UC Davis Bee Haven
2022 Annual Report

University of California, Davis
Department of Entomology and Nematology

December 2022

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Prepared December, 2022 by Christine Casey, Academic Program Management Officer

Greetings from the UC Davis Bee Haven. Yes, that's correct -- we have a new name. This change reflects that we are more than honey bees and that we've had many supporters since the initial Häagen-Dazs gift that created the garden. However, nothing has changed in our mission to educate and inspire visitors about bees and the plants that support them.

SUPPORT

Financial

The Haven continues to rely on grants and donations for our funding. Classes and guided tours also bring in operational funds; we were able to offer a limited number of these in 2022. Operating expenses in FY2022 were $6438. This is a small budget for a garden of our size; we are able to operate efficiently thanks to the hard work of our volunteers.

A breakdown of FY2022 expenses is shown in Fig. 1 in Appendix I. Haven 2022 salary support of 50% time came from the California Department of Food and Agriculture's Specialty Crops Block Grant program, "Promoting Pollinator Plant Awareness, Access, and Habitat Expansion to Benefit California's Nursery Industry." Donations and class and guided tour fees cover our operating expenses.

Volunteers

The Haven volunteer team continues to make tremendous contributions, with work taking place on Tuesday mornings. In 2022, volunteers contributed 218 hours to the Haven. This has an in-kind value of $6530 based on the national volunteer labor rate of $29.95. Volunteers with 25 or more hours of service are recognized in the garden.

GARDEN OUTREACH PROGRAMS

Events, guided tours, and virtual events

In 2022, we reached 1263 people through on- and off-site events and virtual programs. This is far below the thousands we reached prior to the pandemic, but represents a 62 percent increase from the pandemic low. A breakdown of visitors and programs is shown in Appendix II.

Media coverage

Links to online media coverage in 2022 are in Appendix II.

VIRTUAL HONEY BEE HAVEN

Social media

We use a variety of social media platforms to create the virtual Honey Bee Haven, including Instagram (@hbhgarden), Facebook, and The Bee Gardener blog.

YouTube

We continued to post short videos about bees and gardening to the Haven's YouTube channel in 2022. This allows us to reach beyond the Sacramento region.

Web resources
The garden's web page is updated regularly and serves as another source of information for bee gardeners.

RESEARCH
Haven scientists have previously completed studies evaluating the attractiveness of common landscape plants to bees. This has allowed us to recommend optimal plant choices for gardeners. In this work we were only able to sample a small portion of the plants available to gardeners, and new plants are continually coming to market.

Thus our next step in this work is the development of an easy, accurate sampling program for growers, garden centers, and plant breeders so that they may continue to evaluate the attractiveness of plants to bees. This will allow the best choices and recommendations to their customers and will help growers to focus bee-compatible pest management to the appropriate plants. Our research evaluating sampling methods was presented at the annual meeting of the Entomological Society of America in November. The poster presentation is shown in Appendix III.

