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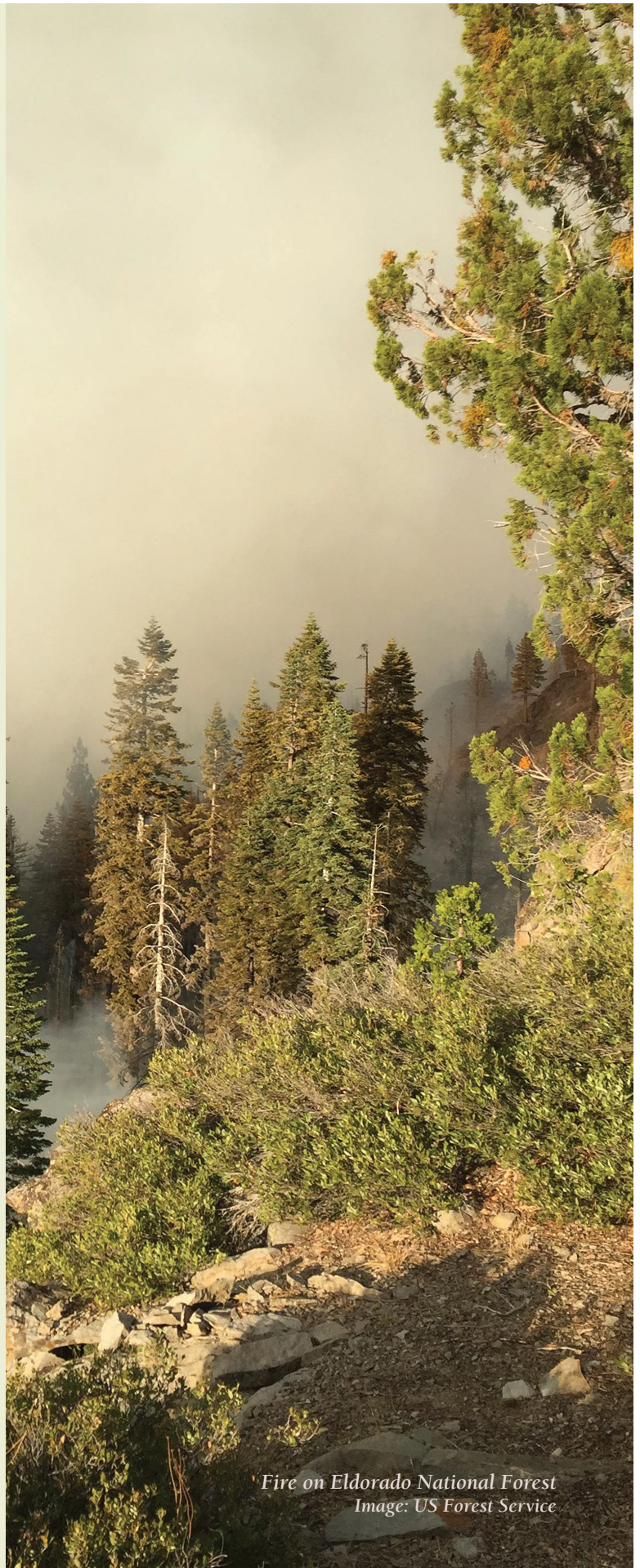
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Bumble bees and post-fire chaparral management in the Sierra Nevada

Image: Alma Schrage



Bumble bees (*Bombus spp.*) are important pollinators for many native plant species across diverse ecosystems. However, many bumble bee species are declining, due to causes that likely include disease, pesticides, and loss and degradation of habitat. Habitat needs of native bumble bees in the Sierra Nevada mountains of California have been studied mostly in riparian areas and meadows, but upland chaparral, particularly chaparral that grows after forest fire, may also provide valuable habitat. Post-fire chaparral is often targeted for suppression or removal during forest restoration efforts, to reduce competition with young trees. In the pages that follow, we summarize a recent study of bumble bees in post-fire chaparral in the central Sierra Nevada, and provide specific recommendations that forest managers can implement to conserve bumble bee populations, even while pursuing active forest restoration efforts.

