



A Snapshot of Bee Diversity on Mount Wanda in John Muir National Historic Site

Importance: *Bees' role as plant pollinators makes them a critical component of a healthy natural ecosystem.*

Bees are a diverse group of flying insects belonging to the order Hymenoptera, a group that also includes wasps and ants. There are more than 20,000 known species of bees worldwide, 4,000 species in North America, and more than 1,500 species in the state of California. While some bees are highly social like honey bees, most lead solitary lives, and while most bees nest underground, some prefer hollow cavities. One thing that bees have in common is that they all collect pollen or nectar for their offspring and therefore play a vital role in the business of plant pollination.



Will Elder, NPS

The green sweat bee (*Agapostemon texanus*) is among the bee species found on Mount Wanda.

Many bees specialize on the pollen of certain plant species, or certain groups of plants, so high plant diversity generally attracts more bee species. When plant diversity is reduced by invasions of non-native plants, habitat fragmentation or other factors, bee diversity may also be reduced. As a result, bees can serve as an important indicator of ecosystem health. Bees also help sustain ecosystems with their pollination services. Without bees, plants that depend on external pollination would have difficulty reproducing. Reduced bee diversity can have a negative affect on people as well: around 30 percent of the world's food crops, like the fruits in John Muir's historic orchards, depend on pollination by bees.

Susan O'Neil, NPS



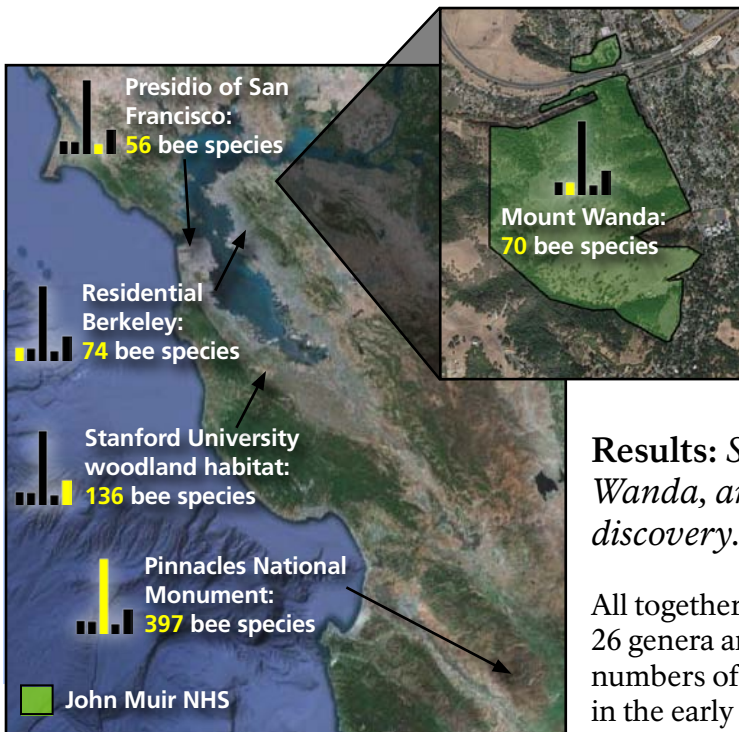
Blue oak woodland is the dominant habitat type on Mount Wanda, and is one of the two habitats, along with chaparral, that was surveyed for bees.

The US bee population has been declining due to a combination of development, invasive species, pesticide and herbicide use, disease, and more. Still, considerable bee diversity can thrive in some urban environments, and especially in embedded protected areas like Mount Wanda at John Muir National Historic Site in Martinez, CA. Studying Mount Wanda's bees helps establish an important baseline for understanding future changes in bee diversity and ecosystem health so that the National Park Service and others can respond with appropriate conservation or restoration efforts.

Inventory Methods: *Scientists from the USDA-ARS Pollinating Insects Research Unit at Utah State University (USU) and the University of California,*

Berkeley (UCB) collected bees over a period of more than six months on Mount Wanda.

Researchers set up two 200 x 50m study plots on ridge tops on Mount Wanda: one in blue oak woodland habitat, and the other in open chaparral habitat. Between mid-March and late-September of 2002 (months when most plants flower) the scientists visited these sites every three weeks to collect bees between 9:00am



Mount Wanda in the John Muir National Historic Site and other locations in the San Francisco Bay Area where bee inventories have been conducted.

and 3:00pm. They used a series of fluorescent blue, fluorescent yellow, and white “pan traps” arranged inside the plots to collect some bees, and nets to collect additional bees from flowers in and around the plots during set times. The flowers that the bees were found on were also identified and recorded. All collected bees were cleaned, pinned and labeled. Since bees are notoriously difficult to identify, the preserved specimens were then sent to the USDA-ARS Pollinating Insects Research Unit at USU for formal identification.

Results: *Seventy bee species were documented on Mount Wanda, and many more are probably still awaiting discovery.*

All together, 70 species of bees were found on Mount Wanda from 26 genera and all six of North America’s bee families. The greatest numbers of bees and bee species were recorded on Mount Wanda in the early spring. After June, the abundance of bees and the diversity of species dropped substantially. Fifty-eight of the bee species were found using 45 of the 283 species of flowering plants found on Mount Wanda. Almost half of the flowers used belonged to the Asteracea, or daisy and sunflower, family. While there were

more native flowers than exotics on Mount Wanda throughout the study, more bees visited exotic plants during the early spring peak in bee abundance and diversity. This could mean that limited numbers of exotics may enable a higher seasonal abundance of the bees that can use them.

While the 70 bee species found on Mount Wanda is comparable to the number of species found so far in nearby areas like the Presidio of San Francisco and residential Berkeley, it is not as many as have been documented in very similar habitats like the Stanford University woodlands. It is likely, however, that more bee species inhabit Mount Wanda. When species richness estimators, which mathematically predict how many species may go undetected by a study given its size, methods and results, are applied to the Mount Wanda data, they suggest that there may actually be 100-185 species. Additionally, a four-year inventory at Pinnacles National Monument uncovered a remarkable 397 bee species, but less than a third (31%) of those species were found during only one of the four years. This suggests that while the six-month inventory on Mount Wanda is a good baseline for bee diversity, more years of study would reveal many more bee species that have not yet been detected there.

Additional Resources:

Bees in the San Francisco Bay Area National Parks:
www.sfnps.org/bees

USDA-ARS Pollinating Insects Research Unit:
www.ars.usda.gov/npa/beelab

UCB Urban Bee Gardens:
nature.berkeley.edu/urbanbeegardens/

For More Information:

For more information on the bees at John Muir National Historic Site contact Dr. Mietek Kolipinski at mietek_kolipinski@nps.gov. Summary written by Jessica Weinberg.



A bumble bee (*Bombus* sp.) visits lizard tail (*Eriophyllum staechadifolium*), a member of the sunflower and daisy family Asteracea which received 46 percent of Mount Wanda’s bee visits.