

Whether or not herbaria are truly disappearing, the pressure felt by collections staff to justify the continued support of their collections and prove their relevance is certainly real. Professional societies such as the Society of Herbarium Curators (founded in 2005) and the Society for the Preservation of Natural History Collections (founded in 1985) have been formed specifically to address these threats. The Society for the Preservation of Natural History Collections [SPNHC] Wiki names funding cuts, changes in research or teaching focus,

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[19] Sarah Kaplan, "A University Is Eliminating Its Science Collection — to Expand a Running Track," Washington Post, July 5, 2017, https://www.washingtonpost.com/news/speaking-of-science/wp/2017/03/29/a-university-is-eliminating-its-science-collection-to-expand-a-running-track/

[20] Thiers, 17-18.

[21] Sara Peres, "Saving the Gene Pool for the Future: Seed Banks as Archives," *Studies in History and Philosophy of Biological and Biomedical Sciences* 55 (February 1, 2016), 98-99.

retirements, and institutional reorganizations as the major reasons why collections become orphaned, and urges collections staff to take a variety of proactive measures such as documenting their collections and developing collections policies and plans. Their top two suggestions are "to communicate the importance of natural history collections" and "justify the cost of collections care and management."[22] Beyond basic collections maintenance and fulfilling research and teaching needs, SPNHC implies that collections staff must become public relations experts who can market their collections to administrators and the public.

One major thrust of this public relations effort has been to emphasize various practical applications for uses of specimens. Traditional taxonomic research and teaching alone are no longer viewed as sufficient demonstrations of value. Tewksbury et al., for example, point to applications for specimens in human health, food security, conservation, and recreation—all areas with clear economic implications.[23] Vicki Funk lists 72 uses for herbarium specimens, ranging from basic research functions (e.g. naming species that are new to science) to more creative notions such as artistic inspiration and design or plant identification for use in forensic investigations.[24] Beyond descriptions of actual and potential uses of specimens, Bradley et al., having previously documented the monetary costs of collecting and maintaining mammal specimens at the Museum of Texas Tech University, attempted to assess the benefits of five years of collecting activity. While the authors do emphasize that many of the benefits of

[22] "Threatened and Orphaned Collections," SPNHC Wiki, accessed March 8, 2019, https://spnhc.biowikifarm.net/wiki/Threatened_and_Orphaned_Collections.

[23] Joshua J. Tewksbury et al., "Natural History's Place in Science and Society," *BioScience* 64, no. 4 (April 1, 2014): 300–304, https://doi.org/10.1093/biosci/biu032.

[24] Vicki Ann Funk, "100 Uses for an Herbarium: well at least 72," *American Society of Plant Taxonomists Newsletter* 17, no. 2 (2003): 17-19.

maintaining collections are not easily quantifiable, their measures included the number of loans, number of students trained, number of publications produced, and number of visitors.[25] Their reliance on statistics to demonstrate value is clearly analogous to data-gathering practices of academic libraries described by Quinn. The underlying market-based logic is made explicit by Winker, who argues that collections must find a new "business model" to survive, consider different "rewards systems", and redirect their focus to satisfy a wider range of "clients."[26]

While lists and articles such as those mentioned above are clearly written for the staff of herbaria and other natural history collections who wish to demonstrate value to administrators through explanations of practical uses and quantitative assessments, other types of articles are targeted towards the public. It is not enough to focus solely on convincing administrators of the worth of collections: public buy-in and support is also seen as necessary. In addition to presenting information about practical uses of specimens, these articles sometimes draw on nostalgia. One example of this is Robinson Meyer's 2016 piece in *The Atlantic* titled "What Good Is A Library Full of Dead Plants?" Drawing heavily on quotes from UC Berkeley Herbaria Director Brent Mishler, Meyer's article mentions uses for specimens in understanding the impacts of climate change on biodiversity and recent initiatives to digitize specimen data. The aim is somewhat contradictory: Meyer attempts to paint a romantic picture of collections—"[the specimens] lie in wait on big, stiff sheets of yellowed paper, wrapped gingerly in envelopes and stacked on top of each other, before being inserted into dozens and dozens of cabinets"—while

[25] Robert D. Bradley et al., "Assessing the Value of Natural History Collections and Addressing Issues Regarding Long-Term Growth and Care." *BioScience* 64, no. 12 (2014): 1152-1153.

[26] Kevin Winker, "Natural History Museums in a Postbiodiversity Era," *BioScience* 54, no. 5 (2004): 458.

also arguing that herbaria are forward-looking and have modern, practical relevance.[27] Similarly, in a 2017 piece from the online art and culture magazine Hyperallergic, Allison Meier both describes the "futuristic Digital Imaging Center" at the New York Botanical Garden and the historical continuity of the actual preparation and arrangement of specimens: "Each specimen sheet, going back to the 1700s, is arranged in almost the same way, with the pressed and dried botanical, detailed notes on where and when it was found, its environment, and a description of its color before it fades."[28] These pieces written for popular audiences seem to recognize that a large part of the public interest in herbaria *is* their age and the sense of history they convey, which is quite different from the message of modernity and cutting-edge science that curators hope to impart on the administrators that control their funding.

Herbaria in the University of California system

The University of California was chartered in 1868, following the 1862 passage of the Morrill Act, which provided each state a land grant to support public universities in the teaching of agriculture and mechanical arts.[29] Berkeley was the site of the first campus in the UC system, and was later followed by campuses in Los Angeles, Santa Barbara, Davis, Riverside, San Diego, San Francisco, Santa Cruz, and Irvine, with the newest campus established at Merced in

[27] Robinson Meyer, "What Good Is a Library Full of Dead Plants?" *The Atlantic*, March 18, 2016, https://www.theatlantic.com/science/archive/2016/03/the-peculiar-importance-of-a-dead-plant-library/474438/.

[28] Allison Meier, "Why a Herbarium of 7.8 Million Plants Is One of New York's Most Valuable Resources," *Hyperallergic*, April 11, 2017, https://hyperallergic.com/366584/why-a-7-8-million-plant-herbarium-is-one-of-new-yorks-most-valuable-resources/.

[29] William Warren Ferrier, *Origin and Development of the University of California* (Berkeley, Calif: Sather Gate Book Shop, 1930): 44-46.

2002.[30] Of these ten campuses, three (Merced, San Francisco, and San Diego) do not have herbaria. At the other seven campuses, the herbaria range considerably in size and prestige. UC Berkeley, on one end of the spectrum, holds approximately 2.2 million specimens, is the seventh largest herbarium in the United States, and the largest herbarium in the U.S. held by a public university.[31] The scope of the collections is worldwide and includes many type specimens and rare plants. In addition to their impressive holdings, the University and Jepson Herbaria at Berkeley are also a major center for plant research and the leader in numerous collaborative projects to develop floras and digitize collections for public access. On the other end of the spectrum, the herbarium at UC Santa Cruz holds just over 15,000 specimens, mostly consisting of local collections. Between these two extremes are the herbaria at Davis, Riverside, Santa Barbara, Los Angeles, and Irvine campuses.

The basic characteristics of these seven UC herbaria are provided in Table 1, which draws on information from Index Herbariorum and the websites for the respective herbaria, unless indicated otherwise. Data from Index Herbariorum is self-reported and the frequency of updates varies from institution to institution; furthermore, the number of specimens is usually an estimate rather than exact figure, and that number may or may not include specimens other than vascular plants (e.g. algae, mosses, lichens, and fungi—although fungi are not in fact plants). I have added in the number of non-vascular plant specimens and fungi when that information is available, as these types of collections may make up a considerable portion of the total. For

[30] "A Brief History of the University of California," University of California Office of the President, accessed February 17, 2019, https://www.ucop.edu/academic-personnel-programs/programs-and-initiatives/faculty-resources-advancement/faculty-handbook-sections/brief-history.html.

[31] Thiers, 8.

instance, this was the case for the Santa Cruz Herbarium, where approximately 6,000 out of 15,150 specimens or almost 40% of the collections are fungi, but only the number of vascular plant specimens is listed in the Index Herbariorum record. When conflicting information has been given (such as in the case of the UC Berkeley Herbarium, which reports its founding date on its website as 1895 but as 1872 on Index Herbariorum), I have followed the most recently updated source or sought clarification from staff.

Table 1. Characteristics of the UC Herbaria.

Campus	Acronym	Date established	Total specimens	Curators[32]
Berkeley	UC/JEPS	1895[33]	2,200,000	19
Davis	DAV	1885[34]	300,000	1
Riverside	UCR	1956	277,000[35]	1
Los Angeles	LA	1935[36]	200,000[37]	0
Santa Barbara	UCSB	1948	113,000[38]	4
Irvine	IRVC	1965	36,250[39]	0
Santa Cruz	UCSC	2002	15,150	1

[32] The distinction between curators and collections managers and other types of herbarium staff varies somewhat from institution to institution. Curators typically hold PhDs in botany or related fields, but some collections managers do as well (as is the case at UCLA). Curators may also have teaching responsibilities. Collections managers and their equivalents are generally part-time staff in the UC system, although in some cases they may be partially funded by outside sources.

[33] 1895 is the date given for the University Herbarium [UC], according to the University and Jepson Herbaria website. The smaller Jepson Herbarium [JEPS], specializing in California plant collections, was established in 1950. See "About the Collections," The University and Jepson Herbaria, accessed February 16, 2019, http://ucjeps.berkeley.edu/main/collections.html#UC.

[34] According to Index Herbariorum, 1885 was the date the Viticulture Herbarium at UC Davis was established. The two main herbaria at Davis, the Agronomy Herbarium and the Botany Herbarium, were established in 1913 and 1920, respectively. All three have since been combined into a single herbarium. http://sweetgum.nybg.org/science/ih/herbarium_details.php?irn=126621.

[35] Andy Sanders (UC Riverside curator), interviewed by the author at Riverside, California, November 2018, transcript, 8.

[36] Barry Prigge (former UCLA Herbarium staff research associate), interview by the author in Los Angeles, California, November 2018, transcript, 9.

[37] Tom Huggins (UCLA collections manager), personal communications with author, November 2018.

[38] From the UCSB Herbarium website, this number includes vascular plant specimens, lichens, algae, and pickled collections. I excluded diatom slide collections. "Botanical," Cheadle Center for Biodiversity and Ecological Restoration, accessed April 10, 2019, https://www.ccber.ucsb.edu/collections/botanical.

[39] Rebecca Crowe (UC Irvine Nursery Manager), email message to the author, January 16, 2019. This number includes vascular plants, lichens, and fungi.

The UCLA Herbarium

There is conflicting information on the date and circumstances of the official founding of the UCLA Herbarium, but it seems certain that small teaching and research collections affiliated with the botany faculty existed prior to the moving of the campus from its old Vermont Avenue location to its current location on the west side in 1927. In her oral history, former director Mildred E. Mathias described Carl Epling's role in enlarging the teaching collection through the acquisition of the herbarium and library of the nearby California Botanical Garden, which closed in the mid-1930s because of financial difficulties. This collection, which included many of E. D. Merrill's specimens from the Philippines, became the core of the UCLA Herbarium.[40] Other significant additions to the collection include specimens from the Santa Monica Mountains, cultivated plants, and collections related to the specific research interests of faculty, such as Henry Thompson's *Loasaceae* specimens. Initially located in Haines Hall, the herbarium was moved in the late 1950s to the new Botany Building (now the La Kretz Botany Building) on the south side of campus. It currently occupies portions of three floors in this building and is located near the Mildred E. Mathias Botanical Garden. A thorough description is provided in the following section.

As of 2018, the UCLA Herbarium is administered through the School of Life Sciences. The herbarium and Mildred E. Mathias Botanical Garden share a common director, Dr. Philip Rundel, who reports to the Dean of Life Sciences. Although the herbarium lacks a fulltime curator, its day to day operations are overseen by a part time collections manager, who is responsible for hiring, training, and overseeing the student workers and volunteers who perform

[40] Mildred E. Mathias, interview with Mary Terrall, *Among the Plants of the Earth*, (Los Angeles: Oral History Program, University of California Los Angeles, 1982), 65-67.

basic curatorial work. There are also seven permanent botanical garden staff, some of whom are occasionally involved with herbarium activities. In the summer of 2018, herbarium and garden staff received surprising (but very welcome) news that a private donation had been secured to renovate the entire La Kretz Botany Building. This renovation would include the herbarium, which has not been significantly updated since its move in the late 1950s and has in recent decades struggled with low visibility and decreased use. As a mid-sized herbarium in the UC system now anticipating major changes, the UCLA Herbarium serves as an excellent case study of how herbaria are surviving in the public university context and conceptualizing their mission today.

In the following section, I will describe my methods for data collection and analysis and provide a detailed description of the layout and collections of the UCLA Herbarium as of March 2019. I was working in the herbarium as a volunteer before formally beginning this thesis, and so I already was familiar with the space and had established relationships with the staff and some of the student workers and volunteers. Although this familiarity had clear advantages, I will also explain some of the difficulties that came with adopting an insider role. I will then describe three major themes that emerged from interviews, observations, and a review of archival materials. While each of the UC herbaria operate in their own unique context, they also share similar features and issues. In particular, I describe the personal investment of the staff and other herbarium workers in the collections, the significance of the relationships staff developed within the university and with other herbaria, and how the staff negotiated for and organized space. Finally, I will return my focus to the UCLA Herbarium and review its strengths and some of the challenges it is currently facing, and provide a few possibilities about where this herbarium may be headed in the future as the staff prepare for the upcoming renovation. I will end with a series

of recommendations to address some of these challenges. While there are many more questions still to be explored—for example, this thesis only considers herbaria at public universities, and not those affiliated with private institutions or government agencies—it will hopefully provide the groundwork for other studies on the future of these unique collections.

Chapter 2. Methods

This case study of the UCLA Herbarium is based on data gathered from archival materials, observations, and interviews with current and former staff, faculty, and volunteers and student workers conducted from June 2018 to February 2019. While the focus is on the history, use, organization, and management of the UCLA Herbarium, I interviewed curatorial staff at four other herbaria in the UC system for additional context. Because of my work background and past volunteer work at the UCLA Herbarium starting in September 2017, I was already well acquainted with the herbarium and its staff and treated as an insider before the beginning of the study, although my role changed over time and I later transitioned from a volunteer to part-time student worker (see "Observations" below for more detail on this relationship). Then, following Bruno Latour and Steve Woolgar's method of analysis in their study of the construction of facts in a laboratory setting, I identified three of the common themes that emerged from the interviews, observations, and archival materials. I also discuss some of the challenges that arose from this form of data collection and analysis.

The Site

The UCLA Herbarium occupies portions of three floors of the La Kretz Botany Building. The building is located on the south side of campus, directly north of the seven-acre Mildred E. Mathias Botanical Garden, and across the street from the large Life Sciences building complex, which includes the Louise M. Darling Biomedical Library and most of the biology and health sciences departments (Figure 1).

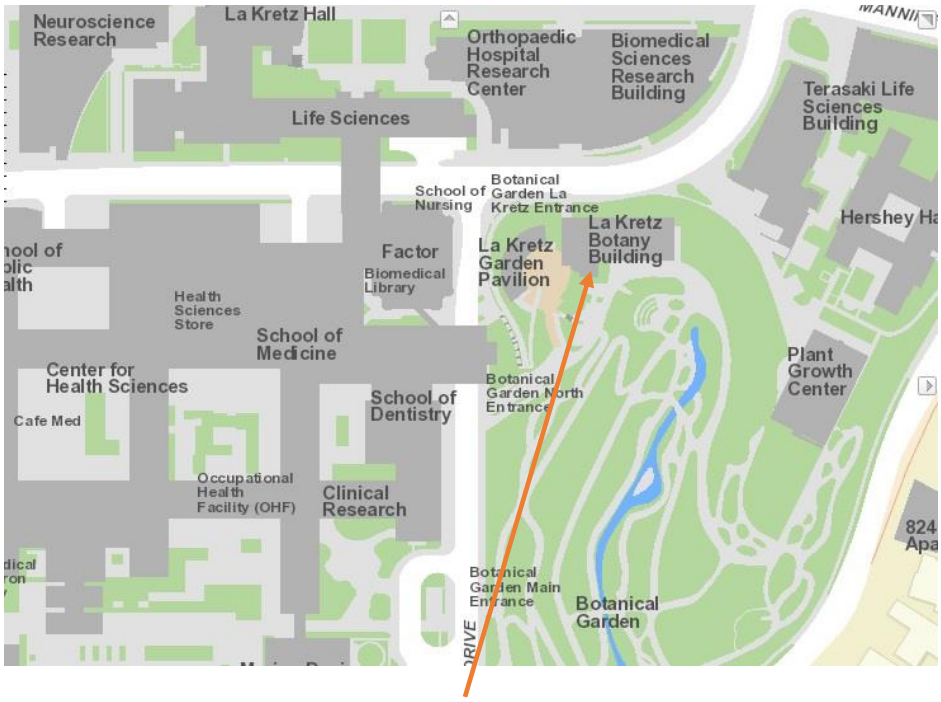

Figure 1. Approximate location of the UCLA Herbarium in the La Kretz Botany Building and the surrounding area.[41]

Many of the faculty in the Ecology and Evolutionary Biology Department (including the director of the botanical garden and herbarium) have their offices and laboratories in the Life Sciences building rather than the La Kretz Botany Building. The herbarium has not been renovated since it was moved to this building in the late 1950s.

