Landscape and local effects on pollinator biodiversity and plant-pollinator interactions in prairie fragments in Southern Vancouver island

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NSERC-CANPOLIN CANADIAN POLLINATION INITIATIVE

NSERC CRSNG



- Pollinators are declining, mostly due to habitat loss and fragmentation (Biesmeijer et al. 2006, Winfree et al. 2009)
- Invasive species are increasingly modifying wild ecosystems

A bit about pollinators….

- Anything that visits a flower has the potential to move pollen, normally in proportion to visit frequency (Vazquez 2005)
- In our data, bees comprise ~70-95% of visits
- ~ 800 bee species in Canada, ~ 450 in BC
- Bees are central place foragers, range determined by body size

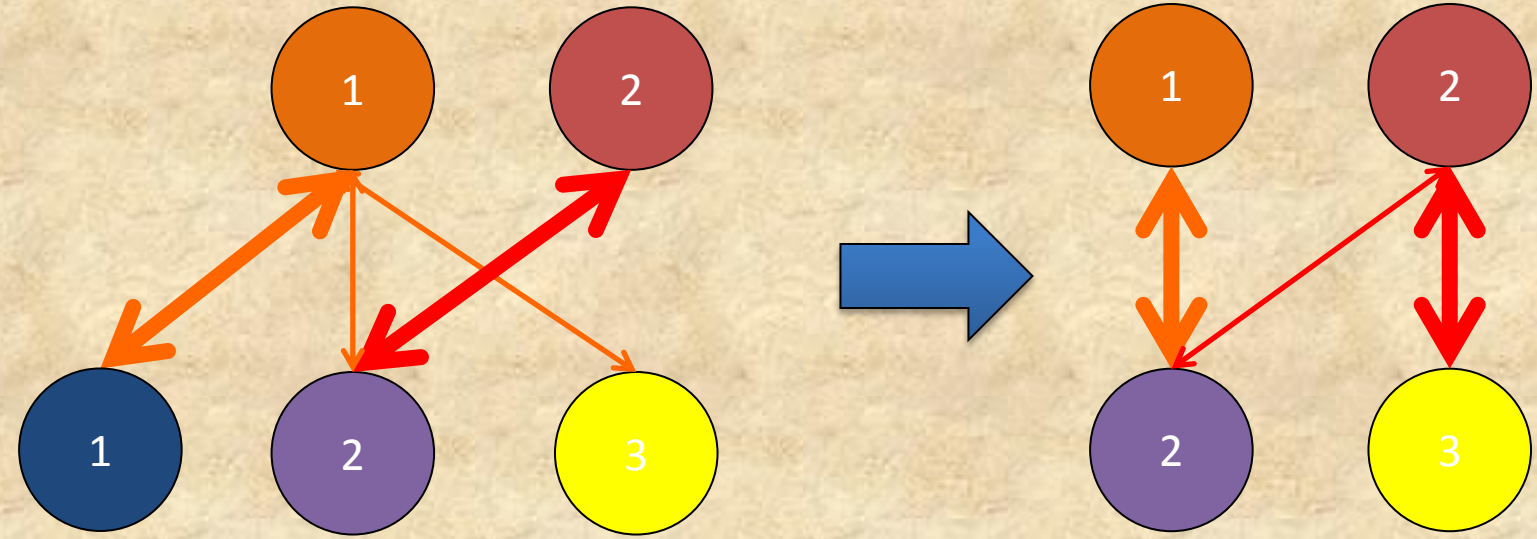
Bee nesting guilds

Wood renter (solitary)

Ground excavator (solitary)

Ground renter (social)

- Many pollinators are flexible foragers



Two pollinator projects

- **Landscape**: how do pollinator communities vary across the landscape?
  (Julie Wray, Lisa Neame)

- **Local**: How does invasion by scotch broom change plant-pollinator interactions?

1. Landscape: habitat area and configuration effect community composition

- Oak-savannah ecosystem: highly fragmented, less than 5% remains
- Pattern Q: do smaller fragments support less biodiversity?

