

# The impacts of post-fire succession on native bee diversity within the Rocky Mountain Ecosystem



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## Abstract

Allowing natural fires to occur in Rocky Mountain forests may be an important factor in increasing native bee populations, as larger populations of native bees have been found in early successional stages of post-fire forests in other forest systems. Burned dead trees are preferred nesting sites for cavity-dwelling bees and the bare ground from fires is important to ground-dwelling bees. In this work, I examined how the two recent fire disturbances on Casper Mountain (2006 and 2012) impacted native bee diversity and abundance. I hypothesize that more native bees will be found in early post-fire succession than later post-fire succession or nearby non-burned (control) areas. I tested this hypothesis by collecting 4690 native bees within burned and non-burned areas of the mountain then counted and identified the collected specimens using morphological and molecular techniques. Overall, bees were more abundant and more diverse in burn areas than in the control areas. This is important information for fire management practices in regards to native bee conservation.

## Introduction

This study examined how native bees in Rocky Mountain Forest ecosystems respond to post-fire succession. Using Moericke and Blue Vane traps, I collected bee specimens in the field, identified them morphologically, and used molecular techniques (extraction, PCR, sequencing) to gain additional information on diversity. I hypothesize that more native bees will be found in early post-fire succession (East Casper Mountain) than later post-fire succession (West Casper Mountain) or non-burned (control) areas.

## Methods

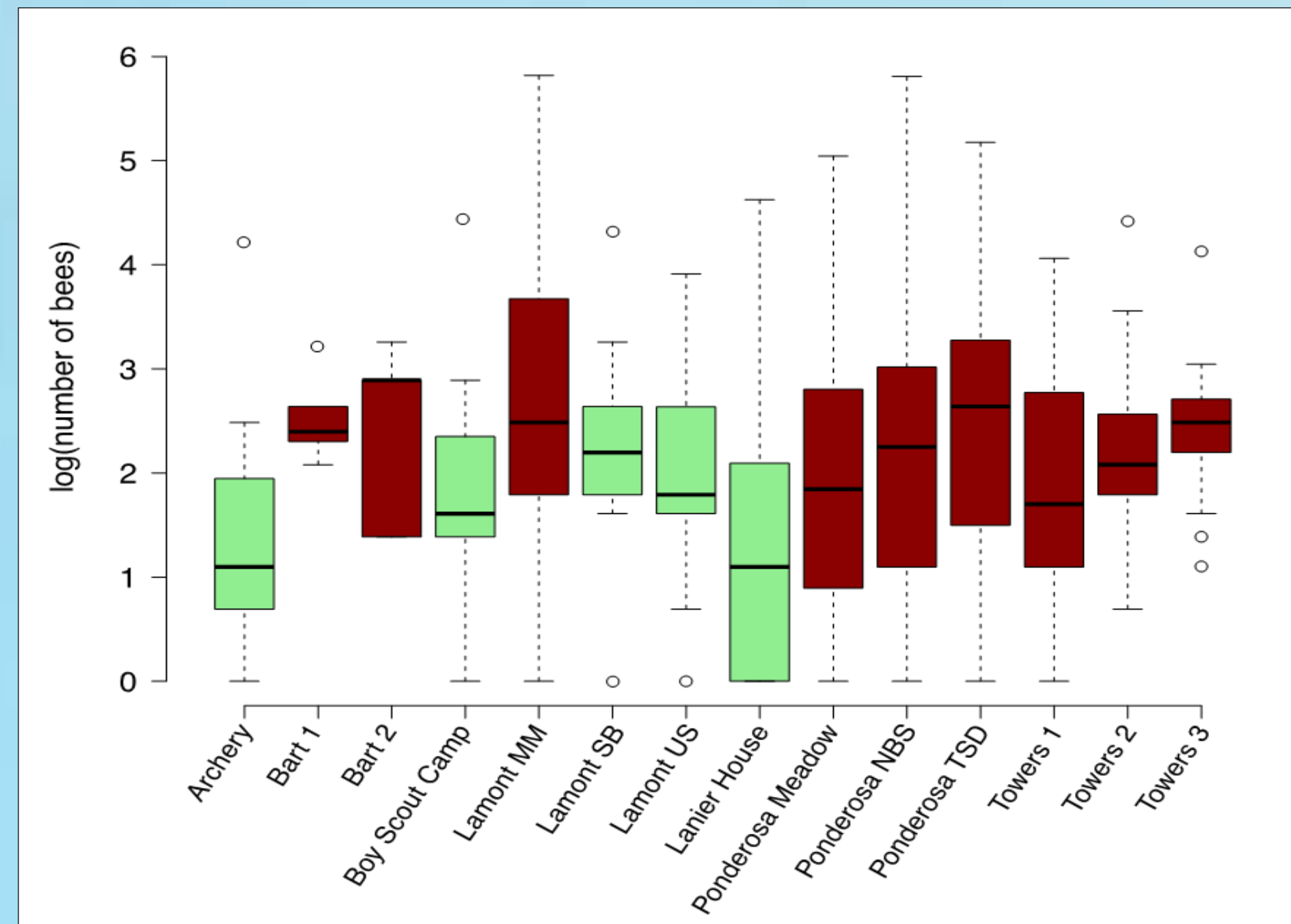
Each site was analyzed individually for species diversity and overall number of native bees found at the site. The information from each burned area was compared to its control (non-burned area). Data were also compared between the 2006 Casper Mountain site, and the 2012 Casper Mountain site to determine if successional age impacts population diversity.