The herbarium can be entered through one door on the first floor or two doors on the second floor. The first floor is the main point of entry and is adjacent to the small office used by botanical garden staff, which has a side door that opens into the herbarium. Because of the proximity of the two offices, garden staff and volunteers often interact with herbarium staff, both for work-related issues and social visits. The herbarium does not have its own sink, so herbarium staff, student workers, and volunteers will often use the garden office sink to clean paintbrushes used for mounting specimens or to empty out the dehumidifier on the first floor. The two doors

[41] "Campus Map." UCLA Space Inventory, accessed May 11, 2019, http://space.admin.ucla.edu/.

on the second floor are rarely used. Apart from a small window in the door in the second floor hallway, there are no windows to see into the herbarium from the outside.

Most activities are conducted on the first and second floors. The first floor contains the herbarium library, most of the slide collections, a partitioned area with computer workstations and some herbarium and supply cabinets, and an office space that is currently shared by one herbarium staff member and one garden staff member (Figure 2).

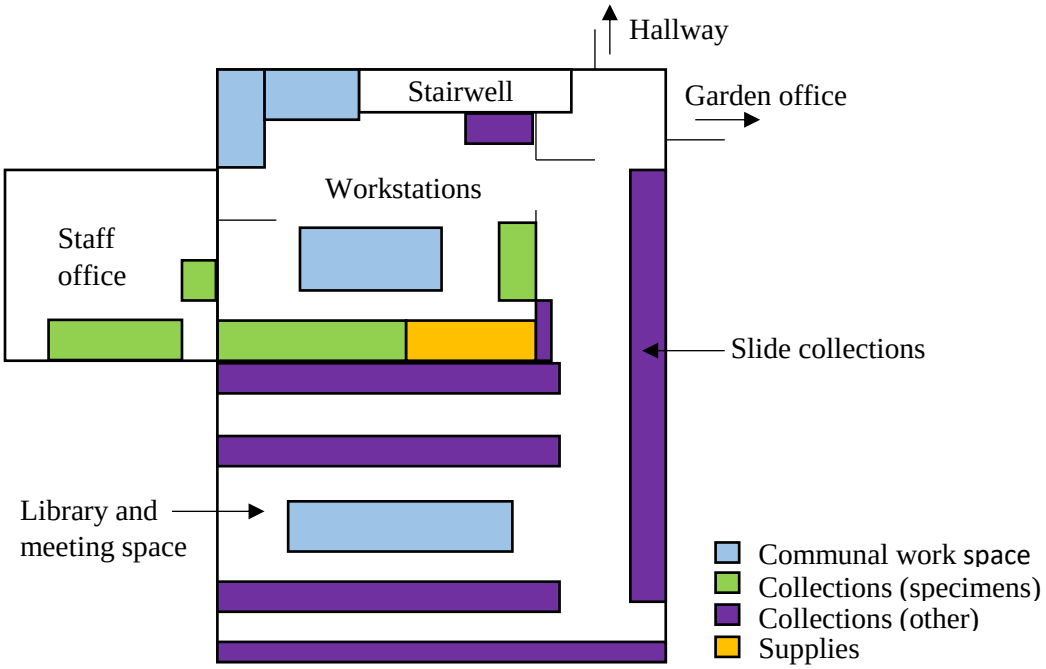

Figure 2. Basic layout of the first floor of the UCLA Herbarium. Not to scale.

The staff who work in the shared office spend most of their time answering emails and phone calls. The office is often used to conduct small and informal meetings, as well as meetings that require a greater degree of privacy. Just outside the office are two computer workstations and cabinets containing books, supplies, herbarium specimens, and other miscellaneous items such as old microscopes and slide carousels (Figure 3).

Figure 3. One of the first floor workstation for databasing specimens and scanning slides. The door to the office is in the background.

The workstations are mainly used by herbarium staff, volunteers, and student workers to database herbarium specimens or to scan slides for special projects. This partitioned area also contains file cabinets with old herbarium and garden paperwork, such as loan records, invoices, inventories, and some of Mildred Mathias's correspondence. These are almost never consulted by the current staff, and the herbarium collections manager instead uses another filing cabinet on the second floor to store his current paperwork.

A narrow hallway with a long countertop extends towards the back end of the herbarium (Figure 4). The countertop contains a small book for visitors to sign and an informal display with various fruit and insect specimens and a framed picture of former herbarium and garden director Mildred Mathias (Figure 5). Mathias is an important figure in the herbarium and pictures of her can be found scattered throughout.

Figure 4. View of the UCLA Herbarium from first floor entrance. To the left: the visitor log and one of ten large metal slide boxes. The library can be seen in the background. To the right: partitioned area with two computer workstations and a few cabinets for herbarium specimens, supplies, and various herbarium and garden records.

Figure 5. First floor, UCLA Herbarium. A Mildred Mathias "shrine", directly behind the slide box in Figure 4.

Almost the rest of the countertop is occupied by ten large metal boxes with about 20,000 2” x 2” Kodachrome slides, which are mostly organized either taxonomically or by habitat. This large slide collection is no longer used, although it once had been an important reference collection for teaching. Underneath the counter space are numerous drawers containing reprints, field notebooks, more Kodachrome slides or lantern slides, and other miscellaneous materials such as framed photographs and film reels. The current staff had little knowledge of what was in the drawers or where the items came from.

Towards the far end of the first floor is the non-circulating herbarium library, which contains a mix of books and journals owned by the Biomedical Library and books and journals owned by the herbarium (Figure 6).

Figure 6. Partial view of the herbarium library. The card catalog can be seen in the foreground.

While the Biomedical Library-owned books can be found through the online UCLA Library catalog, the herbarium-owned books only have a card catalog, which has not been updated in years. The shelves in this area have also sometimes been treated as a storage area for boxes of donated papers, slides, and other materials such as slide projection equipment. The books and

journals are not much used owing to their age, condition, and lack of an online catalog, and so the main use for the library is as a meeting space for larger groups. This part of the herbarium has the most obvious environmental problems: air circulation is poor and humidity tends to be quite high, resulting in periodic mold issues, which are partially mitigated by a dehumidifier. Silverfish and ants are also occasional problems on this floor. There are no policies regarding food in the herbarium, and so staff, student workers, and volunteers will often bring in snacks, which may attract ants.

The second floor contains about a third of the herbarium specimen cabinets, a work table for mounting and repairing specimens, a laboratory bench with microscopes, cabinets containing fruit, seed, and wood collections, six map drawers, two cabinets with photographs and negatives by C. A. Schroeder of agricultural subjects, and three supply cabinets (Figure 7).

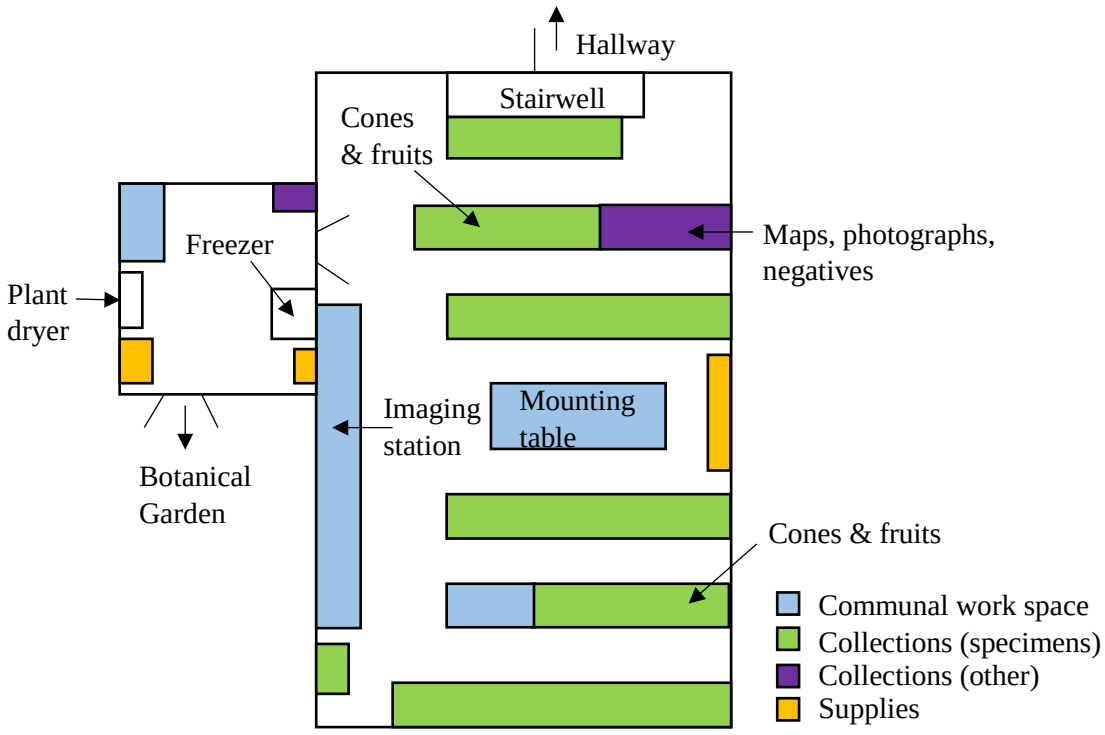

Figure 7. Layout of the second floor of the UCLA Herbarium. Not to scale.

The map drawers contain maps and other miscellaneous items such as botanical illustrations and scrapbooks. The maps were used by previous staff and faculty for fieldwork, but are not used much anymore because GPS is generally preferred. The fruit, seed, and wood collections include specimens collected by Mildred Mathias in the course of her ethnopharmacological research as well as a large synoptic collection of gymnosperm specimens. Although these collections occupy a considerable amount of space on the second floor, they have not been added to in recent years, and the current staff did not have much knowledge of what was in them compared to the regular herbarium specimens (Figure 8).

Figure 8. View of second floor from the bottom of the stairwell leading to the third floor. Left to right: map drawers, cabinet with C. A. Schroeder photographs and negatives, and cabinets with fruit, seed, and cone collections. On top of the cabinets are boxes of specimens, wood specimens in plastic tubs, and microscopes. Herbarium cabinets can be seen in the background.

The fifty herbarium cabinets on this floor contain some of the special collections (e.g. type specimens, cultivated plants, a Santa Monica Mountains synoptic collection), the beginning of the core collection, and other cabinets with backlogged specimens. The cultivated collection receives little use, as the main focus over the past year has been creating and databasing the Santa Monica Mountains synoptic collection. There are 158 herbarium cabinets across the three

floors, of which 42 (27%) contain backlog. Except for a couple individuals' specimens, the majority of the backlog is not being actively processed, and there may be insufficient information to process many of these specimens. No problems with mold have been noticed on this floor. Silverfish and ants are present, and may enter either through the side door that opens into the garden or come in with non-specimen donations (e.g. books).

The main activities on this floor are mounting and repairing specimens, typically done by student workers and volunteers at the large work table in the middle of the room (Figure 9).

Figure 9. Work table used primarily for mounting and repairing specimens.

Students, staff, and visitors sometimes use the laboratory bench on this floor to examine specimens. As of winter 2018, about a quarter of this bench had been transformed by the collections manager into a specimen imaging station for use in a new grant through the Consortium of California Herbaria (Figure 10).

Figure 10. New specimen imaging station on the second floor, as of December 2018. At this stage, the equipment was not fully assembled.

Most of the boxes of donated books and papers that had been stored underneath the bench have since been moved down to the library to be sorted in preparation for the upcoming renovation. Additional boxes of unprocessed specimens are stored under tables or on top of the cases containing the fruit, seed, and cone collections. This floor also has a small side room that can be entered through a set of double doors (Figure 11).

Figure 11. Panoramic view of the side room. From left to right: black file cabinet with current paperwork, the entrance into the herbarium, freezer, door leading to the botanical garden, plant dryer with specimens drying on top, and miscellaneous collecting and cleaning supplies on the shelves.

This space is used mostly for storage and cleaning equipment, as well as the very old freezer that is used to quarantine specimens before introducing them into the collection, and a homemade plant dryer—a long wooden box with lightbulbs at the bottom to provide heat.

The third floor is less used compared to the first and second floors and contains the majority of the core collection and backlog (Figure 12).

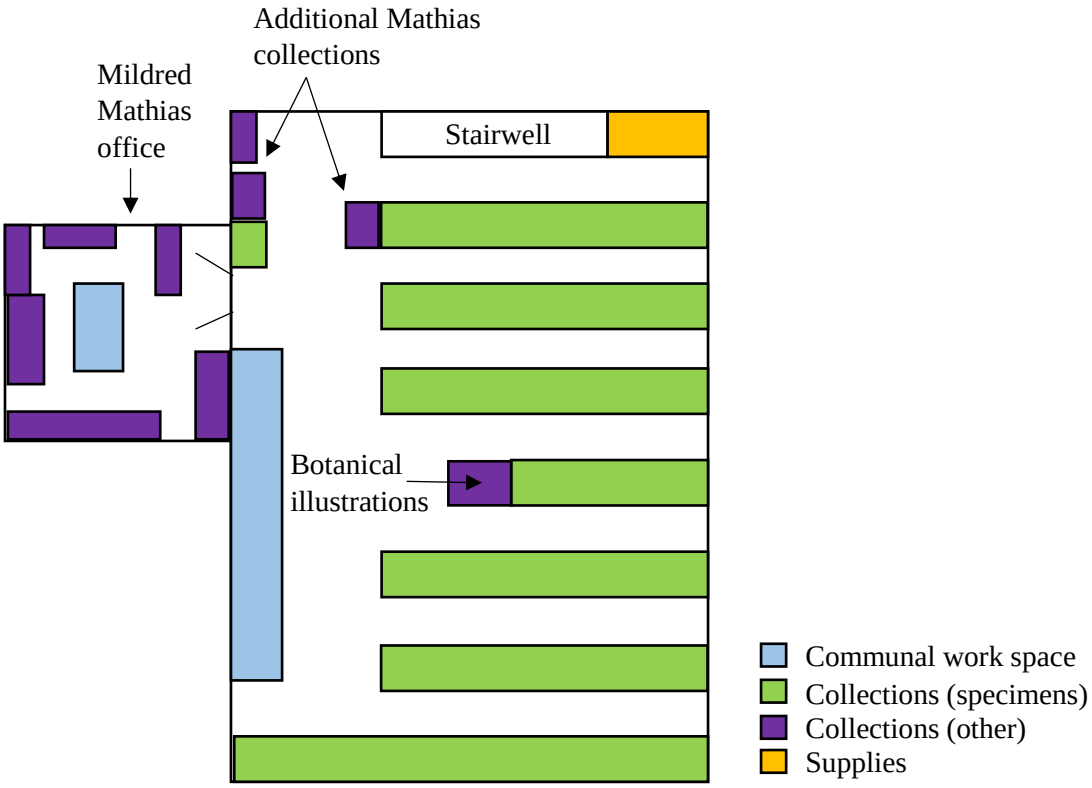

Figure 12. Layout of the third floor of the UCLA Herbarium. Not to scale.

The primary activity that takes place in this area is filing databased specimens back into the core collection. This floor is the most poorly lit, as the cabinets are arranged in rows that tend to block out much of the light. The third floor has its own laboratory bench with a microscope and workspace for examining specimens (Figure 13).

Figure 13. The laboratory bench on the third floor, across from the core collection of herbarium specimens.

Until winter of 2018, more boxes of donated books were stored underneath this bench, as well as boxes of papers and other items belonging to Mildred Mathias that have spilled out of her former office. Mold has not been noted as an issue on this floor, but the general lack of building upkeep is apparent in the sagging or missing ceiling tiles towards the far end of the room (Figure 14).

Figure 14. Sagging or missing ceiling tiles on the third floor. This situation is not unique to the herbarium but relatively common throughout the building.

Mildred Mathias's former office is on this floor. Although Mathias died in 1995, most of the contents of her office are still there, apart from some materials that were given to the Organization for Tropical Studies (OTS) and the UC Natural Reserve System, two organizations that Mathias was heavily involved in. The office is still quite full and holds her library, awards, slide collection, some personal effects such as her glasses, and numerous filing cabinets with her correspondence, materials used in her courses and UCLA Extension ecotourism field trips, and other papers related to her research and work as director of the botanical garden (Figure 15).

Figure 15. Two views of Mildred Mathias's office, showing part of the book collection, papers, field notebooks, and awards on table.

To my knowledge, no systematic efforts were made to inventory or make use of the contents of the office until 2018, with the start of a slide scanning project in spring of that year and an inventory of her library in fall in preparation for the remodel. Herbarium staff had on a few occasions contacted the Louise M. Darling Biomedical Library with the intention of transferring

her papers to their Special Collections, as had been done with other collections in the past such as A. M. Johnson's botanical illustrations and Flora Murray Scott's papers, but the staff had not made it past this initial stage as of winter 2018.

Observations

I first became involved with the UCLA Herbarium in September 2017 as a volunteer. I had previously worked at the herbarium at Rancho Santa Ana Botanic Garden (a nonprofit organization) in nearby Claremont from 2013 to 2017. I had previously met two of the herbarium/garden staff members while working at Rancho Santa Ana Botanic Garden, which eased my transition into the UCLA Herbarium. Because of my experience at Rancho Santa Ana Botanic Garden, I was already quite familiar with various aspects of curatorial work, but I was immediately struck by the differences in activity levels, environmental conditions and overall appearance, types and sizes of collections, and management of the two herbaria. These differences sparked my interest in doing a thesis on this subject. Therefore, because of my past experience at a different herbarium and my volunteer work at the UCLA Herbarium, by the time I began formal data collection in June 2018, I was well acquainted with most of the staff and already treated as an insider with expertise.