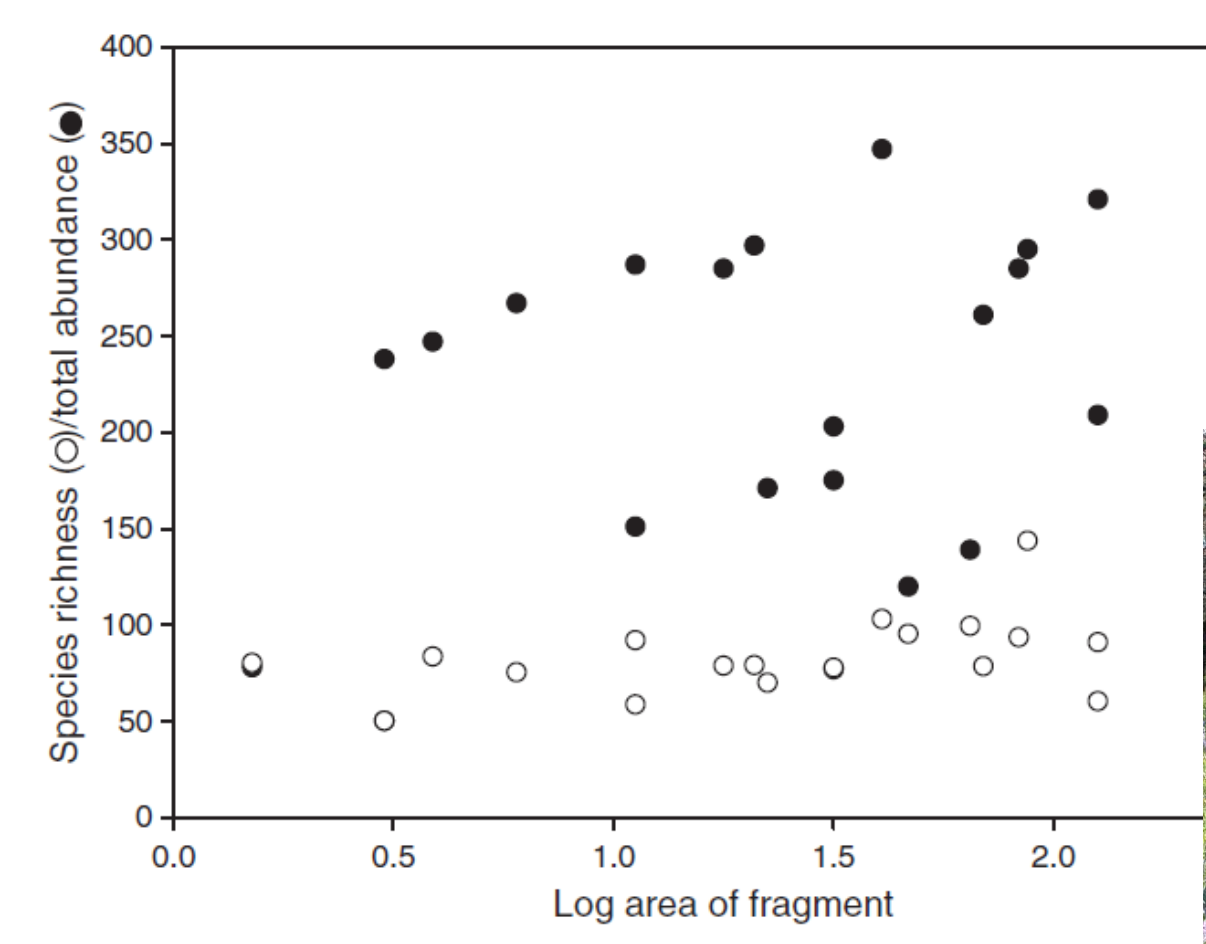
Lisa Neame

4,464 pollinators
138 species
19 sites, 0.3-31 ha

Julie Wray

5,381 pollinators
211 species
10 sites, 4 each of 4 landscapes

