

Slosson Project
"Gardening for Bees in the Greater San Francisco Bay Area"

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Final Report for 2004-'05

In 2003, I proposed four goals to the Slosson Fund to be investigated in 2004 and beyond by our research group at UC Berkeley. The goals are presented here followed by the accomplishments to date in realizing the goals.

2004-'05 Goals

1. Evaluate new ornamental plant elements (spp., cultivars, etc.) for their relative bee attraction in our experimental garden at the U.C. Berkeley Oxford Tract.
2. Compare relative bee attraction of selected conspecific ornamental in different microclimates of the San Francisco Bay Area by assisting gardeners and teachers in developing and monitoring their own experimental gardens. (We identified three individuals in widely separated areas of the SFBA who will be participating directly in our research and will be using these gardens as educational tools for school children and gardening organizations.)
3. Present our finding and offer hands-on training in gardening for bees to a variety of audiences through formal presentations and workshops.
4. Develop a web site with the most up-to-date urban bee-plant research, which will be designed for audiences interested in bee gardening or in using garden pollinators and their plants as educational tools.

Goal 1

Evaluate new bee plants. We evaluated numerous new plant species/cultivars for their attraction to bees, and especially native California species, at the UC Berkeley Oxford Tract garden, just NW of the main campus block. This was done using the bee frequency count method described in the 2004 proposal to Slosson and in Frankie et al. (2002, 2005). Almost all of these species had been recommended to us by our nursery contacts in the Bay Area and beyond - Annie's Annuals and Perennials (Richmond), Berkeley Horticulture (Berkeley), Mostly Natives (Tomaes), and Rana Creek Nursery (Upper Carmel Valley). We regularly purchase plants and receive donations from all of these nurseries.

New Ornamental Plant Species/Cultivars Found to be Attractive to Highly Attractive to Native Bees in 2004-2005:

1. Several *Agastache* spp./cultivars beyond Frankie et al. (2002)
2. *Caryopteris incana* "Bluebeard"
3. *Centaurea rothrockii*
4. Several *Coreopsis* spp./cultivars beyond Frankie et al. (2002)
5. *Cosmos sulphureus*
6. Several *Eryngium* spp./cultivars beyond Frankie et al. (2002)
7. *Helianthus gracilentus* reevaluated beyond Frankie et al. (2002)
8. Several *Penstemon* spp./cultivars (mostly native spp.)

9. *Phacelia californica*
10. *P. viscida*
11. *P. campanularia*
12. *Salvia mellifera*
13. *Veronica spicata* 'Blue Fox'
14. *Ocimum basilicum*
15. *Thymus* spp./cultivars
16. *Lotus scoparius*
17. *Eriogonum nudum*
18. *Madia elegans* (wild variety)
19. *Hemizonia corymbosa*
20. *Gilia tricolor*
21. *Solidago californica*
22. *Coreopsis maritima*
23. *Echinops* sp.

In total 30+ spp./cultivars were found to be attractive to native bees. Several other plants were also tested, but for lack of consistent native bee attraction and/or flowering /growth patterns that might prove to be unacceptable in small gardens, the following plants could not be recommended: *Cuphea* "Kristin's Delight", *Helianthus mollis*, *H. laetiflorus*, *Layia platyglossa*, *Platystemon californicus*, *Salvia columbariae*, *S. apiana*, *Stylomecon heterophylla*, and *Trachymene caerulea*. Finally, several other spp./cultivars are still being tested, and most of these are perennials that require more time to develop enough flowering vegetation for bee monitoring. We require a patch size of about 1.5 m x 1.5 m (Frankie et al. 2005).

It is important to point out that native California bee species and the exotic honey bee species generally prefer native California plants to exotics (Frankie et al. 2005). However, there are exceptions to this trend and the following native plants are examples of non-attractive species: *L. platyglossa*, *P. californicus*, *S. apiana*, and *S. heterophylla* (see above list for full names).

Goal 2

Realizing this goal required the greatest investment of time and resources. Four experimental bee gardens were established for the purpose of comparing bee diversity and relating attraction to mostly conspecific plant spp./cultivars among the gardens. This turned out to be a huge undertaking, especially when it became clear that perennials were favored over annuals by 4 to 1, and that we had to purchase all the plants once we realized that our 3 cooperators would occasionally deviate from our suggested plant list when they went plant shopping alone. Each of the 4 gardens had its own history of development. The 4 gardens are described here, followed by the associated bee work.

a) UC Berkeley Oxford Tract garden - Throughout 2004 and most of 2005, we planted about 60 spp./cultivars known or thought to be attractive to bees. Work went smoothly, and this garden was considered the most developed plant wise by which the others could be compared. It also had a brief history of being very attractive to a rich variety of bee species.

b) Lucas Valley - Miller Creek School (Marin Co.) We planted about 40 spp/cultivars progressively as gardening had to be done in raised flower-beds that were progressively built. They also had to be gopher proofed. Work went relatively smoothly with excellent cooperation from Sue Holland who promoted our work at the school with every opportunity. The garden is in excellent condition for bee visits and evaluations..

c) Randall Museum (San Francisco) - Planting work went slowly here owing to a change in administrators, which amazingly allowed us to expand the original plot 4-fold. We were not prepared for the space that was progressively increased through time. Also, our cooperator Margaret Goodale, asked that most of our bee plants be perennials so as to reduce future maintenance. We spent a lot of time buying and planting plants, and also replacing soil at Randall. This garden is now in good botanical condition.

d) Livermore Community Garden - This garden was full of surprises. First, we were promised 6 garden plots, but eventually only 1 1/2 were provided. Also, we rarely had direct contact with the cooperator, Christine VanHatten. So, only about 20 spp./cultivars of bee plants could be used, far less than was expected. Also, the garden was not well maintained like the others. Even with these difficulties, bee attraction to the 20 plant elements was good.