I initially began volunteering at the herbarium for three hours per week. While at least one staff member was usually present while I was at the herbarium, on some occasions, I was there with other volunteers and student workers or even alone. I would usually ask the collections manager at the beginning of my shift if he had specific things he wanted me to work on, but for the most part, and unlike most of the other volunteers and student workers (herbarium technicians), my volunteer time was unstructured and I worked independently. Some of my typical activities included filing specimens on the second and third floors and cleaning. I also

helped train some of the new technicians on filing, one of the more complex tasks. I did not do some of the tasks performed by the other student workers and volunteers, such as databasing or mounting specimens, although the collections manager did show me the Filemaker Pro database, which the staff had developed in the early 2000s. Because of the loose structure of my volunteer work, I also simply spent some time exploring the various collections and creating mini-projects for myself, such as inventorying the cabinets of backlogged specimens and assisting the archives intern with beginning a slide scanning project. On a few occasions, I gave impromptu tours to visitors if the staff were not available. Over the course of the 2017-2018 academic year, I met more of the current and former herbarium and garden staff, volunteers, and student workers, and came to know some of them quite well. On the whole, the environment was friendly and very casual, and conversations did not just cover work matters but were often social in nature.

In the spring of 2018, as I was developing this thesis, several new developments took place. The first was the beginning of the La Kretz Botany Building remodel, starting with the renovation of the north entrance, where a mosaic and new benches were installed. At the time, it did not seem that the herbarium would be included in this piecemeal remodel. The second development was the beginning of the new digitization project for the California Consortium of Herbaria [CCH], a grant to image California herbarium specimens by members of the Consortium with a focus on phenology. This project was to be overseen by the collections manager, who spent much of the fall and winter of 2018 obtaining and setting up the imaging equipment. The third development was that garden staff had identified a donor to support a paid intern for the ongoing Mildred Mathias slide scanning project. This donor also agreed to support me at five hours per week starting in fall 2018 for a related project to inventory the materials in Mildred Mathias's office. In February 2019, the donor agreed to continue support for both

myself and the archives intern until June 2019 to assist with the moving preparations described below.

When I returned in September 2018, I learned from staff that the herbarium would be renovated and the collections would need to be placed in temporary storage by November 2019, and I was asked to put my five hours per week towards helping them prepare for that process and appraise the collections. Although the staff were excited that the herbarium was going to be renovated, none of them had experience with moving a collection, and there were concerns that the process might be disorganized and there would not be enough time to move everything. Furthermore, apart from the herbarium specimens, the staff lacked a strong sense of what other types of collections the herbarium owned and which ones they wanted to keep. Like them, I had also never been involved in the large-scale move of a collection, and so there was a great deal of improvisation and changing tasks from week to week, and my time was mostly unstructured and self-directed, especially at the beginning.

While at least one staff member was usually present in the herbarium while I was there and I consulted with them regularly, there were several weeks in September and October of 2018 in which they were traveling and I began working on my own to develop protocols to begin documenting and assessing the collections. After the staff returned, we began having formal and informal meetings to discuss priorities, concerns, and delegations of tasks. While most of these meetings were with herbarium and garden staff, others included individuals from different entities within UCLA, such as facilities management and the Biomedical Library. Although I did not meet the architects in capital planning, staff kept me updated on those meetings, shared the proposed designs and other related documents, and asked for feedback. I was also sometimes part of additional meetings and communications with outside groups such as the Huntington

Library, who the staff were hoping might accept donations of some of the less-used non-specimen collections (e.g. slides and old horticultural magazines and journals). Apart from meetings, I worked both independently and with the archives intern (who had previously been working on the Mildred Mathias slide scanning project) to inventory the herbarium library on the first floor and Mildred Mathias's personal library on the third floor.

From September to December 2018, as we embarked on this major project, I kept written notes in order to understand how this space was used and by whom, environmental conditions and challenges, and the shifting priorities as staff prepared for the remodel and other projects. After each shift, I recorded information about who was present in the herbarium and when, summarized the major conversation topics, noted the types of activities taking place and any changes to the space that I noticed. I also took photographs as needed to document how the space was organized, some of the environmental problems, and some of the more unique collections. My observations complemented the interviews and archival material I consulted and provided a more complete picture of how the UCLA Herbarium was changing over this short but exciting period of time.

Interviews

I conducted a total of fifteen interviews from June 2018 to February 2019. Eleven of the fifteen participants were affiliated with UCLA. These consisted of four current herbarium and botanical garden staff, one former herbarium staff member, one faculty member in the Ecology and Evolutionary Biology (EEB) Department with research interests in plant systematics (Dr. Felipe Zapata), and five volunteers and/or student employees. Prior to the interviews, I was already acquainted to varying degrees with the four current herbarium and garden staff, the former staff member, and two of the five volunteers/student employees. Among the staff, the

interviewees included the herbarium collections manager, the joint director of the herbarium and botanical garden, and two botanical garden employees whose work sometimes overlapped with the herbarium. Among the student workers and volunteers, three of the five were UCLA students, including two undergraduate students with conservation biology minors (one volunteer and one employee) and one PhD student in Ecology and Evolutionary Biology. The PhD student and one of the undergraduates were also members of the lab run by Dr. Zapata. The two other interviewees in this group had not been affiliated with UCLA prior to working at the herbarium: one was a former volunteer with a Master's degree in Plant Ecology, and the other was a recent graduate working as a volunteer intern on a special project to digitize parts of Mildred Mathias's slide collection. As mentioned above, this intern position became funded by a donor in the spring of 2018 and her duties later shifted from digitizing slides to working with me to inventory the herbarium library and other types of collections in preparation for the move and remodel. All other volunteers and student employees were working as herbarium technicians under the supervision of the collections manager, Tom Huggins, and with a few exceptions, their tasks were largely limited to working with herbarium specimens.

The final four interviewees were staff at other herbaria in the UC system. These individuals were Dr. Brent Mishler, director of the herbaria at Berkeley [UC/JEPS]; Dr. Ellen Dean, curator of the Davis Herbarium [DAV]; Dr. Andy Sanders, curator of the Riverside Herbarium [UCR]; and Rebecca Crowe, Nursery Manager at Irvine, whose position includes management of both the herbarium [IRVC] and the arboretum. I had previously met the Davis and Riverside curators in the course of my work at the herbarium at Rancho Santa Ana Botanic Garden, though only briefly. In addition to interviews, I also made in-person visits to the herbaria

at Riverside and Irvine and toured and photographed the facilities to better understand how space was being used and the types of activities being performed.

Interviews ranged in length from thirteen to eighty minutes. Twelve of the interviews were conducted in person and three were conducted over the phone. Six of the in-person interviews took place at the UCLA Herbarium, one was at the Riverside Herbarium, and the rest were conducted in the participants' offices. Participants were asked to provide their resume or curriculum vitae before the interview to gain a better sense of their level of experience with herbaria and educational backgrounds. Each interview was recorded and transcribed, and the transcription was shared with the participant. Participants were given the option to make their interview confidential, although almost all permitted their names to be used. Staff and former staff at UCLA and the other herbaria were asked about their work responsibilities, the ways in which their collections are used, their views on the strengths of their collections and the challenges they face, and their perspectives on the importance of herbaria. The UCLA faculty member, Dr. Felipe Zapata, was asked about the use of herbarium specimens in his teaching and research, his specific involvement with the UCLA Herbarium, and the relationship between the EEB department and herbarium. Volunteers and student employees were asked about their impressions of the herbarium and its mission, their volunteer or job duties, the relevance of their herbarium work experience to their educational and career goals, and suggestions for how their experience could be improved. Follow up questions were asked as needed for clarification or to encourage the interviewee to elaborate on a particular subject they raised. For the final portion of the interview, I asked participants if they had questions for me or any other statements they wanted to add. Many of them used that opportunity to ask for more information about why I was

conducting this study and expressed interest in my findings and how they might be used. A list of interview questions for the different groups can be viewed in Appendix A.

Archival Materials

The most thorough written source of information on the history of the UCLA Herbarium is the oral history of Mildred E. Mathias, which was conducted in 1978 by Mary Terrall of the UCLA Center for Oral History Research. Mathias first visited UCLA in 1929 and was hired in 1947 as herbarium botanist, and later become a faculty member and herbarium and garden director. She retired in 1974 but remained an active presence at UCLA until her death in 1995. Her oral history contains descriptions of the early days of the herbarium and botanical garden and the use of the collections in research and teaching, departmental transitions and staffing changes, and relationships with administrators and other groups inside and outside of UCLA. She paints a picture of an herbarium that, although never as large or influential as the Berkeley herbaria, was nevertheless an active center for botanical research and education for many decades. Although the oral history is based on the recollections of a single individual, it provides important context and background on the collections and serves as a basis for comparison for current staff members' understanding of the history of the herbarium and its collections.

Analysis

My analysis draws on Bruno Latour and Steve Woolgar's classic study of the construction of fact in a laboratory setting. Latour and Woolgar generated a set of themes and concepts that emerged from a combination of participant observation (one researcher embedded as laboratory technician), interviews, and review of literature produced by laboratory members

over the course of the study.[42] I identified three major themes that came out of my review of observations, interviews, and archival materials: personal investment of curatorial staff and their workers in the collections, the personal and professional relationships curatorial staff cultivated inside and outside of their institutions, and how staff negotiated for and used space. Within those themes, I identified and elaborated on certain subthemes. For all three themes, I mainly drew on interviews and Mildred Mathias's oral history; for the third theme, I also made use of photographs and my observations on the organization and use of space. I have attempted to use direct quotations whenever possible. I then take these themes into account in the conclusion in considering the possible trajectory of the UCLA Herbarium and in making recommendations.

There are numerous challenges in making meaning out of all this data. For one, choosing particular themes inevitably means that other themes are left out. There were other themes I considered (managing uncertainty, for example) that I ultimately decided to not treat as distinct to better draw attention to the concepts I felt were most important and applicable across the different herbaria, and to avoid overwhelming the reader. Second, the interviews and oral history of Mildred Mathias that I relied on to develop these themes are drawn from a select group of people, and they may not represent the entire range of viewpoints of those affiliated with the herbarium. For instance, although I reached out to ten current and former UCLA Herbarium student workers and volunteers, I only received responses from five. I was not successful in my attempts to connect with administrators, another group of key stakeholders who undoubtedly have a distinct set of priorities and perspectives on the value and uses of collections. Consequently, I was only able to catch glimpses of these larger administrative structures, and had

[42] Bruno Latour and Steve Woolgar, *Laboratory Life: The Social Construction of Scientific Facts*, (Beverly Hills: Sage Publications, 1979), 39-40.

to rely on second- or third-hand explanations of what was taking place in these other circles. Furthermore, while I interviewed people in a range of different roles at the UCLA Herbarium, my contacts with the other UC herbaria were limited to single individuals, and I was unable to visit the Berkeley or Davis herbaria in person. Third, while my insider status undoubtedly helped me achieve a greater degree of access and candor from participants compared to an outsider, I found it increasingly difficult at times to separate my own feelings of investment in the collections and relationships with the individuals involved from my desire to maintain some measure of objectivity, especially after transitioning from a volunteer to part-time paid staff. Although it did not occur to me to include it in my observations at the time, in retrospect, I wish I had made efforts to record my own feelings in the course of my work—my excitement at discovering collections I hadn't known existed, my frustration after certain meetings, my confusion over my role and what was expected of me.

Bearing all these challenges in mind, I hope to convey some of the dynamism and complexity of herbaria in the following sections. Though the situation at each herbarium in the UC system is unique, at all of them, I found their staff to be resourceful in the face of external and internal pressures and uncertainty. The UCLA Herbarium in particular is at a crossroads as the staff grapple with questions about who the herbarium should serve and what its collections and space should look like going forward. Far from passively "withering away," as Boer Deng suggests, herbarium staff are actively fighting to secure the future of their collections and understand their purpose in the 21st century.[43]

[43] Boer Deng, "Plant Collections Left in the Cold by Cuts," *Nature News* 523, no. 7558 (July 2, 2015): 16, https://doi.org/10.1038/523016a.

Chapter 3. Results

Based on the interviews, observations, and review of archival materials, I identified three major themes. The first theme concerns the ways in which staff, student workers, and volunteers express a deep sense of personal investment in the collections and the active role they take in trying to attain the resources the university does not provide. Many of these individuals emphasized the irreplaceable scientific and historical value of herbaria and herbarium specimens. The second theme explores the importance of the personal and professional relationships herbarium staff must develop inside and outside of the university in order to survive. Apart from maintaining good relationships with administrators, faculty, and student workers and volunteers, herbarium staff are also frequently in communication with other herbaria, who can become formal collaborative partners or sources of informal advice and aid. Finally, the third theme examines how the staff negotiate for and use the space provided to them by the university. Because space is a very limited resource, the staff must be able to continually justify how they use it. The location, organization, and quality of the space determine patterns of use and perceptions of value.

I chose to focus on these three themes because they were broadly referenced by multiple individuals across the five herbaria included in this study. For example, the staff at the Davis, UCLA, and Irvine herbaria all mentioned their experiences dealing with insect infestations as a result of poor environmental conditions (either in the past or present). Many staff spoke about how they handled their relationships with administrators and faculty. At the same time, there were clear contrasts among the different herbaria. Berkeley, which is larger than all the other UC herbaria combined, operates on a completely different scale than the others and tends to assume a leading role in major collaborative projects. Meanwhile, the UCLA and Irvine herbaria share

certain commonalities—e.g. struggles with diminished use over time and low visibility—as do the Riverside and Davis herbaria, which are similar in size and have grown steadily under the leadership of a single long-term curator. In this section, I attempt to also draw out some of these key differences and their implications.

Personal Investment

Because most of the UC herbaria are maintained by a small number of staff, student workers, and volunteers, the degree of personal investment by these individuals can significantly impact the direction and health of the collections. Personal investment by staff and their volunteers and student workers is demonstrated in multiple ways. First, personal investment is shown by the paid staff who spend considerable amounts of time and energy beyond their regular duties of collections maintenance and oversight of junior staff and volunteers by initiating projects, advocating for the collections, and fundraising for supplies and resources that the university does not provide. These staff—especially those who have been with their herbarium for many years—often have a strong sense of ownership over their collections and believe in the intrinsic and irreplaceable scientific and historic value of herbaria. A lack (or perceived lack) of investment by higher level staff and administrators, conversely, can result in neglect of the collections. Second, personal investment is also demonstrated by individuals who work in related areas, but nevertheless become involved in supporting the herbarium in various ways. Third, because paid staff are not able to fulfill all curatorial duties, volunteers and student workers fill that gap and provide crucial labor and expertise. While individuals in this group come from a variety of backgrounds and bring different levels of knowledge and experience, they believe that their work is important and understand the collections to have value in of themselves.

Except for the Berkeley Herbarium, which employs nineteen curators, fifteen staff, and numerous graduate students, the four other UC herbaria in this study are all run by a small number of staff.[44] The Davis and Riverside herbaria are both led by full time curators who oversee one to two curatorial staff, who are either full- or part-time and whose appointments may be funded by the university, outside sources, or a combination of both. At UCLA, the herbarium is managed by a part-time collections manager. The Irvine Herbarium is run by the nursery manager, who also has responsibilities for the Irvine Arboretum; this position is currently grant-funded and not supported by the university. All of these staff report to a director, who in turn reports to a dean. For these four herbaria with limited staffing, the degree to which these individuals can successfully advocate for these smaller collections is one factor that helps determine whether or not they can thrive. A committed fulltime, long-term curator can shape the direction of the collection according to their research interests, goals, and personalities. This has especially been the case at the herbaria at Riverside and Davis, where the curators have ensured continuity and stability while developing different strategies for advocating for their collections and addressing challenges resulting from limited university support.

Dr. Andy Sanders has been curator of the Riverside Herbarium for almost 40 years. Under his leadership, the collection has grown from just under 16,000 specimens to 279,000 specimens. He has personally databased nearly all of these specimens, a task he generally does not entrust to volunteers because he wants to ensure that information is recorded with minimal errors. His approach to curation has been based on accepting only high-quality specimens with what he considers sufficient data to be useful to science and then making as much of that data

[44] "Staff Directory," The University and Jepson Herbaria, accessed February 2, 2019, http://ucjeps.berkeley.edu/main/directory.html.

available as possible through various online portals. Because the university pays only his salary and the salary for a part-time collections manager and does not cover supplies, he fills that gap by taking on consulting work through university contracts in addition to his main duties. He clearly feels pride in the collection he has built over the years: "[The herbarium is] sort of like my baby, so I'm very devoted to the thing." However, he was uncertain about the future of the herbarium, as he is expecting to retire sometime within the next few years, and he did not know if the next curator would "be as crazy as I am about doing all this extra stuff to keep it afloat…The next person might be more oriented towards their own career…I can't perceive the future. I just do what I can in the here and now." [45]

At the Davis Herbarium, instead of raising money from consulting to cover gaps in funding, curator Ellen Dean has developed a strategy based on outreach. Although her main job responsibilities when she was hired in 1995 were to identify plants and teach a popular class on the flora of California, her actual activities came to include many other things, such as curation, managing junior staff and volunteers, and working with the Davis Botanical Society to produce newsletters, process memberships and donations to raise money, and hold events. The Davis Botanical Society was formed by a group of former staff and other supporters of the herbarium after the university cut funding in the early 1990s as a result of a major financial crisis in the UC system. Because of changes in how friends groups like the Davis Botanical Society can be administered, she has gradually assumed a greater leadership role with the Society. Through her fundraising efforts, she has been able to hire staff and student workers, provide field research grants to students, and move the collections to a facility with better environmental controls. Like

[45] Andy Sanders (UC Riverside curator), interviewed by the author at Riverside, California, November 2018, transcript, 5.