No relationship between fragment size and abundance or richness

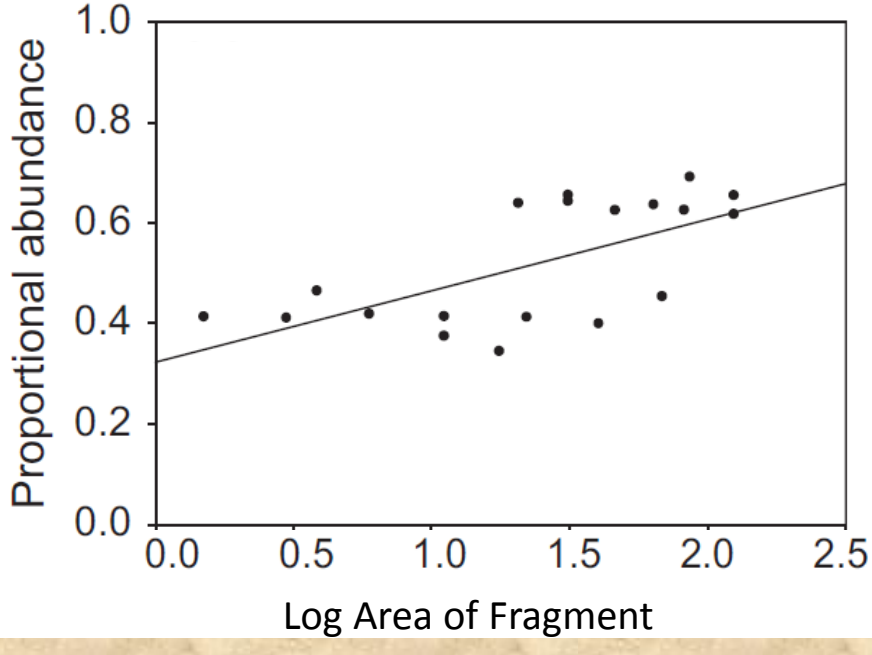


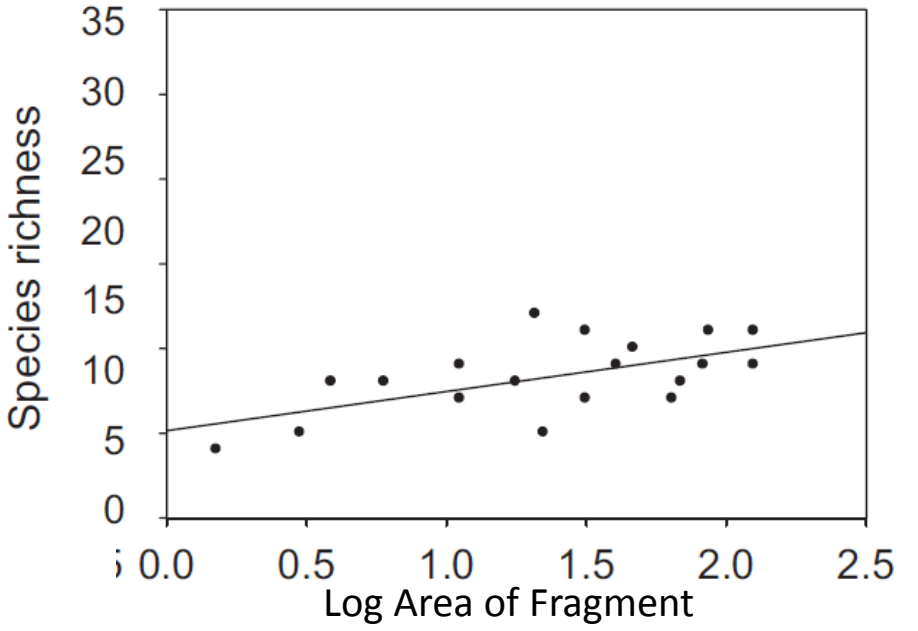
Neame, Griswold, Elle 2013. Insect Conservation and Diversity