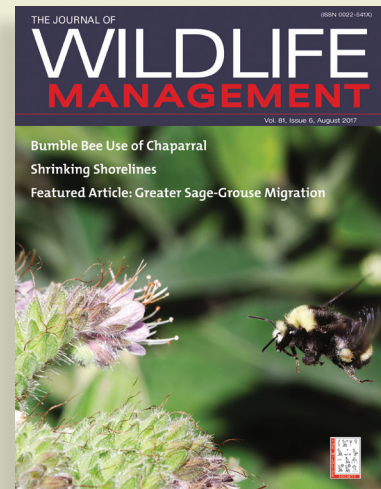


Fire on Eldorado National Forest
Image: US Forest Service

About Our Recent Study: **BUMBLE BEE USE OF POST-FIRE CHAPPARAL IN THE SIERRA NEVADA**

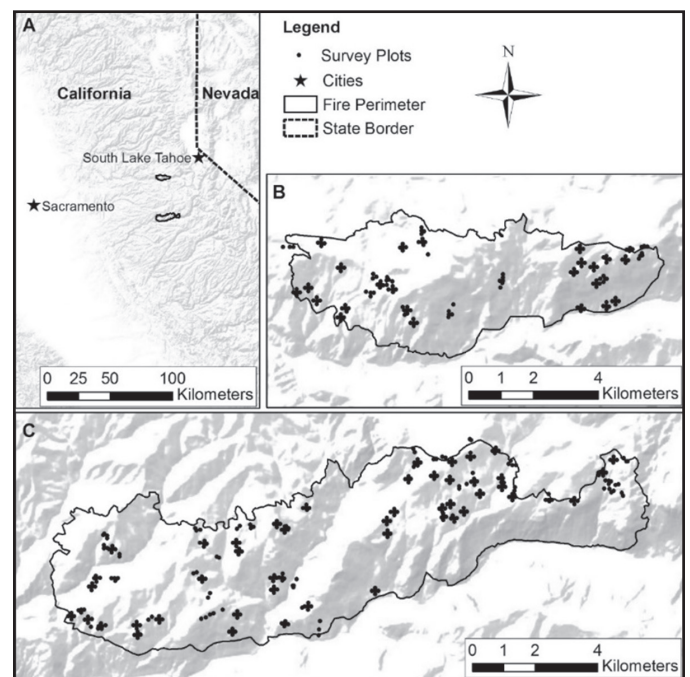
The Institute for Bird Populations is partnering with the US Forest Service and scientists at San Francisco State University and the University of Connecticut to study the ecology and habitat needs of bumble bees in burned landscapes. We published our first scientific paper from this effort in *The Journal of Wildlife Management*, where it was featured on the cover of the August 2017 issue (right).

Loffland, H.L., J.S. Polasik, M.W. Tingley, E.A. Elsey, C. Loffland, G. Lebuhn, and R.B. Siegel. 2017. Bumble bee use of post-fire chaparral in the central Sierra Nevada. *The Journal of Wildlife Management* 81:1084–1097.