Andy Sanders at Riverside, she also intends to retire soon, and she has put significant work into preparing her staff and the Davis Botanical Society leadership for the transition. When asked about the future of the herbarium after she leaves, she said, "I'm hoping that I'm setting it up for success, because the new collections manager is in place…And the herbarium has an endowment now that's $150,000 or something, and I set that up. And some people, when they pass away, have already said they're giving bequests to that, so at some point it should be more like $500,000…I've made a bunch of money in the last year or so, and so at least starting out, they'll have enough money in their accounts. I've been trying to be proactive."[46] The amount of planning she has put into the transition shows a high degree of interest in ensuring the herbarium is not just able to survive but will be able to keep growing even without her leadership.

This concern is very reasonable, as herbaria tend to become more vulnerable to loss of support when long term leaders and advocates leave. The UCLA Herbarium currently lacks a fulltime curator position and has struggled to grow after a major transition in the late 1970s and early 1980s when significant leaders such as Mildred Mathias and other faculty retired or left. More than twenty-five years after her death, Mathias remains a particularly beloved figure—her many awards and photographs of her can be found scattered throughout the herbarium—but the loss of her leadership left a gap. In combination with changes in the composition of the Department of Ecology and Evolutionary Biology, this resulted in a long period in which use of the collections gradually declined and the prominence of the herbarium was greatly reduced. Botanical garden and herbarium director Phil Rundel, who was appointed to his position in 2012 but has been a faculty member since 1983, noted that the collection had not changed much since

[46] Ellen Dean (UC Davis Herbarium curator), phone interview by the author, November 2018, transcript, 9.

the time he had arrived at UCLA, apart from the addition of some Santa Monica Mountains collections. He attributed this to turnover in the department and the attrition of the plant systematists that had been the main user base.[47] Former curator Barry Prigge, who worked in the herbarium from 1984 until his retirement in 2014, agreed that use of the collections had declined during that time and the change in departmental focus was a driving force. He also felt that the former director and former dean had not placed much value on the collections or field biology since laboratory-based research brought in more grant money and prestige. Even then, the herbarium suffered because it shared a budget with the botanic garden, which tended to receive more resources: "The herbarium [was] just sort of a sideshow to the botanic garden…I always had a hard time getting materials for [the herbarium], because the botanic garden would spend the money, every cent they got, and left nothing for me."[48] Like curator Andy Sanders at Riverside, Dr. Prigge supplemented the herbarium and garden budget through consulting work at Fort Irwin and other projects, but felt he never received sufficient support for all the additional work he had done or knew exactly where the money ended up because he lacked control over the budget. The combination of apparent disinterest in the herbarium by leadership and the loss of faculty members who could advocate for the collections as the focus of the department changed decimated the traditional user base. This neglect, in turn, has made it difficult for potential users to actually use the collections. According to Dr. Felipe Zapata, the only plant systematist in the Ecology and Evolutionary Biology Department, part of the reason why he had not used the

[47] Phil Rundel (UCLA Mildred E. Mathias Botanical Garden and Herbarium Director), interviewed by the author at Los Angeles, California, June 2018, transcript, 3.

[48] Barry Prigge (former UCLA Herbarium staff research associate), interview by the author in Los Angeles, California, November 2018, transcript, 7.

herbarium more was because "some of the collections are too old and not well curated" enough to be useful for his research.[49]

The Irvine Herbarium also lacks a fulltime curator to provide stability and vision, and has suffered from gaps in custody over the years since the Museum of Systematic Biology closed in 1995. Nursery manager Rebecca Crowe felt that the main reason why the herbarium had stayed at Irvine while the other museum collections were sent elsewhere was because of the advocacy of two faculty members (including the current director) who were using the collections for their research. While she had hope that the herbarium would survive and expand its user base because there was still some faculty interest in keeping it, she was very concerned about the future of the arboretum. She noted that the arboretum had gradually lost advocates over the years, who had in the past been able to stop the university from moving forward with development plans: "A lot of the professors have retired [and] the friends group [was] disbanded years ago before I took over…So it's down to a small group now of folks that are willing to stand up for it."[50] Similar to the UCLA Herbarium, she attributed these challenges to a change in departmental focus, although she was hopeful that the presence of new faculty might spark renewed interest in the herbarium.

The staff at all five herbaria stressed the teaching and research value of herbarium specimens and strongly believed that the collections were irreplaceable and needed to be maintained, even if their role in research in evolutionary biology had changed and their collections were not used as much as they had been in the past. According to Berkeley

[49] Felipe Zapata (UCLA Assistant Professor, Department of Ecology and Evolutionary Biology), interview by the author in Los Angeles, California, October 2018, transcript, 2.

[50] Rebecca Crowe (UC Irvine Nursery Manager), interviewed by the author at Irvine, California, November 2018, transcript, 12.

Herbarium director Brent Mishler, "Collections are not less valuable now than they used to be; they're getting more and more valuable" because they serve as baseline data for understanding how the flora of an area is changing over time.[51] He mentioned that herbarium specimens also have applications in medicine and agriculture, and that advances in technology could mean there are other potential uses for these collections that have not yet been tapped. Many staff cited the role of collections in conservation biology and as a means to study the effects of climate change, which they tied to the new Berkeley-led Consortium of California Herbaria project to digitize specimens and record phenology data. Some staff also discussed the unique importance of the collections at their own institutions; Dr. Ellen Dean, for example, noted that the tomato and grape specimens at the Davis Herbarium provided an important record of the history of plant breeding and pesticide use in the Central Valley, and these specimens were not duplicated in other herbaria.[52] Staff at the Irvine and UCLA herbaria both felt that their collections held valuable information about how the local flora was changing as a result of land development. Beyond research uses, many of these staff also felt that herbarium specimens were an important tool for educating students and the public about biodiversity. According to one UCLA garden staff member, the ability of an herbarium to showcase biodiversity "is really important in terms of captivating the imagination of the public and being able to express ideas about nature to people."[53] Riverside curator Andy Sanders named some of the other public services that the herbarium offers, ranging from plant identification for curious homeowners to assisting law

[51] Brent Mishler (UC Berkeley and Jepson Herbaria Director), phone interview by the author, December 2018, transcript, 5.

[52] Dean, 10.

[53] Anonymous UCLA Botanical Garden staff member, interviewed by the author at Los Angeles, California, October 2018, transcript, 5.

enforcement. However, he did not widely advertise these services because he felt he already had enough to do and because he did these identifications for free, "so there's no real direct benefit."[54] Former UCLA staff research associate Barry Prigge also emphasized the importance of the herbarium providing plant identifications to members of the public, though he had not done this often while he had been on staff.

Apart from dedicated herbarium staff who maintain and advocate for the collections, at the UCLA Herbarium in particular, the close relationship between the herbarium and botanical garden has resulted in some garden staff becoming voluntarily involved with various aspects of herbarium work outside of their normal duties. A sense of personal investment in the herbarium, therefore, is not just limited to curators and collections managers who work directly with specimens. Former curator Barry Prigge recalled that garden manager and horticulturalist Dave Verity would frequently assist with herbarium work when herbarium staff were unavailable.[55] Several of the current garden staff have taken a particularly active role in the UCLA Herbarium, including working with campus architects on the remodeling plans for the herbarium, being involved in the hiring and oversight of part time temporary staff to assist with the move, and outreach efforts. One staff member saw the remodel as a major opportunity to assess the future direction of the herbarium and grow the user base: "I think there's lots of ways it could be more integrated [into the UCLA community]. I think there's a lot of potential uses for it that aren't being tapped currently."[56] He noted that although the nature of botany research has changed and herbaria are no longer considered as central to the curriculum as they had been in the past, he felt

[54] Sanders, 4.

[55] Prigge, 13.

[56] Anonymous UCLA Botanical Garden staff member, 4.

they were valuable for gaining a broad understanding of biogeography and taxonomy, especially for students: "If you work in an herbarium for a couple years, you're going to understand plant families at a very instinctual level. You're really going to know about diversity. And I think that's really important to have people who have that broad perspective, because we're churning out scientists who are super detailed and specific on one small group of organisms, and you could go out into nature with them and they could name everything in their group that they focus on but they don't know anything else."[57] Even though his main job responsibilities did not include herbarium work, he still felt that it was an important enough resource to devote his time and support. Similarly, although she claimed she did not have a strong understanding of the use of specimens in scientific research, Garden Visitor Services Coordinator Jules Cooch believed that the herbarium was important because of its history and because "we have a cool opportunity to just engage people generally with the beauty and wonder of plants."[58] She felt that the collections lacked visibility and was pleased that the remodeled space would include room for exhibits and would be more open. She had liaised with the development office to cultivate relationships with herbarium donors and also promoted the collections through the garden website and social media accounts. As of the time of the study, she was also working with other staff to plan an event celebrating the life of Mildred Mathias, which would draw on various materials such as slides and books housed in the herbarium.

Personal investment is not just demonstrated by paid staff, but also by long term volunteers. These volunteers—many of them retired former staff—offer not just labor but

[57] Ibid., 4-5.

[58] Jules Cooch (UCLA Mildred E. Mathias Botanical Garden Visitor Services Coordinator), interviewed at Los Angeles, California, February 2019, transcript, 3.

expertise, institutional knowledge, and continuity, and staff frequently rely on them to perform more complex curation tasks compared to student workers and interns. At Irvine, nursery manager Rebecca Crowe felt fortunate to have the assistance of former curator Fred Roberts, who visits every other week to help her process and organize parts of the collection that have limited information.[59] At Davis, curator Ellen Dean mentioned one particularly dedicated volunteer who has "always been like an extra employee."[60] This individual is a retired staff member who has been volunteering for nearly thirty years and comes in three times a week to assist with label making, plant identification, curating the library, and even overseeing other volunteers. At UCLA, even though he does not volunteer on a regular basis, current staff often rely on retired staff research associate Barry Prigge as a source of institutional memory and deep knowledge of the collections. Similarly, until her death in 1995, Dr. Mildred Mathias remained an active figure in the botanical garden and herbarium after her retirement and kept her office there. It is clear that these volunteers value their institutions, are deeply committed to their missions and long term success, and also have sufficient time and resources to dedicate to volunteer work.

Compared to the other herbaria, the volunteers at UCLA tend to be younger, more short term, and are often looking for opportunities to develop their resumes and gain work experience. While some volunteers and student workers arrive with backgrounds in botany and prior experience in herbaria from a curation or research perspective, for others, the UCLA Herbarium is their first exposure to an herbarium. Collections manager Tom Huggins named the education of these volunteers and student workers as one of his primary goals, and he hoped that one day

[59] Crowe, 3.

[60] Dean, 3.

the herbarium would be able to offer funds to graduate students in the plant sciences to support their studies.[61] In addition to herbarium work, he also has invited students and volunteers to join him on field trips to the surrounding area to see plants in their natural environment and on visits to other herbaria. According to one garden staff member, "I've always been impressed by the amount of students that are here and how this is a really meaningful space to them, and they always seem really happy to be here and excited to be here. They're clearly learning a lot and getting a lot out of it, and it's showing them a different side of science that they might not get from their classes."[62]

Of the five current and former UCLA student workers and volunteers I interviewed, all agreed that their experience in the herbarium was relevant to their career and educational goals and that they had learned new skills. They had positive relationships with the staff, enjoyed what they were doing, and found the work meaningful, even if some of it was tedious or repetitive. Many were impressed by the age of the specimens and other collections. Undergraduate student Dalissa Arteaga Alanis had originally been hired as a work-study student employee, but she planned to continue as a volunteer even after her work study ran out. Although she had initially been unsure that she would like the job, she discovered that she especially liked mounting and repairing specimens, which she compared to making a piece of art. She expressed an interest in making her own plant collections so she could gain a better understanding of the entire process. She explained the value of herbaria from a historical perspective: "We can learn from our past and learn how to do different things in the future…even though you might not think it's ever going to be useful, maybe one day it might be helpful to just one researcher and it might help us

[61] Huggins, 7.

[62] Anonymous UCLA Botanical Garden staff member, 3.

discover something new, [and] the record will never be erased, because of the herbarium."[63] Undergraduate volunteer Rudy Diaz mentioned multiple uses for herbarium specimens in scientific research such as understanding species distribution and evolutionary relationships. With the encouragement of collections manager Tom Huggins and Professor Felipe Zapata, he had gone on to curate his own collection of fungi to deposit in the herbarium. Because UCLA offers few botany courses, he especially valued his volunteer experience in the UCLA Herbarium and the botanical garden, which led him to a summer internship at the Field Museum. He intended to pursue a graduate degree in ecology and evolutionary biology.[64] Former volunteer Carla Monoy, who holds a masters degree in plant ecology, viewed the herbarium as an important general resource for plant taxonomists and also had an interest in some of the specific collections housed at UCLA, such as the flora of California. Furthermore, because she is from the Philippines, she was especially excited to learn that the UCLA Herbarium held early twentieth-century specimens from the Philippines collected by botanist E. D. Merrill. She felt these collections had important historic value: "During [World War II], they bombed the science building [at the University of the Philippines] and most of the original collections are gone…I was hoping that maybe I'd find some that are here…I think the value in having an herbarium is you still have that record of what was there before. I think that's what I found fascinating in the old collections."[65] She also enjoyed taking pictures of the oldest specimens she could find.

[63] Dalissa Arteaga Alanis (UCLA Herbarium undergraduate student worker), interviewed by the author at Los Angeles, California, October 2018, transcript, 3.

[64] Rudy Diaz (UCLA Herbarium undergraduate volunteer), interviewed by the author at Los Angeles, California, October 2018, transcript, 2.

[65] Carla Monoy (former UCLA Herbarium volunteer), phone interview by the author, September 2018, transcript, 4.

Archives intern Maya Edmond recalled a similar sense of wonder the first time she had been to the herbarium: "I saw all of Mildred [Mathias's] slides, and I was like, 'Oh my gosh'; just really excited and enthused…I just thought it was very cool…So much history was here."[66] While most of these volunteers and student workers were only expecting to be there for the short term, for many, it was more than a job or an item to add to their resumes—it also held personal importance and meaning.

Because university support for herbaria is not reliable, the personal investment of staff, volunteers, and student workers is critical for the survival and growth of the collections. Long term curators such as Andy Sanders at Riverside and Ellen Dean at Davis devote considerable time and energy towards raising funds for supplies, additional staffing, and even improved facilities. Especially at the UCLA Herbarium, garden staff also make significant contributions and care about the future of the collections, even when they have no direct responsibilities in the herbarium. Long term volunteers—many of them former herbarium staff—freely offer their labor and expertise, and even short-term volunteers and student workers demonstrate care and commitment to the herbarium. Staff, volunteers, and student workers all strongly believed in the scientific, educational, and historical value of herbaria, although the members of these different groups emphasized different aspects. At the same time, personal investment by the staff and other groups alone is not enough to guarantee their future. Herbarium staff must also navigate university bureaucracy and develop strong relationships inside and outside the university in order for the herbarium to survive and grow.

Personal and Professional Relationships

[66] Maya Edmond (UCLA Herbarium archives intern), interviewed by the author at Los Angeles, California, October 2018, transcript, 1.

While a sense of ownership and personal investment in the herbarium by the staff and their volunteers and student workers is important for advocacy and filling in gaps in university support, the development and maintenance of three kinds of relationships are also critical for ensuring an herbarium in the UC system is able to obtain necessary resources to survive and grow. First, herbarium staff must build strong relationships within their parent institution, including administrators in key roles and the faculty members that make up the traditional user base, although some degree of autonomy is desirable. Poor or nonexistent relationships with administrators and faculty can result in the collections becoming devalued or underused, which can in turn lead to funding cuts and even disposal of the collection. Second, herbarium staff must cultivate good relationships with their student workers and volunteers, who may go on to become donors or members of related institutions. Third, the staff must maintain connections to other herbaria for support. These connections may take the form of collaborative projects, which can bring in grant money and prestige, but they are also often informal, as staff across the different herbaria share advice and equipment and also advocate for each other. This third type of relationship can be especially important for small or less established herbaria, which are particularly vulnerable to loss of resources and frequently lack the ability to initiate major projects on their own.

Within the university, the strength of the personal and professional relationships of herbarium staff to key members of the administration can significantly affect the trajectory of the collections, as the administration is the major source of financial support and physical space. These connections are built over time and depend on the personalities of the people involved, but good relationships can have clear benefits and can protect the herbarium during financial downturns. At the Davis Herbarium, for example, curator Ellen Dean has also worked to develop

long term relationships with administrators. She noted that her "money person" in the College of Biological Sciences was a member of the Davis Botanical Society and her daughter had also interned at the herbarium. She felt that these connections were especially valuable when administrators were planning budget cuts: "All of this stuff is personal relationships with people…When they're going to cut money, and they see, okay, who's the name attached to it—I think it really helps that they know who you are. You're not just some anonymous person."[67]

At UCLA, Dr. Mildred Mathias played a central role in building and maintaining ties with administrators over the course of her long career through her involvement in numerous campus committees and organizations as well as other social and academic activities. Mathias was hired as an herbarium botanist in 1947 and was later promoted to director of the botanical garden and herbarium, a role she held until her retirement in 1974.[68] In her oral history, she described how she was able to come into contact with key individuals through Carl Epling, who belonged to a committee to invite faculty research lecturers. He would host parties for these visiting lecturers at his house, which were frequently attended by UC President Robert Sproul and other important administrators and faculty: "This was the way I met so many of the people on campus and statewide from the university, because [Epling] would just go down the list of all the senior professors with whom he had worked on the senate, and these people would always turn up."[69] In this manner, she was able to gain high-level supporters such as Chancellor Franklin

[67] Dean, 8.