Bee Collections at the 4 Gardens - We were able to make quality bee collections and observations at all the gardens. Our best monitoring was done at the UC Berkeley garden where a large number of plant spp./cultivars had been in the ground for a longer period of time and thus provided more floral resources for the bees. We used a new bee sampling protocol that is being suggested by a group of bee biologists working on pollinator decline issues throughout North America (see protocol at <http://online.sfsu.edu/~beeplot>). It involves the standardized use of fluorescent pan traps (6 oz.) and light aerial netting by two workers to give diversity and abundance measures. We also did bee frequency counts on flowers that provided more abundance data and a good measure of relative host-plant attraction. The bees from these collections, which were made monthly from April to October, are being progressively identified by Robbin Thorp at UC Davis.

Overall, it appears that a similar composition of bee groups can be found at all four gardens. Further, based on limited samples, it appears that conspecific plants in each garden have about the same relative attraction for bees. The bee sampling protocol at UC Berkeley Oxford Tract has yielded 36 bee species, and this is quite remarkable considering that the garden size was only 15' by 60'. The gardens at Lucas

Valley and Randall Museum were not sampled in a standardized way until 2005 (owing to slower garden development). One more sample is scheduled in each of these two garden in mid October '05. Casual bee samples were terminated at Livermore in Oct '04, and no standardized samples were taken at this site.

In conclusion, it seems clear that the same groups of bees are attracted to the same plant elements in each of the North Bay cities. Spot samples in other cities, north and south of the Bay Area, suggest that the attraction to conspecific plants may be the same in other large urban areas such as Sacramento and Santa Barbara.

Goal 3

We gave several slide show presentations and bee demos to local groups during the spring months of 2004. We did not offer all day workshops as originally planned (as in 2003) owing to the enormous amount of time invested in setting up the 4 experimental bee gardens (Goal 2) and following up with bee collections and monitoring work. We did, however, open the UCB Oxford Tract to 3 large garden tours in late spring 2005. On one of these tours, we attracted 530 visitors over a 6-hour period.

Goal 4

A large amount of time in 2004-'05 was invested in developing a web site with all the urban bee-plant information that we have developed to date. Numerous photos had to be taken (a few were purchased) and small narratives had to be written by the P.I. and then edited to be user friendly for gardeners, teachers and kids. Fortunately, there were two excellent people working on the website with the P.I. One of these was Mary Schindler who, in addition to her field and lab duties as a technician on the urban project, was highly experienced in writing and editing pieces to fit the target audiences (see also Schindler et al 2003 for a sample of her published work). M. Schindler also did some of the presentations mentioned above (Goal 3). The second person was the local web designer, Matt Jacoby, who developed a personal interest in our work and guided it over a 15-month period, with continual recommendations that were both creative and useful. The site (<http://nature.berkeley.edu/urbanbeegardens>) is considered a first edition, and we continue to do additional work on it. In August 2005, we summarized all of our work to date on recommended bee plants for the SFBA and beyond. These are plants that will flower within 2 years; most in one year (see website). We are now working on a long series of photos of each of these plants, which will be added shortly to our website.

Expected and Realized Outcomes

Overall, we realized more than 90% of the stated goals of our 2004 proposed project to the Slosson Fund. In addition, several other products have emerged. One is a paper on all of our urban bee-plant work to date in the Journal of the Kansas Entomological Society. (see attached hard copy.) Second, we have been invited by the editor of California Agriculture to submit an article, which we are currently working on. Third, a special committee to address issues of urban bees and their ornamental plants

has been established by the North American Pollinator Protection Campaign, and it is scheduled to meet for the first time in late October '05. This committee was set up by my suggestion to the executive director, Laurie Davies of the Co-evolution Institute of San Francisco. Finally, the natural history editor of the UC Press, Jenny Wapner, has invited me to submit a proposal to the press for a book on "City Bees and their Plants in California". This invitation was recommended by the former Exec. Editor of UC Press, Doris Kretschmer. I am currently working on the proposal.

Literature

Frankie, G.W. et al 2002. "Bees in Berkeley?" *Fremontia*. 30: 50-58.

Schindler, M. and G.W. Frankie et al. 2003. "Bees in the Burbs." *Pacific Horticulture*. 64: 29-35.

Frankie, G.W. et al 2005. Ecological Patterns of Bees and Their Host Ornamental Flowers in Two Northern California Cities. *Journal of the Kansas Entomological Society*. 78: (In Press for publication in Oct. 2005)