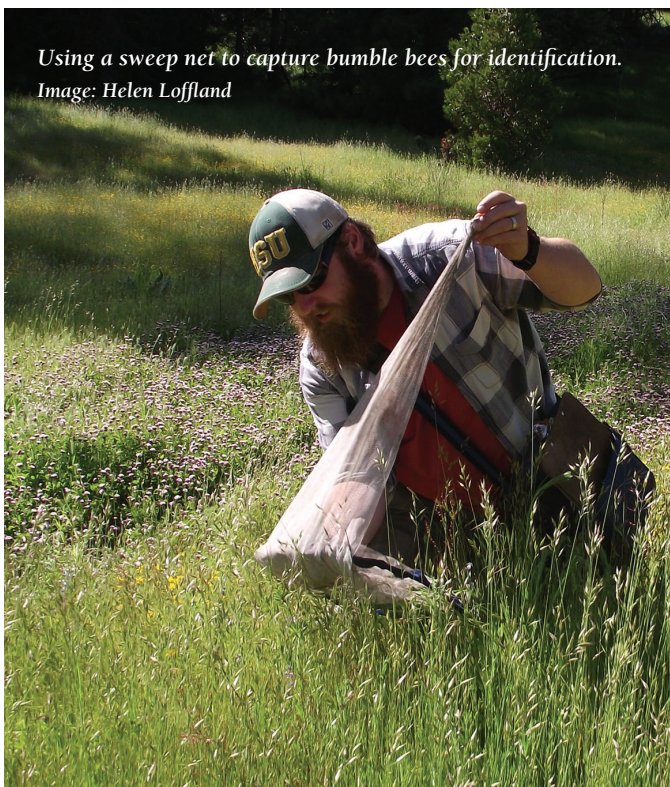
Cover image: John Kehoe

In 2015 and 2016, we surveyed bumble bees within 495 20-m-radius plots located throughout the areas burned by the 2004 Fred's and Power fires on Eldorado National Forest (see figure at right). Our goals were to describe bumble bee abundance and species richness in montane post-fire landscapes, to compare results from chaparral-dominated upland vegetation, with results from interspersed riparian areas, and to identify characteristics of individual chaparral stands that might make some stands more valuable to bumble bees than others.




Above: Plot locations for bumble bee surveys on the Fred's (Panel B) and Power (Panel C) Fires, Eldorado National Forest, CA.

Most plots were visited twice during each summer (late May to mid-August). During each visit we surveyed for bumble bees for 16 minutes, during which an observer would search for bumble bees and capture them in a sweep net. The bumble bees were chilled in a cooler, so that they could be handled and carefully identified. After a few minutes of warming, the bees then flew away unharmed. The observer recorded the plant species each bee was captured on, and collected summary habitat information about the plot, including the five most abundant flowering species during each visit.



Using a sweep net to capture bumble bees for identification.
Image: Helen Loffland

A photograph of a field of low-growing plants with purple and yellow flowers. In the background, a person wearing a hat and a backpack is blurred, standing in a field with mountains in the distance under a cloudy sky.

We captured 2,494 bumble bees of 12 species (see figure, next page). Bumble bee abundance and species richness were substantially greater in riparian plots than in upland, chaparral-dominated plots, but given the much greater extent of upland habitat on the landscape, chaparral-dominated habitats were clearly important to bumble bees, and accounted for the majority of the bumble bees we caught. Within both upland and riparian areas, the extent of herbaceous cover was the strongest predictor of bumble bee abundance and species richness.