[68] Arthur C. Gibson, "Mildred E. Mathias Hassler (1906-1995)," UCLA Mildred E. Mathias Botanical Garden, accessed February 10, 2019, https://www.botgard.ucla.edu/mildred-e-mathias-3/.

[69] Mathias, 248.

Murphy, who Mathias described as especially financially supportive of her efforts to develop the botanical garden until Ronald Reagan's budget cuts took effect and curtailed spending.[70] Her ties to many people in the university also gave her an advantage when administrative decisions were made that affected the botanical garden and herbarium, such as an instance when she discovered that the construction of the new dental wing potentially encroached on the garden: "I got through the grapevine, from somebody in the architect's office, that [the new wing] was coming some thirty-five feet into the garden. So I wrote a letter to the vice-chancellor [Bill Young]…and I immediately got calls."[71] Evidently, the designers had not realized that their plan impacted the garden, but because of Mathias's actions and connections she was able to convince the vice chancellor to revise the plans.

However, because these relationships are personal and not solely professional in nature, the loss or retirement of key individuals can result in weakened ties between the herbarium and administration. Weak relationships between herbarium staff and administrators were frequently characterized by feelings of uncertainty, pessimism, and lack of control on the part of staff. This was especially the case for the herbaria at Irvine and UCLA, which were both largely run by newer staff who had not had the time to develop these long term relationships and successfully advocate for the collections. Prior to receiving news during the summer of 2018 that the UCLA Herbarium was to be included in the remodel of the La Kretz Botany Building, collections manager Tom Huggins had feared that the herbarium would be broken up and distributed to larger herbaria because the university had not invested sufficient resources for its upkeep for

[70] Ibid., 211.

[71] Ibid., 207.

many years.[72] Director Phil Rundel believed that maintaining the support of the dean was critical because "she connects me to higher up in the administration people" and that under a less friendly dean, the herbarium might be forced to downsize or close.[73] Former staff research associate Barry Prigge noted the herbarium had especially struggled in the 1990s under a dean who was not supportive of field biology: "Everything had to be laboratory-oriented biology, so a lot of people left and were not replaced because of him."[74] This poor relationship, in turn, resulted in multiple rounds of budget cuts that affected the ability of the herbarium to operate.

Apart from administrators, maintaining strong relationships with faculty are crucial because faculty are generally the core user base of an herbarium. While most faculty users may be drawn from a single department (if not a botany department, then usually a department in evolutionary biology or a related field), it can be advantageous to form ties across multiple departments. At the Davis Herbarium, curator Ellen Dean stated that when she had originally been hired in 1995, her appointment had been split between two colleges and she worked with faculty members in numerous departments. Although she found this structure personally challenging because of the demands on her time and the need to be accountable to many people, she felt that the relationships she developed with faculty were critical for fundraising for a new facility.[75] Similarly, at the Riverside Herbarium, curator Andy Sanders noted that the herbarium was not just used by faculty in the Department of Botany and Plant Sciences, but also by faculty in entomology, anthropology, and even the arts. Even though he tended to not expend much

[72] Huggins, 5.
[73] Rundel, 14-15.

[74] Prigge, 3.

[75] Dean, 4.

energy on outreach, the herbarium nevertheless had a presence on campus that extended beyond a single department.[76]

Conversely, when an herbarium relies on faculty from a single department to be the user base, problems can arise when faculty retire or leave and the focus of that department changes. This has been the case at both the UCLA and Irvine herbaria, where faculty relationships tend to be limited to one department (Ecology and Evolutionary Biology), and staff felt that the collections were not particularly well known or used as much as they could be by the faculty or their labs. At Irvine, nursery manager Rebecca Crowe felt apart from the director, many faculty were either unaware of the existence of the herbarium or did not realize it was open for use.[77] At UCLA, staff tended to attribute the lack of use of the herbarium to departmental turnover and the loss of researchers who might use the collections. According to former staff research associate Barry Prigge, "Before I got here [in 1984], we had three or four people working in systematics…Plus they had quite a few graduate students, so there was quite a bit of activity here at one time…Basically it was a process of attrition. People retired; they were not replaced."[78] Director Phil Rundel agreed that the composition of the department had changed, and he contrasted the relatively low use and awareness of the herbarium by faculty with the Donald R. Dickey Bird and Mammal Collection, which is more closely aligned with current departmental research interests and consequently receives active use by multiple faculty for research and teaching.[79] Collections manager Tom Huggins noted that some faculty in the Ecology and

[76] Sanders, 3-4.

[77] Crowe, 5.

[78] Prigge, 2-3.

[79] Rundel, 5.

Evolutionary Biology Department had used the herbarium for class tours and occasional specimen preparation workshops and he had also given tours to classes in the Geography Department.[80] However, only a few EEB faculty members were currently using the herbarium for their research.

At the same time, although relationships with the faculty of certain departments was considered important, the staff at the Berkeley and Davis herbaria both felt that some degree of autonomy was necessary for the long term growth of their collections. Of the five herbaria in this study, only the Riverside Herbarium was directly administered through a department, while the other four were considered independent from a department and instead reported to a higher level of the administration, such as a dean (as in the case of UCLA) or a vice chancellor (as in the case of Berkeley). Berkeley Herbarium director Brent Mishler placed high value on this independence: "Whenever a museum is under a department, there's other pressures on the budget…But our budgets run just for the museum, and although they've been cut, we still have our decision about what to do with them. Our department chair can't take parts of it for something else."[81] Furthermore, being a separate entity from a department allowed the herbarium to initiate and continue long term projects such as the Jepson Flora Project, rather than being dependent on the research interests of current faculty members. Davis Herbarium curator Ellen Dean agreed that autonomy was critical for success, and the reorganization decision made in the mid-1990s to separate the herbarium from the Botany Department had been positive: "They realized that the herbarium served people in twelve different departments in two colleges—actually, three colleges, if you count the vet school. So they made the money go through the

[80] Huggins, 6-7.

[81] Mishler, 2.

dean's office at a higher level, so that a department couldn't cut the funding. And that has really saved us."[82] By reporting to a dean instead of a department chair, the herbarium was partially insulated from changing priorities in the department as faculty came and went.

While strong relationships with administrators and faculty are important for ensuring the survival and continued use of the herbarium, other relationships can provide additional forms of support. Mentoring relationships between herbarium staff or faculty and their volunteers and student workers can also have lasting value, as these volunteers and student workers may go on to take positions within the university, work at other herbaria, or become donors. At the Davis Herbarium, Dr. Ellen Dean felt that mentoring of students was one of their strengths, which distinguished them from related entities such as the arboretum and conservatory that also offer internships and employment opportunities. This focus on mentorship has helped them recruit new student workers, interns, and volunteers: "We spend a lot of time talking to them about what they want to do in life and helping them get there. That has started attracting them to us. They'll say [to their friends], 'Oh, you're having a hard time deciding; go to the herbarium.'"[83] She noted that she had maintained relationships with some of those former students, who later became staff at the Davis Arboretum or became supporters of the herbarium as members of the Davis Botanical Society. At the UCLA Herbarium, collections manager Tom Huggins also emphasized the importance of training and mentoring student workers and volunteers, some of whom had gone on to graduate school or to work or volunteer at other herbaria. These mentoring relationships sometimes also resulted in tangible long-term benefits. The value of the mentorship provided by Mildred Mathias was especially apparent at UCLA, where multiple herbarium

[82] Dean, 4.

[83] Ibid.

donors had worked in the herbarium as undergraduate students under Mathias and had very fond memories of their experiences. The project to digitize a portion of Mildred Mathias's slides and make them available on the botanical garden website was funded by one such donor, and other individuals who had joined Mathias on her UCLA Extension field classes contributed their own photographs and audio related to these trips.[84]

In addition to relationships cultivated within the university between staff, faculty, and administrators and mentoring relationships between staff and their student workers and volunteers, herbarium staff also often rely on the staff at other herbaria for formal and informal support. Staff at the different herbaria were generally happy to help each other out and collaborate when possible. Support may come in the form of shared grant-funded projects such as the Consortium of California Herbaria or participation in various professional societies, but it can also include the sharing of informal advice and donating of equipment. These networks are of special importance for herbaria that lack stability and support from their own institution and can prove especially valuable during crises.

Formal collaborative projects provide herbaria with an opportunity to update their equipment and facilities, improve access and use of their collections, and justify continued support from their parent institutions. Collaboration allows for the initiation and sustained success of major projects that likely could not be undertaken by a single herbarium. All herbaria in the UC system, for example, are participants in the Consortium of California Herbaria [CCH], which is hosted by the Berkeley herbaria. Individual herbaria upload their California and Baja California specimen data, which can then be searched and mapped through a publicly available

[84] See "Mildred E. Mathias Gallery & Bio," UCLA Mildred E. Mathias Botanical Garden, accessed February 11, 2019, https://www.botgard.ucla.edu/mildred-e-mathias-3/.

website. This site now contains data for over 2.2 million specimens drawn from more than 40 institutions. The CCH was funded through a major National Science Foundation grant and launched in 2003, and since that time related projects have been added to the grant, such as extensions to georeference specimen data for records lacking coordinates. Most recently, CCH participants are starting a new phase in the project to image herbarium specimens and add phenological information.[85] At UCLA and Irvine in particular, staff expressed considerable excitement over this latest project and were eager to show off their new imaging equipment, which they would not have been able to pay for on their own. Both herbaria are also using this opportunity to move their data out of older Filemaker Pro databases into Symbiota, a newer content management system that has gained popularity in the natural history collections community.

In addition to formal collaborative projects that can secure funding and improve visibility, the staff at many of these herbaria are also participants in or leaders of multiple professional societies, such as Southern California Botanists, the California Native Plant Society, and the Society of Herbarium Curators. UCLA collections manager Tom Huggins, for instance, serves on the board of Southern California Botanists and edits their newsletter, and often traveled to the herbarium at the Rancho Santa Ana Botanic Garden in Claremont for meetings. One UCLA garden staff member viewed participation in these groups as especially important for outreach purposes: "If there were to be full time staff, they certainly should be going to the herbaria meetings; they should be traveling to different herbaria throughout the country, really making a major effort to be part of this community of people who do this, and make sure our

[85] "About the Consortium," CCH1, accessed February 10, 2019, http://ucjeps.berkeley.edu/consortium/about.html.

name and identity is on the table."[86] Beyond face-to-face communication at conferences, information is shared through listservs, newsletters, and social media. These networks can become especially important when a collection is in crisis, such as in the case of the potential disposal of the natural history collections at University of Louisiana Monroe in 2017. Social media allowed the news to quickly spread throughout the natural history collections community and helped bring national attention to the situation. Ultimately, the collections found homes at other institutions.[87]

Beyond formal collaborative projects and participation in established professional societies, herbarium staff also rely on informal networks of support between local herbaria. One form of support can be through the sharing or donation of equipment that would be too expensive for smaller herbaria to purchase outright. For example, at Riverside, curator Andy Sanders had been imaging specimens with a flatbed scanner on loan from the nearby herbarium at Rancho Santa Ana Botanic Garden.[88] The herbaria at UCLA, Riverside, and Irvine all use salvaged herbarium cabinets. New cabinets can cost thousands of dollars, so while second-hand cabinets tend to be of poorer quality and more prone to insect infestations and other environmental problems, they are much more cost-effective. At UCLA, collections manager Tom Huggins proudly pointed out that the herbarium had two cabinets that had once belonged to Asa Gray at Harvard, although one of them did not close properly. Nursery Manager Rebecca Crowe at Irvine

[86] Anonymous UCLA Botanical Garden staff member, 6.

[87] Sarah Kaplan, "A University Is Eliminating Its Science Collection — to Expand a Running Track," Washington Post, July 5, 2017, https://www.washingtonpost.com/news/speaking-of-science/wp/2017/03/29/a-university-is-eliminating-its-science-collection-to-expand-a-running-track/.

[88] Sanders, 10.

noted that many of their cabinets had come from the herbarium at San Francisco State University when that institution received compactors. Even during my visit to the Irvine Herbarium, when I mentioned that the UCLA Herbarium was expecting to get new cabinets as part of the remodel, I was asked about the possibility of receiving old cabinets from UCLA to replace some cabinets with broken doors or mercury compounds in the gaskets.

Apart from equipment such as cabinets and scanners, three of the five herbaria (Riverside, Irvine, and UCLA) rely on specially modified versions of FileMaker Pro databases to record information about their specimens. Using versions of the same database allows for ease of uploading data to online portals such as the Consortium of California Herbaria, as well as the ability to share expertise and troubleshoot, as herbaria that are less well-resourced may not have the staff or infrastructure capable of developing and maintaining their own database. The Filemaker Pro database previously used at the Irvine Herbarium was a direct copy of the database developed in-house at Riverside by Andy Sanders in the 1990s. However, nursery manager Rebecca Crowe noted that the quality of the data had suffered over the years: "[As long as] there was a person who knew the database, I think it worked out well, but with these frequent staff turnovers and losing people for years at a time, that institutional knowledge is lost. And so you have the next person take over, and if the errors aren't resolved, they just propagate."[89] She was excited for the herbarium to switch from Filemaker Pro to Symbiota because many other herbaria were already using it, and so even if she left her position, the next person would have sufficient support to learn the ins and outs of the new database.

[89] Crowe, 9.

In addition to more material forms of support, the staff at the different herbaria are also generous with sharing advice on curatorial issues. Because the community is small, many of the staff at the different local herbaria know each other well and have personal and professional ties to other institutions. For instance, the director of the Irvine Herbarium had worked with Phil Rundel, director of the UCLA Herbarium, when Dr. Rundel had been faculty at Irvine in the 1970s. Undergraduate volunteer Rudy Diaz has volunteered at both the UCLA and Riverside herbaria. Multiple UCLA herbarium and garden staff previously worked or been graduate students at the nearby Rancho Santa Ana Botanic Garden.[90] As new questions continued to crop up around the logistics of preparing the UCLA Herbarium for the upcoming remodel, staff frequently turned to their colleagues at other institutions for answers. In response to a question about the best way to move herbarium specimens, Riverside curator Andy Sanders spontaneously offered to loan boxes to assist with the moving process. At the Irvine Herbarium and Arboretum, nursery manager Rebecca Crowe noted that she had frequently been in communication with UCLA botanical garden staff while they waited to learn more about what the university's proposed development plan for the arboretum would entail.

Finally, while these relationships between staff at different herbaria can have clear benefits, especially for smaller and under-resourced collections, this does not mean that they are entirely without conflict. At UCLA, former staff research associate Barry Prigge described a unique historical relationship with the herbarium at Berkeley that persisted as late as the 1980s that he felt was disadvantageous to UCLA. Although he was unclear on the exact origins of the arrangement, he explained that because UCLA was originally considered a satellite of Berkeley,

[90] This includes myself—in the course of my previous work at the herbarium at Rancho Santa Ana Botanic Garden from 2013-2017, I first met UCLA collections manager Tom Huggins and Riverside curator Andy Sanders.

many significant collections by UCLA faculty and other affiliates were ultimately sent to Berkeley, including Lamiaceae collections by Carl Epling and Apiaceae collections by Mildred Mathias. He believed this was an informal practice that gradually went away as certain individuals left or retired: "There was all this funny stuff going on, understandings between Berkeley and UCLA. Probably it was only the old-timers that knew it, and all the younger people never knew anything about it."[91] This differs from the usual practice of specimen distribution, in which a collector typically deposits a full set of specimens at their home institution but may designate sets of duplicates to go to other herbaria. Although Mildred Mathias's oral history does not mention this arrangement, it is clear that there were close personal and professional ties between faculty at the two campuses; for instance, Berkeley staff and faculty frequently traveled to UCLA to give seminars. Mathias herself believed that the collections at Berkeley were superior to those at UCLA, though she appreciated having greater freedom to develop new projects and courses.[92] Therefore, even though UCLA had historically been an important center for plant taxonomy research, the actual collections associated with that research are not available for current faculty and staff at UCLA.

The strength of these three kinds of relationships herbarium staff develop and maintain with different groups are important factors for survival and success of herbaria in the UC system. Many of these relationships are built over time and are both professional and personal in nature. Relationships between herbarium staff, administrators, and faculty within the university help determine how much an herbarium is valued and used. Weak or nonexistent relationships in this area can result in loss of resources or threaten the existence of the herbarium itself. Because

[91] Prigge, 10.

[92] Mathias, 202.

university support is unreliable, staff must build relationships with other groups for support, including current and former student workers and volunteers, who may go on to become donors or work at other herbaria, as well as the staff at other local herbaria, who can become potential collaborators on projects and provide informal advice and share supplies and equipment. The combination of personal investment in an herbarium by the different stakeholders and the strength of these different relationships come into play when staff must negotiate and organize one of their most vital resources: space.

Negotiations for and uses of space

The spaces occupied by the UC herbaria are constantly being negotiated and are subject to the changing needs and priorities of the university, as well as university policies, funding availability, and funding sources. Because space is a limited resource and never guaranteed, the result of these ongoing negotiations are a measure of the relative value and influence of an herbarium compared to other institutions on campus. Herbarium staff must continually adapt to these changes and justify their use of space. While these staff can exert some power to influence decision making, the process can often involve a high degree of uncertainty and activities across many levels of complex bureaucracy that staff may have little control over or understanding of, sometimes leading to outcomes that seem arbitrary or confusing. Ultimately, the location, amount, and quality of space provided to an herbarium can determine patterns of use, ability to grow, and perceptions of value.