Appendix I. Honey Bee Haven FY2022 financial report

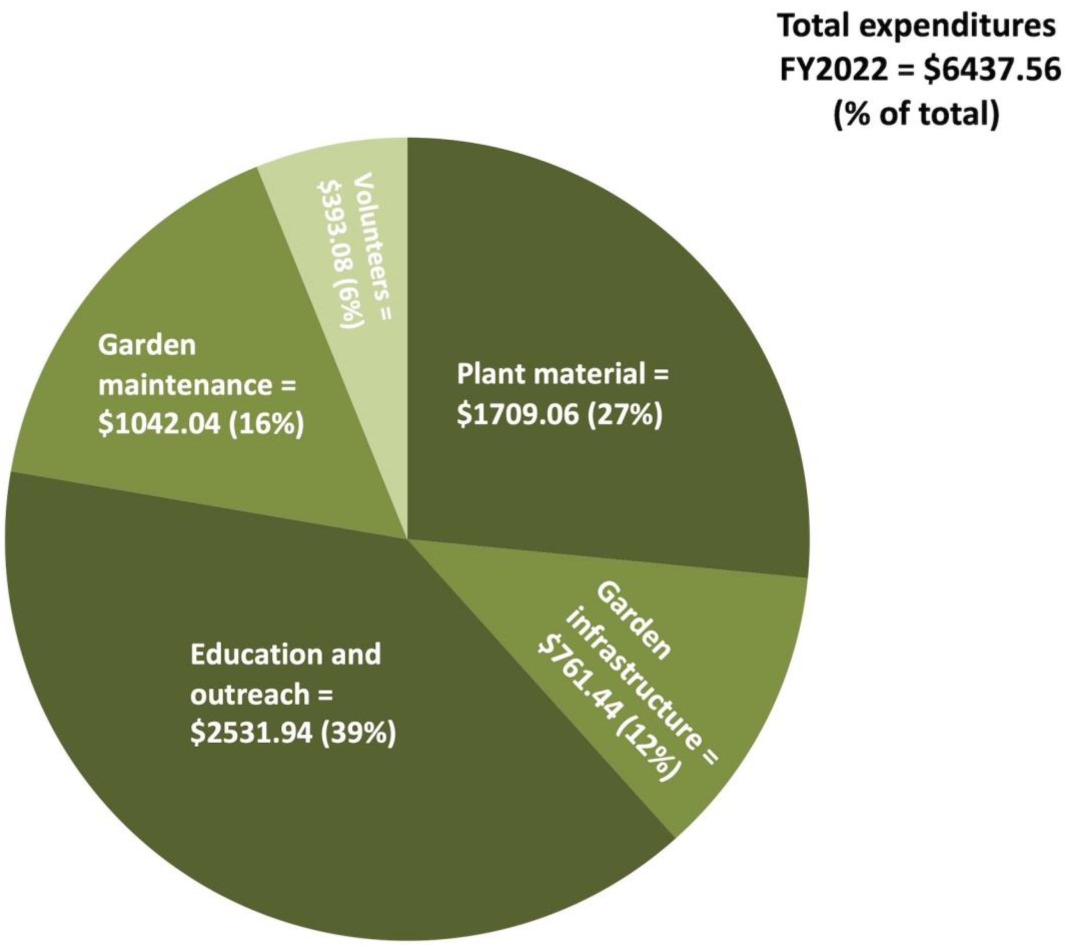

Figure 1. Breakdown by category of Honey Bee Haven expenditures in FY 2022.

In addition to salary, it cost $6438 to run the Haven in FY2022. The categories cover expenses as follows:

Plant material: All plants and seeds used in the garden
Garden infrastructure: Construction and maintenance of garden facilities including fencing, raised beds, and pathways
Education and outreach: Handouts, signs, and other display materials
Garden maintenance: Tools, soil amendments, and other supplies needed to maintain the garden
Volunteers: Refreshments and safety supplies for volunteers

Appendix II. UC Davis Bee Haven events and media coverage in 2022

Attendance and affiliation of garden event and guided tour participants

Event or organization	Number attending	Type
Biodiversity Museum Day open house	150	Public
Courses, career days	38	UC Davis undergraduates
Staff events	50	UC Davis staff
Private group tours	63	Public
School group tours	130	Teachers/K-12
Yolo County Master Gardener volunteers	25	Master Gardener volunteers

Attendance and affiliation of off-site virtual event participants

Date	Event	Number attending	Type
1/24/22	California Master Beekeepers January meeting	13	Beekeepers
2/3/22	Humboldt County Beekeepers	39	Beekeepers
4/15/22	San Diego County Master Gardeners Spring Seminar	683	Master Gardener volunteers
6/14/22	California Native Plant Society, San Diego chapter	72	Public

Media coverage in 2022

UC ANR Backyard Orchard blog	https://homeorchard.ucanr.edu/index.cfm?blogtag=Christine%20Casey&blogasset=45538
UC Davis Magazine	https://magazine.ucdavis.edu/plight-of-the-pollinators/
Winters Express	https://www.wintersexpress.com/community/bee-friendly-celebrate-world-bee-day
RealDaily	https://realdaily.com/what-would-happen-to-our-food-supply-without-bees/
HappeningNext	https://happeningnext.com/event/i-planted-a-bee-garden-now-what-eid3a09eg3kse

Appendix III. Research to support bee gardens
Poster presented at the Entomological Society of America Annual Meeting, November 2022