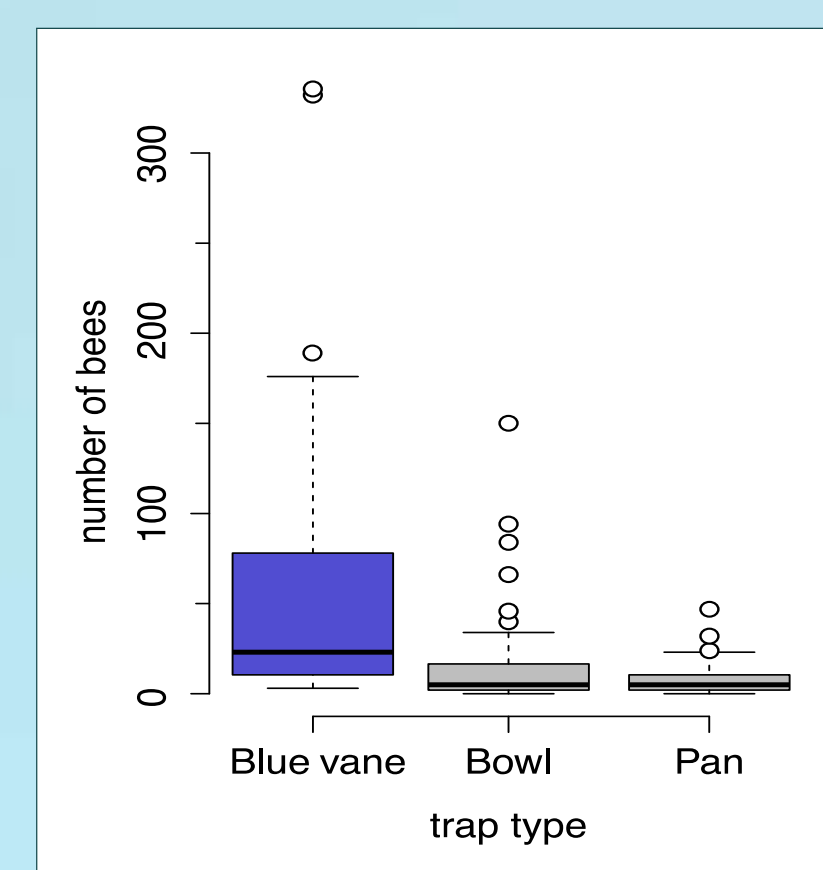
**Figure 1** - Four Moericke traps created from pie tins. Each color attracts different species of bees.