Major changes in a university's strategic plan regarding the use of space can have direct and indirect effects on an herbarium. Because these decisions are made at a high level in the administration, herbarium staff may have limited influence and must simply adapt as best they can. At UCLA, the decision to dissolve the College of Agriculture in the 1950s and develop or

sell the land the college had been occupying affected a significant component of the herbarium's user base. Mildred Mathias attributed rising land values in the Los Angeles area as a major factor in the university's choice: "The decision was made that they simply couldn't afford to keep the college here with the experimental fields they needed and so forth in a metropolitan area where the land was so valuable."[93] This not only had implications for the use and appearance of spaces on campus as fields and orchards were transformed into buildings and parking lots, it also resulted in many faculty with research interests in agriculture or ornamental horticulture transferring to Davis or Riverside. To this day, the herbarium still maintains specimens, books, and archival materials related to UCLA's past history as an agricultural school, but apart from their historical value, they have limited relevance to current faculty interests. Although not the only factor in the gradual decline in activity at the UCLA Herbarium over time, this change certainly affected a considerable portion of its user base.

Uncertainty over the future of their space was a significant issue at the Irvine Herbarium, where staff had limited control or even knowledge over what was going to happen to it. Nursery Manager Rebecca Crowe named physical space as the only support the university provides, and even that was in doubt, because the staff knew that North Campus where the arboretum and herbarium are located in is now slated for development because of a major change in the university's strategic plan. The uncertainty has affected their ability to plan new projects: "We're not able to do anything at the arboretum until we get further guidance from the university about what they're going to do to the site. It could be under houses in a couple years. It's not just a lack of funding and resources, it's a lack of [knowledge about] 'Are we going to be here?' that makes

[93] Mathias, 260.

things more difficult."[94] While she felt there was enough interest among faculty to keep the herbarium at Irvine, she was unsure where it would actually end up once the university moved forward with its development plans. She mentioned several possibilities that had been raised, including moving the herbarium onto the main campus to be closer to students and faculty, combining the plant collections and art collections following a model based on the Huntington Library, or keeping it attached to the arboretum should the university decide to maintain the arboretum as a community garden. As of the time of our interview, she felt that none of the ideas were fully formed and the future of the herbarium and arboretum were still unclear.

Beyond major decisions about space made at the highest levels of the administration as strategic plans are revised, specific university policies about space can govern how that space is obtained and used. At Riverside, curator Andy Sanders has successfully grown the collection from 16,000 to 277,000 specimens over the course of four decades. He has overseen multiple collection moves as the university has at various points needed the space the herbarium was located in for other groups or projects. He has been able to take advantage of a university policy that offers an equivalent amount of space to any group they ask to move. In the most recent collections move in the early 2000s, the Riverside Herbarium was taken out of a series of double-wide trailers and placed in a single building, which had the same square footage but could be organized in such a way to maximize the amount of space available for the collections: "[The previous location had] a lot of hallways and all kinds of weird little spaces. It was a lot of wasted space I couldn't use effectively. So [in the current space] I got to design the place with one big collections room and a workroom in the back."[95] He also cited a favorable departmental

[94] Crowe, 6.

[95] Sanders, 3.

review that found that the herbarium needed more space, which subsequently allowed them to double in size. However, he was now concerned that at the current rate they were adding specimens, the Riverside Herbarium would run out of room within the next few years.

At UCLA, in contrast, in-kind space is not guaranteed in the event of a move, and policies set by the capital planning program also restrict the sizes and dimensions of offices and other spaces. Botanical garden and herbarium director Phil Rundel noted that the capital programs have become "much more business-like" and consequently "space has certain characteristics it has to have."[96] He felt that this mindset and policy sometimes resulted in decisions that made little sense, such as in the case of a recent renovation of a portion of the Life Sciences Building in which office and lab size restrictions led to space being wasted, or another renovation that tore out relatively new labs and put offices in their place. This policy has come into play as garden and herbarium staff have worked with the architects to design the remodeled herbarium, especially with regards to the number and locations of office spaces, as the initial building remodel did not include a designated office for botanical garden staff. Consequently, some garden staff have attempted to negotiate for such an office within the herbarium, but these policies have made that process more complex and reduced flexibility. As of spring 2019, it remains to be seen what the final layout of the remodeled herbarium will be and whether a garden office will be included.

Beyond university policies, funding availability and sources also play a major role in how space can be obtained or updated. University funding alone is rarely enough to support facility improvements. At Davis, curator Ellen Dean had been successful in obtaining a facility with better climate controls, but it had required major fundraising efforts on her part. She attributed

[96] Rundel, 16.

this to a strong business mentality at Davis, which she felt was distinct from the other campuses in the UC system: "Everybody has to be like a little business. You have to be a little entrepreneur to keep your particular corner of the university going."[97] Similarly, the upcoming remodel of the UCLA Herbarium and rest of the La Kretz Botany Building only came about through the work of the Dean of Life Sciences in securing a massive private donation, which would be matched by university funds. Director Phil Rundel noted that the La Kretz Botany Building had not been remodeled in many years and badly needed to be updated, but it had not been a priority for the university until a donor was found. He explained that the process of securing the donation had been piecemeal: "[The donor] gave us a million dollars for the entrance to the botanic garden. And then he and his daughter liked what we were doing, and they gave us five million dollars to build the building. So then…what suddenly came out of the blue was he wanted to promote the botanical sciences…And then, with some negotiation, he popped for five million dollars more to remodel the first floor of Botany, and some work on the fourth floor."[98] From there, the university was able to obtain a large enough donation to remodel the rest of the building, including the herbarium. Under the current plans, as of spring 2019, the remodeled herbarium will occupy the same space, but with significant upgrades such as climate-controlled areas on the first and second floors. This is a major reversal from previous negotiations over the fate of the UCLA Herbarium, where Dr. Rundel had felt pressured to downsize from three floors to two. He believed that the main reason they had not been forced to do so was because of high renovation costs: "They want the herbarium to use negative space…If there were a cheap way to do it, I

[97] Dean, 14.

[98] Rundel, 15.

think they would have told us to cram into a smaller space. But in order to put a whole floor in there, and utilities and everything, that would be as expensive as everything combined."[99]

The location of the herbarium on campus relative to its potential user base affects its visibility and accessibility. The two herbaria in this study that experienced the greatest challenges with attracting users—Irvine and UCLA—both had problems with visibility, which the staff partially attributed to their location. This was especially the case at Irvine, where the herbarium is not even located on the main campus but in an area called North Campus. Although the Irvine Herbarium had originally been on the main campus as a part of the Museum of Systematic Biology, the museum was moved to the North Campus area in 1988 and then closed in the mid-1990s. The herbarium, however, never returned to the main campus and was instead absorbed into the Irvine Arboretum. Meanwhile, the Department of Ecology and Evolutionary Biology and many of the faculty members that would potentially use the herbarium are located on the main campus. Nursery Manager Rebecca Crowe felt that the relationship between the department and herbarium was poor because many faculty members did not know about it, or, if they did know about it, they did not realize it could be accessed. Her hope was that eventually the herbarium would be moved back to the main campus, because then it would be more accessible to researchers and students.[100] Furthermore, apart from the physical distance from the main campus, access to the herbarium in its current building is difficult because the collections and workspaces and storage areas are split across five rooms that are not next to each other or necessarily marked. This fragmentation also makes it more difficult for the staff to use the space

[99] Ibid., 4.

[100] Crowe, 6.

they do have effectively, compared to the more centralized designs of the Riverside and UCLA herbaria.

At UCLA, the herbarium occupies a portion of three floors in the La Kretz Botany Building, but can only be entered through the door on the first floor. Although the door has a small label identifying it as the herbarium and there are posters and flyers pinned on the bulletin board in the hall, the door is typically kept closed even when staff are present and there are no windows to see inside (Figure 16).

Figure 16. UCLA Herbarium, 1st floor entrance (right), and Mildred E. Mathias Botanical Garden office (left).

Some staff and student workers and volunteers felt that the herbarium was difficult to find and believed most people on campus were unaware it existed. According to former volunteer Carla Monoy, "I don't think people even know there is an herbarium there. It seems like a secret for all the people who are in that building…People know about the garden, but not the herbarium."[101] Botanical Garden Visitor Services Coordinator Jules Cooch described the herbarium as "a little

[101] Monoy, 3.

mysterious door. You would never know the herbarium is there…It's not really a public space."[102] As one of the newer staff members, she had only started to become aware of the herbarium and its collections because she had to go there to interact with other garden staff. When asked about the relationship between the herbarium and the EEB Department, Collections Manager Tom Huggins said, "I feel like the department for many years didn't realize the herbarium was really here, and so it's hard to value something when you don't know that it exists."[103] A garden staff member noted that in the current configuration, the faculty that were most likely to use the herbarium for their research had their offices and labs in the Life Sciences Building across the street, and he expected that the plan to move those faculty (especially plant systematist Felipe Zapata) into the renovated La Kretz Botany Building would improve herbarium use. He felt that the distance decreased the likelihood those faculty would visit the collections because "if you have to walk a hundred steps you're going to be a lot less likely to do something."[104] This seemed to be the case even for garden and herbarium director Phil Rundel, who did not have an office in the La Kretz Botany Building. Consequently, he tended to only come to the herbarium for meetings or if there was a garden event to prepare for.

At the Irvine and UCLA herbaria, some portions of their space had to be shared with other groups. The need to share space can be problematic, as it takes away room that could otherwise be occupied by herbarium. This was the case at Irvine, where one of the rooms the collections were stored in doubled as a lab space for a faculty member, who used it to euthanize birds for her research (Figure 17).

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[102] Cooch, 2.

[103] Huggins, 6.

[104] Anonymous UCLA Botanical Garden staff member, 4.

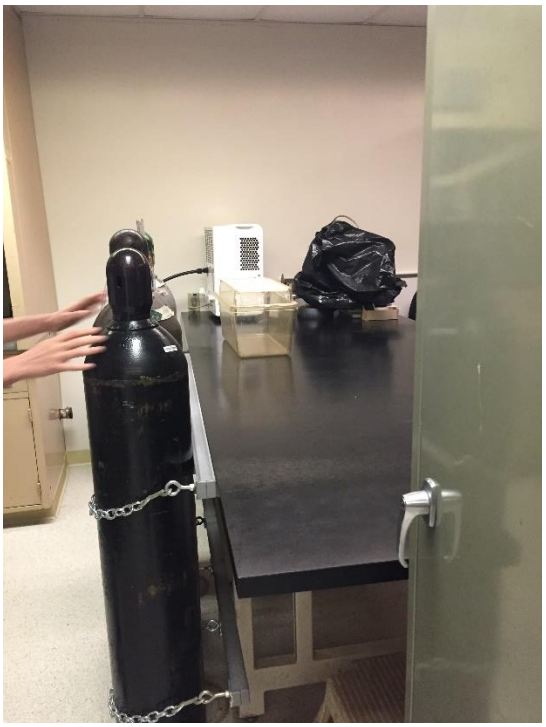

Figure 17. UC Irvine Herbarium. Lab equipment in the shared collections space.

In contrast, at UCLA, the botanical garden office is adjacent to the herbarium and one garden staff member has an office within the herbarium. In this instance, sharing space has allowed the staff from the two groups to interact frequently, contributed to a sense of a shared mission, allowed garden staff to become familiar with the collections, and provided opportunities to engage in collaborative projects, usually at the initiation of garden staff. For example, garden staff designed and oversaw the Mildred E. Mathias slide digitization project for intern Maya Edmond, who relied on archival materials stored in the herbarium and eventually posted the images on the botanical garden website.[105] Such projects highlight the close historical

[105] See "Mildred E. Mathias Archive," UCLA Mildred E. Mathias Botanical Garden, accessed January 30, 2019, https://www.botgard.ucla.edu/mildred-e-mathias-2/.

relationship between the garden and herbarium and increase visibility for both groups, and would be harder to execute if key garden staff were not situated close to the herbarium.

In addition to location and size, the quality of the space can affect how staff, student workers, and volunteers spend their time and the types of challenges they encounter. Collections housed in older or rundown buildings can experience environmental problems ranging from insect infestations to mold, which in turn impacts use. Staff at Davis and UCLA both mentioned past issues with insect infestations caused by a lack of climate control and proper seals to the outside environment. At Davis, curator Ellen Dean noted that the insect problem ate up significant amounts of staff time and resources, and was only resolved through obtaining a better facility: "We were freezing 10,000 specimens a month, just cycling them through, because the insects were so bad in our old facility…And now, since we've moved into our new facility and we keep the temperature at 60 degrees in the collections area, we haven't had a live insect for 13 years."[106] This allowed her staff to reduce pest management duties to checking cabinets twice a year and focus their energy on other duties such as mentoring students and managing volunteers.

The UCLA Herbarium has also experienced serious insect infestations over the years, but instead of moving to a new facility, the staff used various insecticides to try to solve the problem. Former herbarium staff research associate Barry Prigge recalled that many specimens had simply been thrown away because they were so badly damaged. He attributed the problem to the fact that the building had previously been running on a swamp cooler, which created a humid environment, and because other researchers in the building had been storing rodent food and other materials that attracted insects. Because of the severity of the problem, specimens were treated with an array of chemicals over the years, including—but possibly not limited to—lauryl

[106] Dean, 2.

pentachlorophenate, Drione dust (a silica-based desiccant), and fumigation with methyl bromide. Only Drione dust is still commercially available. Dr. Prigge felt that even though environmental health and safety staff had said there was no serious health hazard to herbarium staff and users, it nevertheless discouraged use.[107] Collections manager Tom Huggins agreed that the use of chemicals had made users and potential users more hesitant to handle specimens, and one of the first projects he initiated when he started in his position in 2014 was to begin vacuuming the Drione dust out of the cabinets and wipe down the folders—a labor-intensive process that took him six months to complete.[108] Even now, deteriorating pest strips are still occasionally found in cabinets and disposed of. The UCLA Herbarium no longer uses chemical treatments for pests, and consistent with current best practices, the staff now treat specimens by freezing them for a seven-day period before they enter the collection. The staff do not perform regular checks for beetle infestations or have written pest management policies, even though other types of insects such as silverfish and ants have been observed in the herbarium. They felt that the current measures were sufficient as no major outbreaks had occurred over the past few years, but they preferred an environment with climate controls and new cabinets with better seals.

At Irvine, managing insect infestations remains an ongoing challenge. Nursery Manager Rebecca Crowe named pest management as one of her main job responsibilities. Along with her student interns and volunteers, she spends a considerable amount of time monitoring cabinets for beetles, freezing specimens from infested cabinets, and repairing damaged specimens (Figure 18).

[107] Prigge, 16-17.

[108] Huggins, 5.

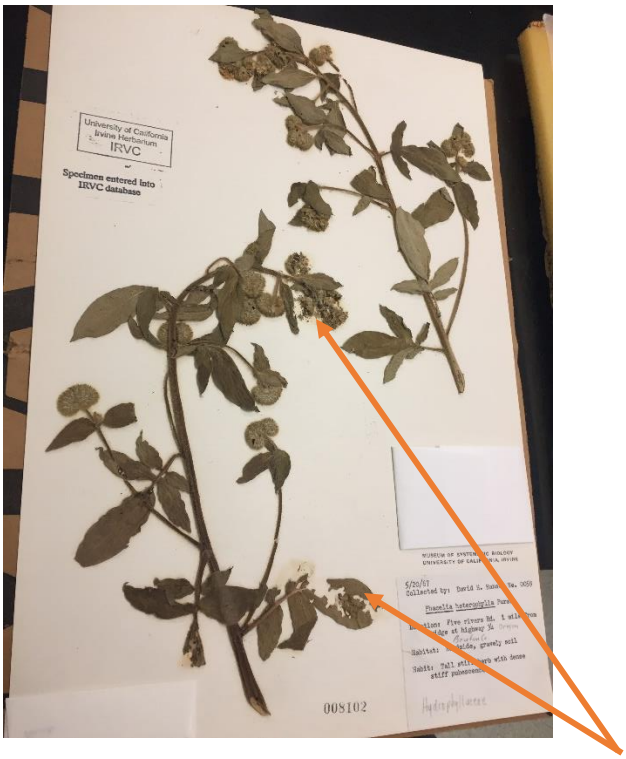

Figure 18. UC Irvine Herbarium. Repaired specimen showing signs of past beetle damage.

She noted that summers had been especially bad for beetle activity because of the high humidity in the building. She suspected that the problems with insect infestations had most likely started when the Museum of Systematic Biology was closed and the herbarium was put into storage for period of time with no active custodian to look after it, and that there had been multiple major infestations because specimens of all ages were affected. Similar to UCLA, pest strips had been used at some point to try to control the beetle problem, but she had decided to phase them out because of health and safety concerns. She named facility improvements for the collection as one of her main priorities: "I've done the best that I can in this space keeping it as cool and dry as possible, but it's still not where it needs to be…it's always very humid here, so humidity is our

huge challenge. If we can get humidity and temperature down, we won't have this recurring beetle problem…Establishing a safe spot for the collections is a challenge."[109]

In addition to insect infestations, lack of climate controls also creates conditions favorable for mold. This was an issue at the Irvine and UCLA herbaria, which are both housed in buildings more than fifty years old—and, in the case of Irvine, in a building that had been intended to be a temporary structure and not a permanent home for collections. At Irvine, Crowe had isolated and frozen specimens that she had discovered to have mold, though she had not had the resources to treat them. She was using a dehumidifier in one of the rooms holding part of the collection to try to control the humidity. At UCLA, the problem with mold had mainly been confined to the first floor where the library was kept, but it has affected the ability of individuals to use this collection. Although the staff purchased a dehumidifier to attempt to slow the mold growth, the dehumidifier must constantly be monitored and emptied out by the staff and volunteers and does not resolve underlying HVAC problems with the building. One of the major changes in the design for the remodeled herbarium would be to move the library to the third floor, where air circulation is better and active mold has not been observed.