Plants for Bees: Promoting Bee Habitat in Gardens

C. Casey[1,4], L. Corkidi[2], A. Nabors[2], K. Hung[3], J. Bethke[2], E. Niño[1] and G. Spinelli[2]
[1]Department of Entomology and Nematology, University of California, Davis, CA, USA
[2]University of California Cooperative Extension, San Diego, CA, USA
[3]Department of Biology, University of Oklahoma, Norman, OK, USA

ABSTRACT

California bee populations are declining due to lack of ample, healthy forage, which could be mitigated by increasing the use of bee forage plants in urban landscapes and gardens. To address this, we have recently completed a four-year evaluation of bee attractiveness of select California native and non-native landscape plants. We were only able to evaluate a small proportion of the hundreds of plants grown in nurseries, and new species and cultivars continue to come into production. Growers need to be able to continue to identify those plants most likely to be attractive to bees.

This project compares grower-useable bee attractiveness assessment protocols to evaluate their utility for the nursery industry. The relative net precision of different bee sampling methods will be compared to determine which can most effectively be used by growers and land managers to evaluate bee attractiveness. We report here on our first year's results.

INTRODUCTION AND METHODS

Many studies have documented declining wild bee populations and managed honey bee colony losses due in part to lack of adequate, healthy forage. At the same time, a growing body of work indicates that bees can be diverse and abundant in urban gardens, but knowledge about the garden plants that will best support them is lacking. This gap exists in many regions and is exacerbated by the varied knowledge and research behind bee plant recommendations (Garbuzov and Ratnieks 2014a).

We are addressing this gap through studies of bee plant preferences and development of grower-usable bee sampling schemes. There have been several studies in existing gardens documenting bee plant preferences in California (Frankie et al. 2019). We built on this work with replicated field trials conducted from 2018 to 2021 in northern California (Davis, CA) and southern California (San Juan Capistrano, CA) to evaluate commonly-available, low-water plants in demand by California consumers. (Casey and Niño, unpublished; Nabors et al. 2022). Five replications of 15 plants were tested in each region, with six of the 15 tested in both.

It is not possible to evaluate all the available ornamental plants, so our next step is to develop a grower-usable approach to evaluate new plant introductions for bee attractiveness. This will allow growers to market these plants appropriately and to know which plants to target with bee-compatible pest management during production.

In our attractiveness studies the southern CA team used timed counts, while the northern CA team used a snapshot count method (Garbuzov and Ratnieks 2014b). This consists of 20 second quick counts of every plant that is repeated three times in succession rather than a single 3-minute timed count. The snapshot count is faster to complete and more readily worked into the day of an otherwise busy nursery employee.

The purpose of this study was to calculate the relative net precision (RNP) of each bee counting method at a wholesale nursery (Fallbrook, CA) and a public garden site (Encinitas, CA) in San Diego county, CA. RNP is calculated as shown below and is a way to assess sampling efficiency by balancing precision and sampling cost (Buntin 1994).

$$RNP = [1/(\text{cost} \times R_v)] \times 100, \text{ where } R_v = (SE/\text{mean}) \times 100$$

Plants in full bloom were sampled weekly for at least 4 weeks using both methods. Bees were counted as honey bees or other bees as this distinction is easy for an untrained observer.

RESULTS

Did our attractiveness evaluations support previous studies?

Six of the 15 plant genera were tested in both regions. Five of these six were among the 10 most attractive plants in both regions (Table 1). This confirms previous work that has shown the attractiveness of these genera (Frankie et al. 2019, Garbuzov and Ratnieks 2014a) and suggests they will be useful for bees throughout California.

How do timed and snapshot counts for bee attractiveness compare?

The different sampling methods used in each region's field plot study from 2018 to 2021 produced similar population assessments (Table 1), suggesting that the less-used snapshot counting method may be as useful as the standard timed count.

In our 2022 sampling method evaluation, results at both locations were similar; only the nursery data is presented here. Mean honey bees/min was consistently higher for the snapshot counts than the timed counts, but the pattern of most to least attractive was consistent across plants (Table 2) This is supported by the strong correlation between honey bee counts for the two methods (r^2= 0.87888; df=1,17; F=116.1008; p>0.0001). We are most interested in consistent measurement of relative attractiveness rather than absolute number of bees, but we will nonetheless look for reasons for this discrepancy as we continue this work in 2023.