Image: Alma Schrage

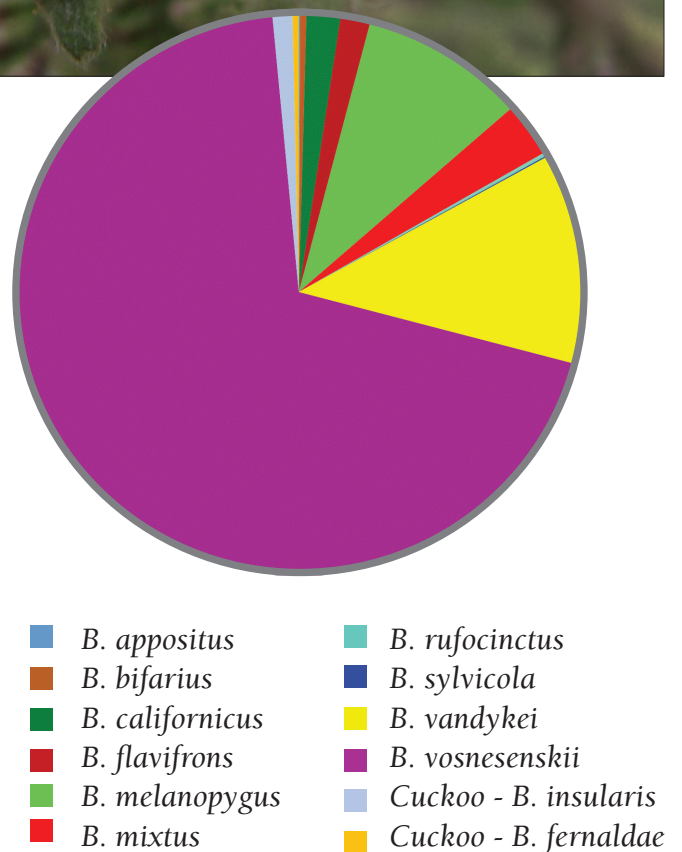
Most Popular Entrée

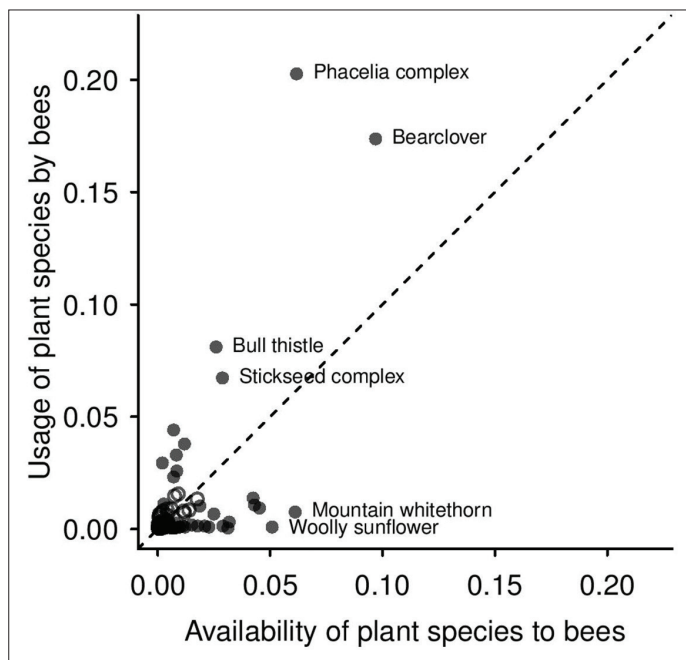
We assessed the frequency at which the bees foraged on dozens of woody and herbaceous plant species. One chaparral shrub species, bearclover (*Chamaebatia foliolosa*, pictured here), was foraged on preferentially over all other shrubs and over all but one herbaceous plants, and was associated with increased occupancy probability in the Vosnesensky bumble bee (*Bombus vosnesenskii*), the most abundant bumble bee species on our study plots.

Image: Bearclover, Helen Loffland

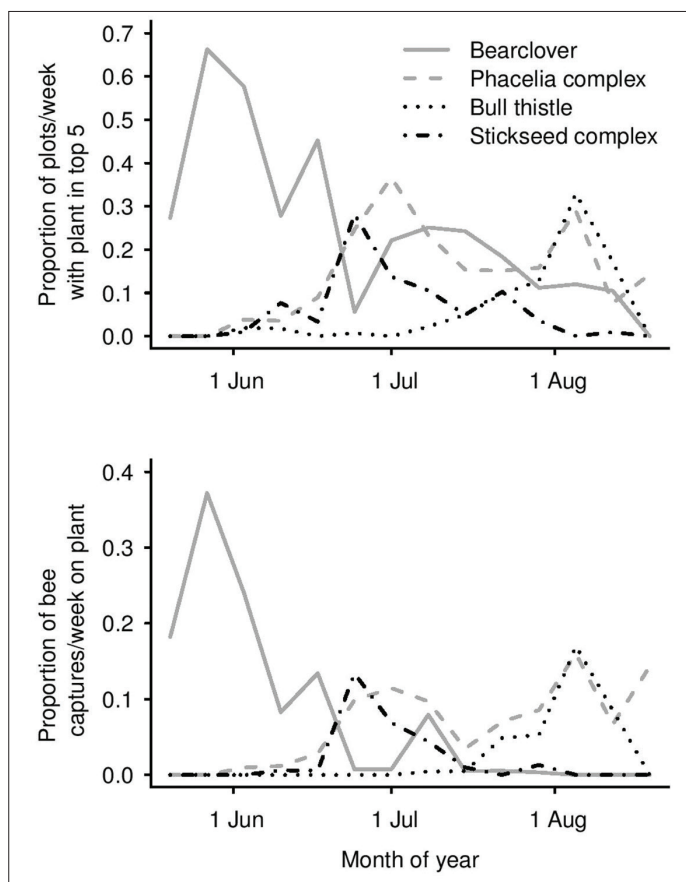
A complex of closely related herbaceous species in the genus *Phacelia* was the plant taxon most frequently used by bumble bees, and appeared to be particularly important during midsummer after bearclover flowers became scarce. The timing of bloom period and bumble bee use for favored forage plants varied substantially, indicating the value to bees of upland habitat that is heterogeneous at a spatial scale that ensures a variety of forage species (and therefore a long period with abundant flowers) within foraging distances for individual bumble bee colonies (usually 100–1,000 m).