Beyond location and quality of the space, the overall appearance and organization of the space affects how staff, users, and volunteers and student workers feel about being there and whether the herbarium is valued or well-used. One theme that emerged in many interviews with UCLA staff and student workers and volunteers were impressions that the current space felt disorganized, claustrophobic, poorly lit, and dated. Dusty boxes of donated books, papers, and specimens that staff had not had time to process were shoved under tables or left on top of cabinets (Figure 19).

[109] Crowe, 7.

Figure 19. UCLA Herbarium, 3rd floor. Boxes of unprocessed donated books, papers, and other materials stored under lab bench.

The staff did not have a regular cleaning schedule, and so dust and dirt would tend to accumulate on the floor and other surfaces until staff had the time to clean them. This gave the impression that the herbarium was not highly valued or used, and also affected the ability of staff and student workers and volunteers to work efficiently. When asked about his first visit to the UCLA Herbarium, undergraduate student volunteer Rudy Diaz noted, "I was impressed by how it seemed to be frozen in the 1960s" and that "it doesn't seem like it's gotten much attention over the last several decades."[110] This remark was echoed by intern Maya Edmond, who commented that "[the herbarium is] a little frozen in time, and it needs sprucing up."[111] PhD student and volunteer Ioana Anghel felt that the disorganization made it more difficult for her to feel excited

[110] Diaz, 1.

[111] Edmond, 4.

about being there and she had sometimes had trouble finding the specimens and tools she needed for her own research.[112] Many of the volunteers and student workers had gone on a field trip to the nearby herbarium at Rancho Santa Ana Botanic Garden in Claremont, which they felt had a more modern and organized appearance. According to undergraduate student worker Dalissa Arteaga Alanis, "Sometimes [the UCLA Herbarium] is kind of messy; sometimes I would like for it to be a little more organized…[The herbarium at Rancho Santa Ana Botanic Garden] was super organized, and it made it a lot easier to work."[113] Even minor, low-cost methods can make a difference, such as Riverside curator Andy Sanders' practice of putting up posters on cabinets to both indicate the types of specimens found inside and add color and brightness (Figure 20).

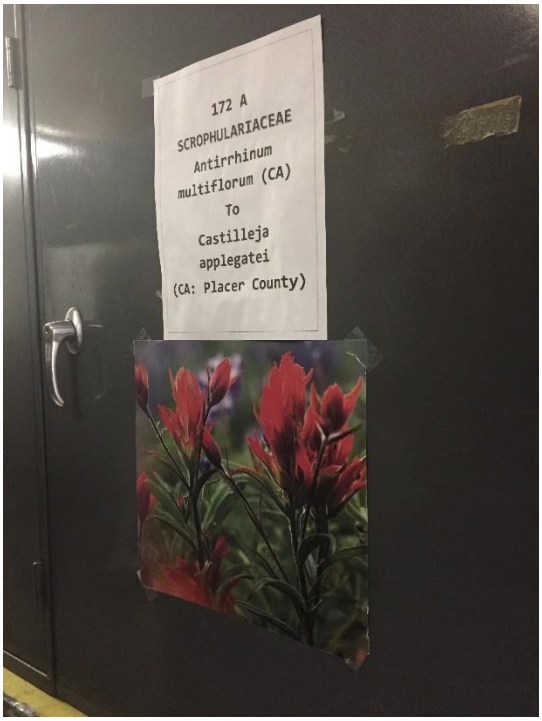

Figure 20. UC Riverside Herbarium. Posters on herbarium cabinets brighten the space.

[112] Anghel, 3.

[113] Arteaga Alanis, 3.

Many staff and student workers and volunteers at UCLA were very enthusiastic about the upcoming remodel and felt that improving the appearance and organization of the space represented a major opportunity to increase its visibility and use. According to graduate student volunteer Ioana Anghel, an attractive space would "attract people who might become interested in it…I think it brings a better community, in some way, when it's a more organized space, [a] more welcoming space."[114] Although the designs by the campus architects reduced the amount of space that could be used to store collections because of partitioning, the staff and student workers and volunteers were nevertheless excited about other aspects of the design, which included study spaces, exhibition cases, windows to allow in light, and new herbarium cabinets in compactors in a climate controlled area. Collections manager Tom Huggins believed that the remodeled space would lead the university to place greater value on the herbarium because "people will be more likely to invest money in a resource that is currently state of the art and organized and up to date."[115] However, despite general agreement that an improved facility was very important, some of the staff and student workers and volunteers named sufficient staffing as the most critical need. Former staff research associate Barry Prigge, for instance, believed it was crucial for the herbarium to have leadership from a plant systematist.[116] Part-time collections manager Tom Huggins stressed that the herbarium needed at least one full time position, possibly an equivalent to the botanical garden's assistant director position. However, as of spring 2019, I am not aware of any plans to fund such a position.

Summary

[114] Anghel, 5.

[115] Huggins, 9.

[116] Prigge, 17.

Because herbaria in the UC system cannot expect full support from the university, their staff have increasingly turned to outside fundraising measures for supplies and additional staffing. At Riverside and previously at UCLA, this took the form of consulting work. At Davis, curator Ellen Dean has developed a fundraising model based on outreach. At the Irvine Herbarium, where the only university support is the space provided to the herbarium, staff are currently funded through grant money. Even at the Berkeley Herbarium, the largest and most prestigious of the UC herbaria, only about 20% of the funding is supplied by the university itself, and the staff have pursued a fundraising strategy based on outreach and grants.[117] Despite the erosion of university support, many of the staff expressed a deep sense of personal investment and ownership over the collections. They strongly believed that these collections held irreplaceable scientific, educational, and historical value, and that this value needed to be communicated both to stakeholders within the university and the general public. This sense of ownership and even pride is especially apparent among those staff that had been with the herbarium for many years, but it is also demonstrated through the labor of long- and short-term volunteers and student workers and by staff in adjacent groups, such as in the case of the botanical garden staff at UCLA.

While the personal investment of staff is critical, that alone is not enough to guarantee the continued existence and growth of an herbarium. The staff also need to build and maintain strong personal and professional relationships inside the university, especially with key administrators and faculty. Good relationships with volunteers and student workers can pay off both in the short and long term, as can relationships with the staff at other herbaria, who are natural partners for formal collaborative projects but are also sources of advice and informal support. In turn, these

[117] Mishler, 2.

relationships have significant material implications. In particular, intra-university relationships play a key role in the distribution and organization of space, one of the most important resources an herbarium can have. The location, amount, and quality of space determine patterns of use and how the herbarium is perceived. An herbarium in a space that is located far from its likely user base will tend to struggle with visibility and ease of access. This has been especially problematic for the Irvine Herbarium, which is not located on the main campus. An herbarium in a space that is environmentally unsuitable may result in damage to the collections themselves, as has been the case for the herbaria at UCLA, Irvine, and Davis. In turn, this damage negatively impacts the ability of individuals to use the collections and requires significant staff resources and time to mitigate. Finally, the organization and appearance of the space affects how users and workers feel about being in the herbarium and how easily they can accomplish their tasks.

Chapter 4. Conclusions

In recent decades—owing in part to the trends towards privatization in public universities and changes in how biological research is conducted mentioned in the introduction—the UCLA Herbarium has struggled to adjust as its traditional user base has dwindled and university support has decreased. Beginning in the 1980s, the research focus of the Ecology and Evolutionary Biology Department began to move away from plant systematics and field biology as the faculty that had specialized in those areas retired or left. Botany is no longer offered as a major or minor, and only a limited number of botany courses are offered. Consequently, the use of the herbarium by faculty for research and teaching has declined, and it is clear that the relationships between the staff and key members of the administration and EEB Department are not as strong as they were in the past. At the same time, the adoption of market-driven ideologies in the university and pressures to reduce public spending have also negatively affected the herbarium. Direct funding cuts have reduced the ability to staff the herbarium: currently, because there is no longer a fulltime curator, responsibility for the day-to-day maintenance of the herbarium falls entirely on a part-time collections manager, with botanical garden staff sometimes pitching in. There are striking parallels here to the de-professionalization of librarianship described by Crowley and Ginsberg as lower-paid paraprofessional staff take over what had previously been professional roles. Furthermore, market-driven ideologies have also meant that administrators' expectations have changed and herbarium staff have felt increased pressure the continued existence of the collections and prove that they are "useful." According to herbarium and garden director Phil Rundel, "The kiss of death [for the herbarium] would be to say that no university courses used it at all…we need to think about justifying how the collection gets used."[118] This fits well with

[118] Rundel, 10.

Rebecca Lave's observation on the rise of the "tyranny of relevance" in neoliberal science regimes, in which funding for basic research programs is sidelined in favor of short term projects with greater marketing potential that can bring in grant money from outside sources.[119] Consequently, even though the staff are invested in keeping the collections at UCLA and feel they are still important tools for education and research, they have struggled to gain the support they need from administrators to modernize or grow. This in turn fuels impressions that the herbarium is outmoded and more of a historical curiosity than a center for research and teaching. Until a recent private donation to renovate the La Kretz Botany Building, some staff believed that the herbarium would either be dissolved or forced to drastically downsize, and only bureaucratic inertia had prevented this from happening. The upcoming renovation represents a major opportunity for the herbarium to modernize and for staff to reconceptualize its mission and how they believe it should be used in the future. However, the renovation alone does not guarantee increased use or that it will be more highly valued by the administration.

In this final section, I focus on some of the major strengths and challenges of the UCLA Herbarium as it enters this transition period, offer some possibilities about where this herbarium may be headed, and provide recommendations. First, I identify three main strengths of this herbarium. This includes the close relationship between the herbarium and Mildred E. Mathias Botanical Garden and the interest of the garden staff in promoting the herbarium and its collections, the emphasis on developing strong mentoring relationships with volunteers and student workers, and the diversity of the collections themselves and their connection to local history. However, the herbarium also faces major challenges, especially understaffing and limited use by faculty. Other notable challenges include a lack of knowledge about the contents

[119] Lave, 23-24.

of the collections (particularly the non-specimen materials) and communication difficulties among the staff. Accordingly, I recommend that the staff adopt a strategic plan to reevaluate the mission statement, address questions of staffing, assess collection strengths, identify user and potential user needs, identify alternative funding sources, consider ways to demonstrate value, and consideration for how to handle future leadership transitions. I also suggest the adoption of written collections policies, especially regarding disaster preparedness and the acquisition and management of non-specimen materials. Finally, in order to improve awareness of the herbarium on and off campus, I recommend that staff consider ways to make the herbarium entrance more inviting and attractive, regularly update the herbarium website, and work with garden staff to develop a stronger social media presence. An active presence online and an improved and modern entrance (perhaps with changing exhibits) will help attract users and supporters, and also inform administrators of the types of activities and projects undertaken by herbarium staff and the value it provides to the UCLA community.

Strengths

Despite some of the issues outlined above, the herbarium has three major strengths: the close ties between the herbarium and botanical garden and the investment of botanical garden staff in promoting the herbarium, the mentorship staff provide to student workers and volunteers, and the diversity of the collections. First, the histories of the Mildred E. Mathias Botanical Garden and herbarium are closely connected, and the garden will almost certainly continue to be a key source of support going forward. While the herbaria at Berkeley, Davis, and Riverside are largely considered separate entities from their affiliated botanical gardens and arboreta, the UCLA and Irvine herbaria share common directors and staff. The downside of this arrangement means that the herbarium and garden can and do compete for the same resources, with the garden

usually receiving greater attention as the more public-facing side. At the same time, the involvement of the current garden staff in initiating herbarium-centric projects and events, participating in the renovation plans, securing donations, and highlighting the collections on the garden website and social media demonstrate their belief that the herbarium and garden have a shared mission and history. These staff feel that the collections are important but underused and poorly known, and they are interested in finding creative ways to boost awareness of the herbarium to the wider UCLA community and the public, especially in relation to Mildred Mathias's archives. Furthermore, unlike the herbarium, the garden has multiple fulltime staff that have the flexibility and time to take leadership roles in these projects. Their understanding of campus politics and bureaucracy, ability to cultivate relationships inside and outside the university, public-oriented perspective, and proactive approach to starting new projects have contributed to their success in improving the visibility of the herbarium.

Second, the mentorship and education of volunteers and student workers has been and continues to be a key strength of this herbarium. Perhaps in part because of the current limited use of the herbarium by faculty for research, the staff have tended to place a strong emphasis on the educational value of having an herbarium for use in classes and for training student workers and volunteers. Garden visitor services coordinator Jules Cooch felt that it was particularly important for the herbarium to support undergraduate student workers, because "at the undergraduate level, there's an amount of curiosity and openness to what they might be interested in pursuing, which differs from the graduate study where people are much more specialized."[120] In her view, herbarium work had the potential to introduce students to botany

[120] Cooch, 1.

and get them excited about a subject they might not be exposed to otherwise. When asked about what he would do if given additional resources, collections manager Tom Huggins expressed a desire to better support graduate student research, and he hoped that in the future they might be able to offer grants that would utilize the herbarium. He also was interested in holding workshops on the local flora for students and the public, similar to those offered by the nearby Rancho Santa Ana Botanic Garden in Claremont.[121] The efforts of the staff have clearly paid off: the volunteers and student workers interviewed for this study strongly agreed that their work in the herbarium was valuable and relevant to their career and educational goals, and they appreciated the support and training they received from staff. Apart from the short-term curatorial labor the student workers and volunteers provide, such relationships can also be beneficial in the long run. The efforts by garden staff to renew ties between former students and affiliates of Mildred Mathias nearly twenty-five years after her death have also been successful, and multiple individuals have consequently become supporters of the herbarium and garden.

Finally, another important aspect of this herbarium is the diversity of its collections. Although some staff felt that they did not have a thorough understanding of what the collections consisted of or their exact provenance (see below), the range of materials do provide a unique snapshot of UCLA and local history. For example, the herbarium currently holds two file cabinets of photographs and negatives donated by former faculty member C. A. Schroeder, which document the early history of agriculture at UCLA and the surrounding area. Another unique collection are hundreds of Kodachrome slides related to the establishment of the UC Natural Reserve System, which UCLA herbarium and garden staff were closely involved in. Mildred Mathias's slides and notebooks related to her work in ethnopharmacology in South and

[121] Huggins, 7.

Central America and Africa in the 1950s and 1960s have anthropological as well as botanical significance. Many of the staff were excited that the renovated herbarium would include exhibit cases that would allow them to share the collections and improve visibility. At the same time, proposed changes in the organization of the renovated space also mean that these non-specimen collections may end up be given away to other entities such as the Biomedical Library Special Collections or disposed of, since they are less used and not considered as much of a focal point as the herbarium specimens. As for the herbarium specimens, all of the staff felt that the collections from the nearby Santa Monica Mountains helped distinguish the UCLA Herbarium from other local herbaria. Some staff also mentioned collections made by prominent researchers such as Harlan Lewis or Henry Thompson, or collections of cultivated plants. However, apart from the California and Baja California specimens, the vast majority of the collections have not been databased and are not yet available online.

Challenges

Even with the upcoming renovation, the UCLA Herbarium still faces significant challenges. Although the renovation is expected to alleviate some of the environmental problems that currently affect the collections and improve visibility to some extent, the renovation in itself will not solve two major problems: first, the lack of adequate staffing, and second, low use of the herbarium by faculty. Regarding the first problem, there is currently only one part-time staff (the collections manager) to oversee the day-to-day maintenance of the herbarium, while most of the basic curatorial labor is performed by short-term student workers and volunteers. Much of the collection manager's time throughout the academic year is dedicated to hiring, training, and overseeing these student workers and volunteers, which leaves him with few opportunities to engage in other types of activities like outreach, applying for grants, or beginning new projects.

Consequently, garden staff have taken on some of these responsibilities instead. The lack of a fulltime herbarium position also means that the collection manager's ability to accommodate visiting researchers or other guests is more limited. Without addressing these underlying staffing issues, it will continue to be difficult to improve access to the collections and for visitors to use the herbarium.

The changes in the user base of the herbarium present another significant obstacle. The staff largely agreed that, because of faculty turnover in the Ecology and Evolutionary Biology Department, the traditional user base of plant systematists had gradually declined over the past several decades. Earlier events such as the dissolution of the College of Agriculture also contributed to the loss of actual and potential users. Low use by faculty, in turn, has decreased the ability of the staff to advocate for additional resources from the university. Many staff, volunteers, and student workers felt that the herbarium was undervalued and had very little visibility, even among individuals in the La Kretz Botany Building. They were not optimistic that more plant systematists were likely to be hired in the near future. The situation at UCLA was similar to the one at Irvine, where staff also struggled with low faculty use and visibility, apart from a small number of individuals. Garden and herbarium director Phil Rundel contrasted the situation in the herbarium with the Donald R. Dickey Bird and Mammal Collection, which is much more heavily used by faculty for research and teaching and has received substantial facility upgrades within the past several years. At the same time, he pointed out that this collection also has the advantage of being partially endowed by the Dickey family, which has helped pay for a part-time curator position.[122] Again, although the renovation may help rectify this situation to an

[122] Rundel, 5.

extent by moving faculty who work with plants into the La Kretz Botany Building where they are closer to the collections, it does not in itself lead to the resurrection of an active research program. Therefore, the staff may need to consider a broader range of potential user groups and how to reach them.