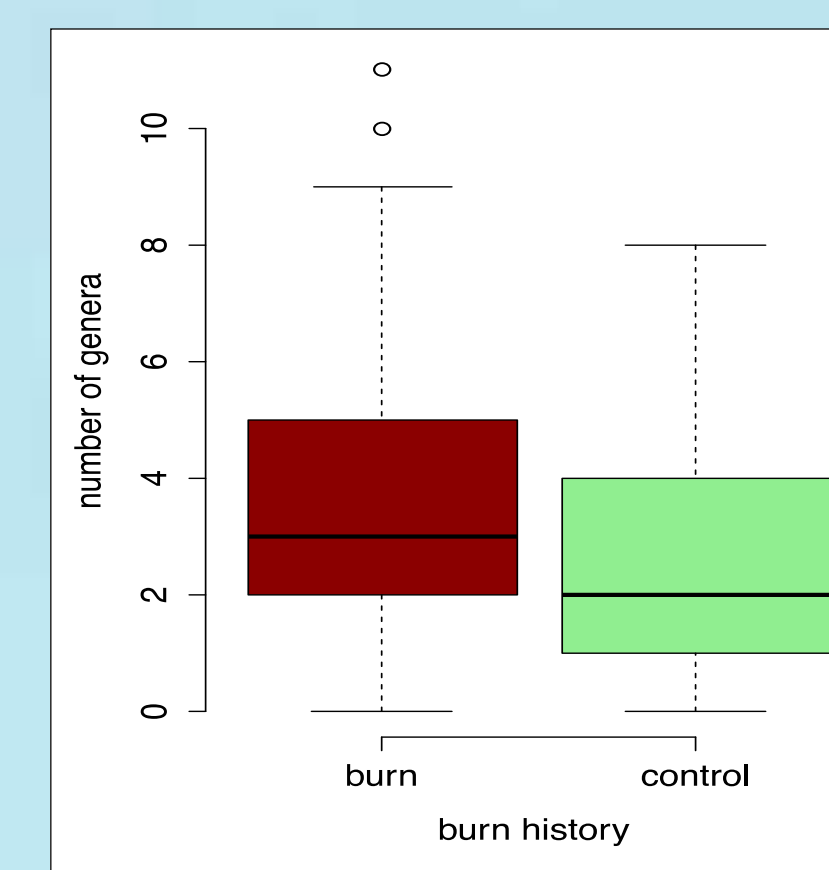
**Figure 2** - Moericke traps made from painted bowl and a Blue Vane trap - the final configuration for bee traps at my study sites.



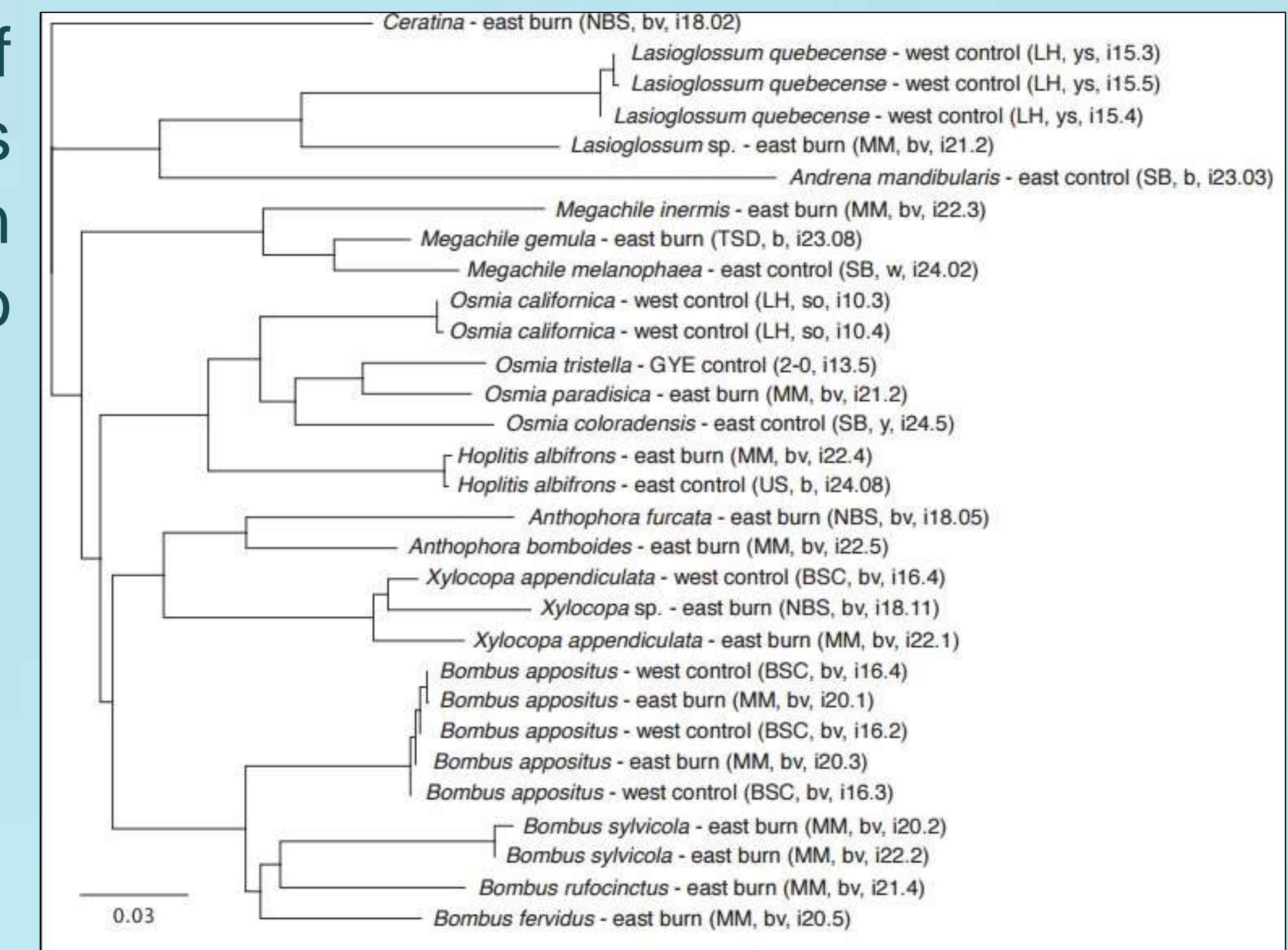
**Figure 3** - Log-transformed number of bees per trap (plus one) per site over the course of the summer. In general, burned sites had higher abundance than non-burned sites.