Right: Relative frequency of bumble bee species encountered during nearly 2,000 survey visits to 495 plots throughout the summers of 2015 and 2016.





Above: Usage versus availability of 70 plants on which bumble bees were observed foraging. Plants above the dotted line were preferentially selected by bumble bees; plants below the dotted line were generally avoided. Note that Bull thistle is a non-native, invasive species in the Sierra Nevada.



Above: Weekly proportion of plots with favored forage plants – bearclover, members of the phacelia complex, bull thistle, and members of the stickseed complex – among 5 most abundant blooming plants (top panel), and the weekly proportion of bumble bee captures on those same plants (bottom panel).

What Can Land Managers Do?

RECOMMENDATIONS FOR FOSTERING BUMBLE BEE HABITAT DURING POSTFIRE FOREST RESTORATION

Post-fire chaparral can be valuable habitat for bumble bees. Based on our research, we provide here a toolbox of management options that will foster bumble bee habitat after forest fires, even while forest restoration is pursued.

KNOW YOUR BEES!

In areas where locally-occurring bumble bee species have not been determined or favored plants for bumble bee foraging are unknown, initiate studies to fill these information gaps.

RETAIN AND FOSTER BUMBLE BEE HABITAT.

Retain or foster forest openings dominated by herbaceous and woody plant species favored by bumble bees, even where the primary landscape management goal may be forest regeneration.

In deciding which plant species to retain or foster, consider particular foraging preferences of locally occurring bumble bee species, if information is available. In our study area in the lower montane zone of the central Sierra Nevada, favored native plant taxa included Phacelia, Bearclover, and Stickseed (see table, next page).

Manage for diversity and spatial heterogeneity in the composition of flowering plants, so that flowers are available to bumble bees throughout the colony life-cycle. Bumble bees typically forage within a radius of hundreds of meters to a kilometer from their nest, so optimal habitat should include a variety of forage plants across this spatial scale.

WHERE SHRUB TREATMENTS OCCUR, REDUCE IMPACT ON BUMBLE BEES.

Apply chemical or hand treatments as narrowly as possible to minimize disturbance of non-target vegetation. When possible, postpone treatments until after the peak bloom period of target shrubs.


If non-native plants that are favored by bumble bees are targeted for removal (e.g. Bull thistle), plant or seed the area with native species that have similar flowering phenology as the targeted invasive species.




Stickseed

Image: Lynn Hori

Native plants preferred by bumble bees in post-fire landscapes
in the central Sierra Nevada (based on Loffland et al. 2017).



Common name	Scientific name	Community
Phacelia	<i>Phacelia hastata</i> , <i>P. heterophylla</i> , <i>P. egena</i>	upland
Bearclover	<i>Chamaebatia foliolosa</i>	upland
Stickseed	<i>Hackelia nervosa</i> , <i>H. velutina</i>	all
Sneezeweed	<i>Helenium bigelovii</i>	riparian
Parish's yampah	<i>Perideridia parishii</i>	riparian
Brewer's monardella	<i>Monardella breweri</i>	upland
Swamp onion	<i>Allium validum</i>	riparian
Canada goldenrod	<i>Solidago canadensis</i>	riparian
Pennyroyal	<i>Monardella odoratissima</i>	upland
Hedge nettle	<i>Stachys ajugoides</i>	riparian



Bee illustrations: Lauren Helton



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Image: Alma Schrage