

Annual Report

To: Boulder County Parks and Open Space

Re: **Boulder County Bumblebees: Population monitoring and conservation genetics**

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Bumblebee declines have been documented in many parts of the world. Our research attempts to address the status of bumblebee populations in Boulder County. At least 23 species of *Bombus* have been collected at some time in Boulder County's history (V. Scott, University of Colorado Museum Collections, UCMC). Three of these species *B. fraternus*, *B. occidentalis* and *B. pensylvanicus* are in decline in other parts of North America, but their conservation status in Boulder County is unknown.

In addition, our study addresses the amount of genetic diversity in local bumblebee populations. Low genetic diversity is associated with an inability to adapt to environmental change. Thus reduced genetic diversity would make bumblebees even more susceptible to environmental factors like pesticides, newly introduced parasites and habitat fragmentation. Conservation genetic research on bumblebees is in its early stages.

In 2010, Diana Oliveras, Carol Kearns, and 3 undergraduate student research assistants, collected bees at nine sites over three elevations (Table 1). Two of the sites were BCPOS properties. A total of 259 *Bombus* specimens were collected, and 40 were released after identification in the field. The collection encompassed 15 species. The species represented were *B. appositus*, *B. bifarius*, *B. californicus*, *B. centralis*, *B. insularis* (*Psithyrus*), *B. fervidus*, *B. flavifrons*, *B. frigidus*, *B. griseocollis*, *B. melanopygus*, *B. mixtus*, *B. nevadensis*, *B. pensylvanicus*, *B. rufocinctus* and *B. sylvicola*. (Note: cuckoo bumblebees, formerly in the genus *Psithyrus*, are currently considered to belong to the genus *Bombus*.)

The Minnick site (BCPOS) was sampled six times from June 16 – Aug 11. At the Minnick site, 53 specimens were collected, and 19 of these were released after identification in the field. The specimens represented six mid-elevation species (*B. appositus*, *B. bifarius*, *B. californicus*, *B. centralis*, *B. insularis* (*Psithyrus*), *B. nevadensis*.) Twenty-six of the specimens collected were queens, and twelve of these were released.

The Mud Lake site (BCPOS) was sampled seven times from June 4 – Aug 11. At the Mud Lake site, only 9 specimens were collected (one of these was released), representing five species (*B. bifarius*, *B. centralis*, *B. flavifrons*, *B. griseocollis*, *B. insularis*.) Only one of the specimens collected was a queen.

All the bees collected from our nine sites have been identified, labeled and databased, and identifications have been checked by Virginia Scott, a bee expert at the CU Museum's entomology collection. The specimens will be incorporated into the UCMC collection.

One leg has been removed from each labeled specimen and that leg has been frozen for DNA extraction. We will use mitochondrial DNA from the legs to make comparisons about the genetic variation in widespread species and species with restricted ranges,

and between abundant and declining species. To date, DNA has been extracted from all the *Bombus appositus* specimens as well as a sampling of other species. Three different primers have been successfully used to isolate different segments of mitochondrial DNA. We are currently characterizing the genetic variation within the mitochondrial DNA of the *B. appositus* specimens. This species has a broad elevational and geographic range and is not known to be in decline. We are comparing genetic variation in our specimens with that of *B. appositus* specimens that were collected in the 1930s, 1940s, 1960s and 1990s. After finishing the longitudinal examination of *B. appositus*, we will look at the genetic variation in a species that is in decline, *B. occidentalis*. We did not collect any of this species in 2010, but we have historical specimens that will be used in our study of genetic variation. The genetics work is in progress this winter. We will continue to process the other species that we have collected to expand our comparisons between abundant and rare species.

We would like to continue to collect bumblebees on BCPOS in the summers of 2011 - 2014. We anticipated keeping few queens in the future and using worker bees for our DNA samples.

I have attached a copy of our original proposal so that you may review it as you make decisions regarding 2011 permits.

Thanks you for permission to collect on BCPOS property in 2010.

Table 1. Study Sites

Low Elevation (approx. 1700 m elevation)

Wonderland Lake – City of Boulder Open Space and Mountain Parks (OSMP)

Beech Property – City of Boulder OSMP.

San Souci – City of Boulder OSMP

Mid Elevation (approx 2600 m elevation)

Quartz Ridge – US Forest Service

Minnick – BCPOS

Mud Lake-BCPOS

High Elevation (approx 3350 m elevation)

Niwot Ridge – Mountain Research Station, U. of Colorado and US Forest Service

Mount Audobon – US Forest Service

4th of July Mine area – US Forest Service