**Figure 4** - Far more bees were collected from the Yellow-Blue Blue Vane traps than from any of the individual Moericke traps.



**Figure 5** - In general, burned sites had higher generic diversity than non-burned sites.



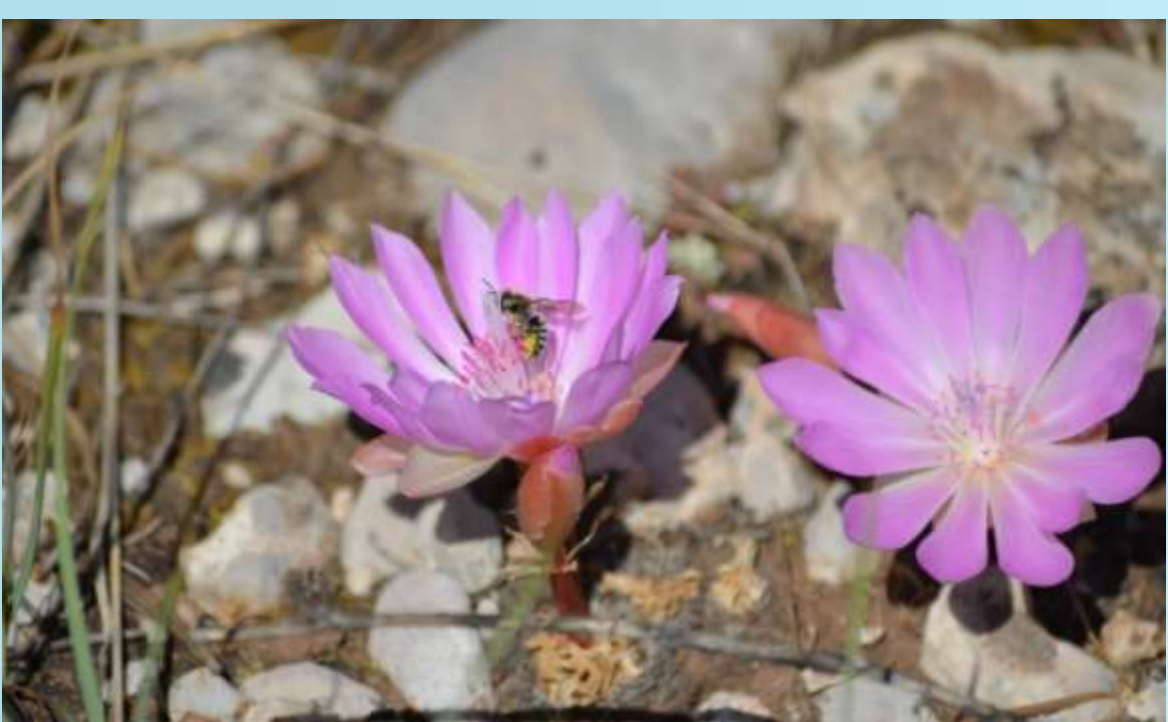
**Figure 6** - Phylogenetic tree showing diversity of all sequenced bee samples and relationship between different species as well as individuals from burned and control sites. Along with species identification (based upon 95% or higher identify of COI in a nucleotide BLAST), each individual is labeled with site type (e.g., east, west, control, or burn) and as well as site name, trap type, and extraction ID are shown.

## Results

Overall, more individual bees and more bee genera were found in burned areas than in non-burned areas. In addition, more bees by genera were found to be in the more recently burned area than the other burned area. This suggests that natural fire cycles may create habitat such as downed trees for nesting and more diverse floral communities that is beneficial to native bee abundance and diversity, and that more recent fires may have a stronger effect than older burned areas.

## Discussion

Our data does support the hypothesis and concurs with what other researchers have found in other ecosystems: early successional stages of post-fire forests have a greater diversity and abundance of native bees than later successional stages of post-fire forests and non-burned areas. This is an important factor to consider for both fire management and native bee conservation.



## Acknowledgements

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