Apart from staffing levels and a limited user base, there are other issues that deserve to be mentioned. One challenge is that the staff themselves do not have a thorough understanding of what is in the collections. Collection manager Tom Huggins did perform initial survey of the herbarium in 2014 to determine the number of specimens according to their geography. However, out of the approximately 200,000 herbarium specimens, only about ten percent have been databased. Databasing efforts have largely focused on California and Baja California specimens for the Consortium of California Herbaria project, and beyond that, the collections are not well documented. For example, the herbarium has many 19th and early 20th century European specimens from the G. H. Bonati Herbarium, but almost none of these are databased and seem to be almost never used. EEB faculty member Felipe Zapata noted that many of the herbarium specimens and books were old and not well curated, which was part of the reason why he had not used the collections much; however, he did not feel that transferring the collections to other institutions like the Biomedical Library was a good solution because he felt they would be even less accessible.[123] Apart from the specimens, the staff had much less understanding about what types of non-specimen objects were in the collection or how they were organized. I frequently discovered collections by accident over the course of my observations simply by opening cabinets to find out what was inside. Because the herbarium has no written collections policies to guide decisions regarding the acquisition and management of non-specimen materials, the

[123] Zapata, 4.

herbarium has gradually accumulated such items over the years. They have tended to accept these donations in order to avoid potentially offending donors, even when the donations are low quality or not relevant to research or teaching interests. Furthermore, the staff frequently do not have the time or resources to process such collections. The result is that the herbarium takes on the appearance of a warehouse, with boxes of books and other materials crammed under counters or left sitting untouched on bookshelves and tables for long periods of time, where they are not available for use.

Finally, the chain of communication among staff is sometimes unclear, which may in part be because not all herbarium and garden staff work in the same building. While the staff generally got along well, they were not always aware of what the others were doing, especially in the context of meetings with other groups in the university and the decisions made during such meetings. Furthermore, the staff were not always in agreement amongst themselves during these meetings with outside parties, resulting in confusion and delays. They tended to rely on verbal agreements about tasks that needed to be completed, and the lack of written reminders occasionally led to people forgetting what they were supposed to do or ambiguity about who was responsible for what. This lack of communication could also be a problem for some volunteers and student workers, who felt they had little idea about what other people in the herbarium were working on. Instituting regular check-ins could help reduce some of the confusion over responsibilities and ensure that projects stay on track.

The Future

Given these strengths and challenges, where might the UCLA Herbarium be headed? As explained above, while the renovation will allow the herbarium to modernize and alleviate some of the environmental problems, this alone may not be enough to create a sustainable and active

herbarium and does not guarantee future university support. Without a thoughtful assessment of collection strengths, staffing capabilities, and user needs, and the development of creative strategies to obtain additional funding and improve visibility inside and outside of UCLA, the renovated herbarium may continue to struggle to demonstrate its value to administrators and attract users. Many collections—especially specimens collected outside of California and non-specimen materials—may remain difficult for users to access. Without collections policies to clearly delineate what kinds of items the herbarium will consider for acquisitions, the staff may continue to accumulate donations that they are unable to process or fall outside their scope. Although garden and herbarium staff may continue to explore new avenues to highlight the collections, these efforts may be piecemeal and will certainly be more difficult while the collections are held in storage. Improvements to the space can help combat perceptions of the herbarium as a place "frozen in time," but the staff must also be able to explain its purpose in a way that will hold weight with administrators. As garden and herbarium director Phil Rundel observed, "Just being a service because it's important to have an herbarium [and] because collections are important isn't going to cut it when the pressure comes on."[124]

However, the renovation can also give staff an opportunity to consider what goals they wish to set for the new space. If the main goal is to increase use of the collections in research and teaching, then the staff will need to consider some of the major factors that currently discourage use (e.g. limited staffing, few plant systematists in the EEB department, many collections are poorly known and not available online, low visibility of the herbarium inside and outside UCLA) and how to address each of these issues. They can reach out to the staff at other herbaria and learn what strategies have been successful, while keeping in mind what will work within the

[124] Rundel, 10.

specific context of UCLA. For instance, although the strategy of raising funds through consulting has worked well at the Riverside Herbarium, working with the garden staff to develop an outreach-based approach similar to the one pursued by Ellen Dean at the Davis Herbarium may help provide more stability in the long run through securing endowments and grants and gaining community support. The garden staff have already had some success in this area through locating donations to fund the Mildred Mathias slide scanning project. Given the amount of backlog, there are undoubtedly many other possible projects along these lines that can help raise the profile of the herbarium and improve access to the collections. A successful outreach program will take time to develop and will require significant planning on the part of staff and relationship building with faculty, administrators, and the wider community, yet it may be the most feasible path towards creating a sustainable future for this herbarium.

Recommendations

In the final section of this thesis, I present several recommendations to the staff of the UCLA Herbarium. These recommendations are not meant to be exhaustive; rather, I aim to address some of the challenges outlined above.

1. Development of a strategic plan. While the Mildred E. Mathias Botanical Garden has a recently updated strategic plan, no such plan currently exists for the herbarium. Creating a strategic plan could help ensure that the herbarium and garden staff share a common vision for the herbarium. A strategic plan could address the following areas:
    a. Evaluation of the mission statement. The mission statement on the herbarium website currently reads as follows:

> The primary role of the UCLA herbarium is to facilitate the taxonomic and ecological study of vascular plants, and act as a teaching resource for UCLA and other academic institutions in the Los Angeles area. In

> addition, the UCLA Herbarium serves the surrounding community as a resource for the identification of plants, both horticultural and native. To this end, the herbarium maintains a large collection of cultivated specimens, as well as a permanent reference collection of species from around the world, with special emphasis on the California Flora including the flora of Baja California, and locally, on the flora of the Santa Monica Mountains. The herbarium also serves as a repository for voucher specimens associated with ecological studies conducted by UCLA faculty and student researchers. The herbarium also contains a library of botanical literature and journals to facilitate research and plant identification. The herbarium library also serves as a meeting place for the Bruin Naturalist Club, a student group interested in the wild plants and plant communities of California.[125]

While an updated mission statement may not be substantially different, it can help guide staff in making decisions about where to focus their time and energy. For example, although the mission statement mentions cultivated specimens, these collections are not databased and therefore not easy for potential users to access. If cultivated specimens are considered significant to the mission of the herbarium, then staff might consider potential projects to advertise these collections and improve the ability of users to find them.

b. Assessment of collection strengths and available space. This assessment should account for not just the herbarium specimens but also the other types of materials. The renovated space is expected to be the same square footage as the current space; however, it will likely be partitioned in a way that actually reduces the amount of storage for the collections and does not allow for growth. Staff must consider which of the current collections best serve the mission of the herbarium and which may be more suited to other institutions. Although this process has

[125] "Mission," UCLA Herbarium, accessed April 3, 2019, https://sites.lifesci.ucla.edu/eeb-herbarium/mission/.

been taking place organically as staff have prepared for the move, a more systematic assessment may be desirable as the inventories are completed and the collections are put in storage. This assessment could also form the basis for new projects that might be suitable for grants or donor funding, as well as better inform tours and exhibits (either physical or digital).

c. Assessment of current staffing levels, needs, and responsibilities. Numerous staff, student workers, and volunteers felt that current staffing is insufficient for fulfilling all curatorial duties. An assessment may help determine which areas staff should focus more of their time on, the ability of staff to begin new projects, and evaluate the needs and interests of student workers and volunteers.

d. Identification of current and potential users and their needs. The staff should consider whether the herbarium is adequately serving the research and teaching needs of faculty in the Ecology and Evolutionary Biology Department, and consult with the faculty if possible to learn how the herbarium can better support them. Although the herbarium can and should continue to serve EEB faculty and support the education of undergraduate student workers and volunteers from that department, the staff may also wish to consider other potential user groups and how to reach them. For example, more active efforts could be made to engage the public through advertising plant identification services, especially for cultivated plants. Although there are other local herbaria with larger collections, such as the herbaria at Rancho Santa Ana Botanic Garden or Riverside, neither of these institutions emphasize Southern California ornamentals. Joint workshops with the botanical garden could help fill this gap and attract a new set of users. At the same

time, any new programming must account for the time, energy, and interests of the staff.

e. Identification of potential funding sources outside of the university. Given current trends in funding cuts at public universities, the herbarium cannot depend on increased support from the School of Life Sciences. Because of the emphasis of the staff on the educational value of the herbarium and interest in engaging the broader public, one possible approach is the creation of a friends group like the one at the Davis Herbarium, which has allowed the staff to cultivate individual donors and secure endowments. Continued participation in collaborative grant-funded projects such as those through the Consortium of California Herbaria is certainly another good source of temporary funding. Furthermore, the diversity of the collections may also make the herbarium a good candidate for IMLS grants.

f. Identification of ways to demonstrate value. The herbarium must be able to demonstrate to administrators that it is actively being used in research and teaching. Because of the more business-oriented approach that many administrators have adopted in assessing resource allocation, finding ways to quantify that value may be especially important. The methods used by Robert Bradley et al. to assess the value of the mammal collections at Texas Tech University provide some helpful examples of possible metrics, such as the annual number of specimens cataloged, number of students trained, and number of visitors, while also describing some of the more intangible benefits of the collections.[126] UCLA Herbarium staff could certainly follow their lead by

[126] Bradley et al., 1152.

compiling annual reports on usage. Any use by faculty for their research should be documented, as well as any herbarium-related events or special donations received (collections or monetary). Exit interviews with herbarium technicians at the end of the academic year could also provide a more qualitative view of what these student workers and volunteers gained from their experiences and areas for improvement. Gathering this information could help both demonstrate value to administrators in the manner they expect and give herbarium staff a better sense of user needs.

g. Preparation for transitions. Although it may not be possible to prepare for every future change, the staff can still take into consideration the sustainability of new and current projects, especially in the event of changes in leadership or administrative reorganizations. Herbaria tend to be most vulnerable after influential staff leave, and so it is particularly important that the current leadership plan ahead for transition periods.

2. Creation of written collections policies. Apart from policies regarding loaning of herbarium specimens, no written policies are in place to provide clear guidelines on acquisition, use, and deaccessioning of collections, address the scope of the collections, or name which staff are responsible for which aspects. In order to ensure consistency, continuity, clarity, and that best practices are being followed, these policies should be written, easily accessible, and regularly updated. Many herbaria have their collections policies readily available online, which can serve as models; staff may also wish to consult with individuals at other herbaria or collecting institutions for additional guidance. In particular, new or updated policies are recommended in the following areas:

a. Policies to address accessioning and deaccessioning of specimens, guidelines for access and use by visiting researchers, and pest management. These first two policies can be basic, but they can help ensure that the materials are being used appropriately and best practices are being followed for adding to the collections. As for the third, while the addition of climate controls is expected to reduce the possibility of insect outbreaks, regular pest management protocols (e.g. routine insect checks and cleanings and guidelines on food and drink in the herbarium) are still recommended in order to prevent infestations or catch them early on. At the Davis Herbarium, which maintains the collections at 60°F, curator Ellen Dean noted that checking cabinets twice per year had been sufficient and live insects had not been found since the facility upgrade.[127]

b. Policies to address the acquisition and management of non-specimen materials in the herbarium, such as books, paper records, slides, and botanical illustrations. A written collections policy addressing acquisition of non-specimen items would both clarify the scope and format of materials the herbarium will accept, set guidelines for the full and clear transfer of ownership, and also empower staff to tactfully decline donations that fall outside their areas of interest or ability to process, and to deaccession materials already in their possession that are out of scope. The Biomedical Library is the closest and most natural partner to consult with in developing policies for these items.

c. There is a need to develop disaster preparedness plans in concert with relevant campus entities such as Facilities Management, especially to address the most

[127] Dean, 2.

likely emergency scenarios in the Los Angeles area: fire and earthquakes. As best as can be determined, the emergency plan for the herbarium was last updated in 1992, and current staff were not aware of its existence. A written disaster plan will define areas of staff responsibility in the event of an emergency and allow staff to prioritize which materials should be salvaged first after a disaster has occurred. While most climate control issues will hopefully be resolved post-renovation, a disaster plan should also address mold remediation, as this has been a recurring challenge. Regular environmental monitoring for relative humidity and temperature is also recommended as a preventative measure to help detect problems early on.

   d. Policies should also be developed to consider security issues, especially because many books in the collection are the property of the Biomedical Library and not the herbarium. While herbarium specimens may remain the main focus of staff, the staff should also familiarize themselves not just with the specimens but with the other materials in their care and maintain a written inventory of these items, rather than rely on the memory of staff and former staff.

3. Development of outreach strategies. Many staff, student workers, and volunteers felt that the herbarium was poorly known on campus, even within the Ecology and Evolutionary Biology Department. While certain aspects of the remodeled space are likely to improve visibility, proactive and persistent outreach to communities of potential users is also needed. The Mildred E. Mathias Botanical Garden has been and should continue to be a major partner for outreach, but the herbarium should also work towards creating its own identity. Building and maintaining good relationships with the development office will

also be important, because those staff have considerable expertise in this area as well as connections to donors. They may be able to point to additional strategies and resources for improving awareness of the herbarium on and off campus.

a. Creating a welcoming and inviting entrance space. The proposed renovation designs should significantly improve and modernize the space and make the herbarium more visible from the outside. At the same time, the staff can also contribute to making the herbarium more inviting by maintaining a well-organized and clean entrance area and by using posters and displays outside the herbarium to explain to visitors what the space is and how it can be used. These exhibits could highlight not just herbarium specimens and their uses, but also the many other types of collections and their connection to UCLA history. The ability to showcase ties to university history may have special appeal to administrators and long-time faculty. The success of past projects and events have shown that Mildred Mathias's contributions and role as a woman scientist have special appeal, but there are certainly other individuals affiliated with the herbarium that are worth highlighting.
b. Routinely updating the herbarium website. The herbarium website has not been updated since 2015, and since that time there have been many new projects and other developments. The website could be updated on a regular schedule, perhaps once in winter and once in summer. Not only would this be beneficial to users and potential volunteers or student workers, it could also demonstrate to other stakeholders such as administrators that the herbarium is active and provides important services.

c. Social media presence. Although current staffing levels may not be sufficient for the herbarium to create an independent social media presence, staff can proactively document herbarium activities and collections of interest and collaborate with botanical garden visitor services coordinator to share on their existing accounts. Images of herbarium specimens, illustrations, books, and other such collections are well-suited to platforms such as Instagram, and can help spread awareness and gain support from communities outside of UCLA. This may be an especially important avenue if the herbarium staff wish to advertise more public-oriented services such as plant identification or workshops on the local flora.

Despite the uncertainty about the future, the UCLA Herbarium is nevertheless at an exciting transition period that offers many possibilities for renewal and reimagining what its purpose should be in the 21st century and who it should serve—though the upcoming renovation alone is likely not enough to revive an active research and teaching program. Like the other herbaria in the UC system, the UCLA Herbarium has had to adjust to changes in how botanical research is conducted and trends toward the privatization of public universities. It has had to compete for space, staffing, and other resources in an environment where collections have sometimes been perceived as less cutting-edge and relevant to modern science. Yet even in these difficult circumstances, the staff at the different UC herbaria that I spoke with have proven to be resilient and deeply invested in the survival of their collections. In response to these pressures, they have developed creative strategies to support the collections and share new applications for specimens, often in collaboration with other herbaria. Many of the staff, volunteers, and student workers I spoke to were happy to explain their work and were also eager to express why their

work mattered and share what their collections could teach us about biodiversity and history. They saw herbaria as more relevant than ever as climate change and human development continue to alter the natural environment. Far from quietly fading into obscurity, herbaria are adapting to changes and rising to meet the challenges they face in the 21st century.

Appendix A: Interview Questions

Questions for current and former herbarium and botanical garden staff at UCLA, Riverside, Irvine, Davis, and Berkeley:

- Can you tell me about your main job responsibilities and what you do on a typical work day?
- What was the herbarium like when you started your current position, and how is it different now (if at all)? Do you feel like it is moving in a good direction or not?
- How important do you feel the herbarium is to the wider department? Do you feel like the herbarium is valued or undervalued, and why?
- What are the strengths of this collection?
- What are some of the challenges this herbarium is facing?
- What do you see as the mission or purpose of an herbarium?
- Do you have any questions for me or anything else you would like to add?

Questions for UCLA faculty:

- How do you use herbarium specimens or specimen data in your research or teaching?
- Have you used the resources in the UCLA Herbarium specifically? If not, why?
- Do you feel it is important to the department to have an herbarium? Why or why not?
- Do you have the impression that the herbarium is used much by faculty or students here?
- Do you have any questions for me or anything else you would like to add?

Questions for volunteers and student workers at the UCLA Herbarium:

- What was your first impression of this herbarium?
- Can you describe what you do during a typical work shift?

- What skills have you learned from your work at the herbarium? Are there other things you would still like to learn but haven't had the opportunity to do so yet?
- Do you feel that working in the herbarium has been relevant to your education and/or career goals, and in what ways?
- Have you used herbarium specimens in any of your classes or your own research?
- Do you have suggestions for how to make the herbarium a better place to work?
- What do you see as the mission or purpose of an herbarium?
- Do you have any questions for me or anything else you would like to add?

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