The RNP was calculated for each sampling method at both sites and was higher for the snapshot count at both locations (Table 3), suggesting that this method may be more efficient (Buntin 1994). We will continue this assessment in 2023 at new sampling sites throughout California.

Plant	Mean HB/min ± SE N. CA	Mean HB/min ± SE S. CA	N. CA rank	S. CA rank
Perovskia atriplicifolia	18.81 ± 0.83	Not tested	1	--
Teucrium chamaedrys	16.94 ± 0.85	Not tested	2	--
Nepeta x faassenii	13.98 ± 0.55	1.07 ± 0.11	3	3
Penstemon heterophyllus	13.36 ± 1.30	0.22 ± 0.04	4	14
Eriogonum fasciculatum	7.97 ± 0.97	1.03 ± 0.17	5	4
Sphaeralcea ambigua	0.86 ± 0.13	Not tested	5	--
Salvia spp.	4.58 ± 0.48	1.17 ± 0.14	6	1
Gaura lindheimeri	3.71 ± 0.23	Not tested	7	--
Lavandula spp.	3.36 ± 0.45	0.61 ± 0.07	8	6
Hylotelephium spectabile	1.90 ± 0.38	Not tested	9	--
Symphyotrichum chilense	1.78 ± 0.32	Not tested	10	--
Heteromeles arbutifolia	Not tested	1.13 ± 0.26	--	2
Gaillardia aristata	Not tested	0.61 ± 0.08	--	7
Bahiopsis laciniata	Not tested	0.60 ± 0.08	--	8
Veronica sp.	Not tested	0.51 ± 0.08	--	9
Escallonia x exoniensis	Not tested	0.47 ± 0.07	--	10

Table 1. Mean honey bees (HB)/min in each sampling region over a 4-year period. Plants in yellow were tested in both regions and had mostly similar rankings. The N. CA site was adjacent to a honey bee yard, which could explain the higher mean HB.

Plant	Snapshot mean HB/min ± SE	Timed count mean HB/min ± SE
Helianthus hybrid	13.47 ± 1.29	4.36 ± 0.72
Lavandula spp.	11.43 ± 1.03	3.26 ± 0.26
Delosperma hybrid	10.57 ± 0.51	2.38 ± 0.17
Scaevola aemula	10.40 ±0.86	2.58 ± 0.40
Lantana camara	8.93 ± 0.79	2.02 ± 0.25
Verbena spp.	8.38 ± 0.62	2.60 ± 0.21
Galvezia speciosa	6.60 ± 0.91	2.60 ± 0.42
Phlomis fruticosa	4.90 ± 0.64	1.95 ± 0.30
Buddleja hybrid	2.33 ± 0.44	0.87 ± 0.17
Penstemon eatonii	1.40 ± 0.28	0.60 ± 0.11

Table 2. Mean honey bees (HB)/min by counting method at a wholesale nursery. Actual values differ by count method but the pattern of most to least attractive was the same.

Site type	Sampling method	Relative net precision
Garden	Snapshot	27.110
Garden	Timed count	7.206
Nursery	Snapshot	37.291
Nursery	Timed count	9.886

Table 3. Relative net precision (RNP) for each sampling method and location. Higher RNP values indicate greater sampling efficiency.

Where can I learn more?
Grower education about this project in both English and Spanish is ongoing through onsite events and these resources:
Web: beegarden.ucdavis.edu
Blog: ucanr.edu/blogs/TheBeeGardener/index.cfm
Instagram: @hbhgarden
YouTube: www.youtube.com/UCDavisBeeHaven

Literature cited
Buntin pp 99-115 *in* Handbook of Sampling Methods for Arthropods in Agriculture. CRC Press, Boca Raton, FL. 1994.
Frankie et al. 2019. J Pollination Ecol. 25(3):16-23.
Garbuzov and Ratnieks. 2014a. BioScience 64(11): 1019-1026.
Garbuzov and Ratnieks. 2014b. Functional Ecology 28: 364-374.
Nabors et al. 2022. Env. Entomol. 20: 1-12.

[4]*Corresponding author:* cacasey@ucdavis.edu

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