Some guilds do respond to loss of habitat

Ground Nesting Bees

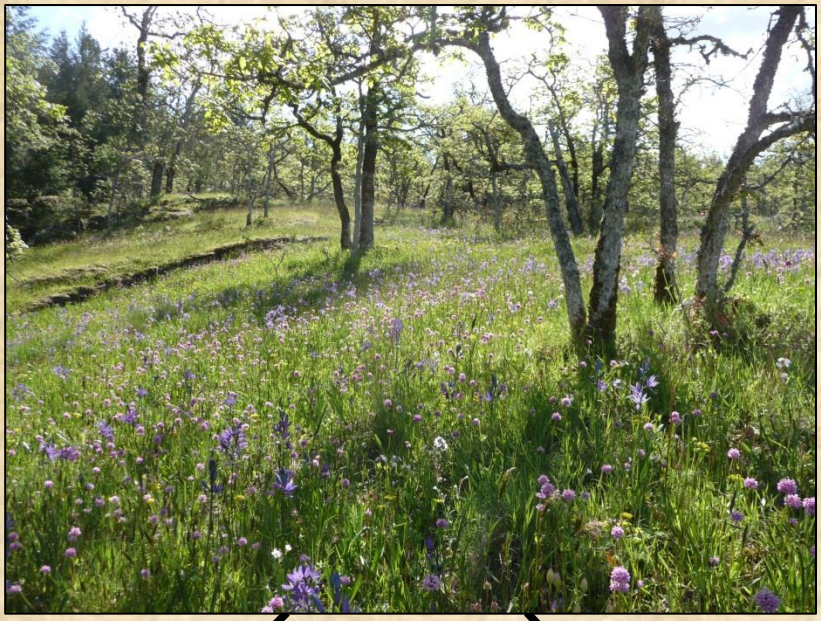
Cavity Nesting Bees





Neame, Griswold, Elle 2013. Insect Conservation and Diversity

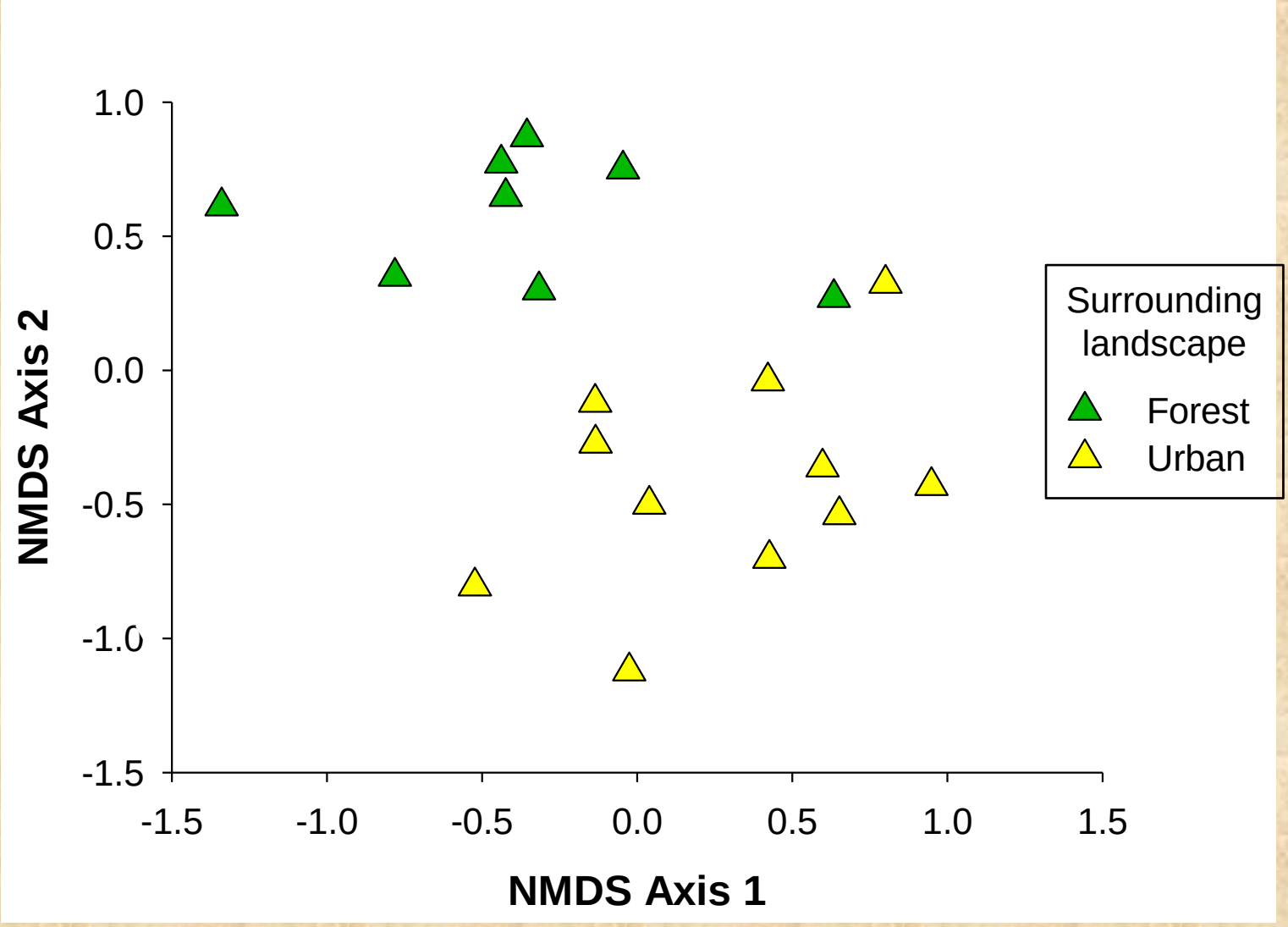
Fragments embedded in different landscapes



Forest matrix

Urban matrix

Bee communities differ between landscapes



Wray, Neame, & Elle 2013. Ecological Entomology

Forest- and urban-associated species differ in size, flight period, and specialization

Forest-associated species:
Early-flying, large, specialized and rare wood-nesting bees

Urban-associated species:
Late-flying, small, generalized and common wood-nesting bees

Using forest for nest sites?


Bombus mixtus

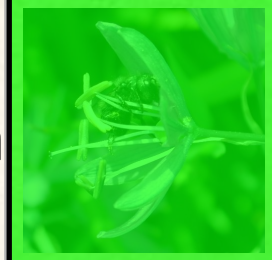

Bombus bifarius


Bombus flavifrons

Need oak-savannah


Andrena astragali


Andrena microchlora


Osmia nigrifrons

Using gardens for food?

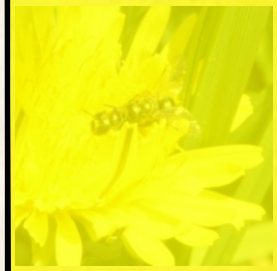

Lasioglossum (Dialictus) spp.


Agapostemon texanus

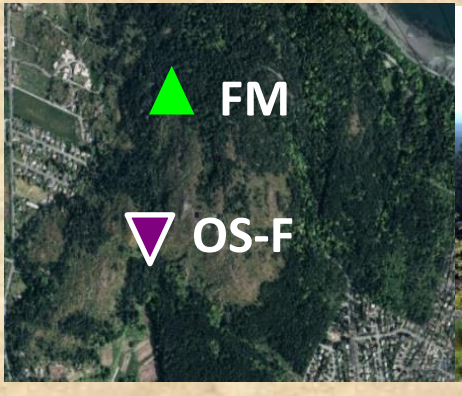

Halictus rubicundus

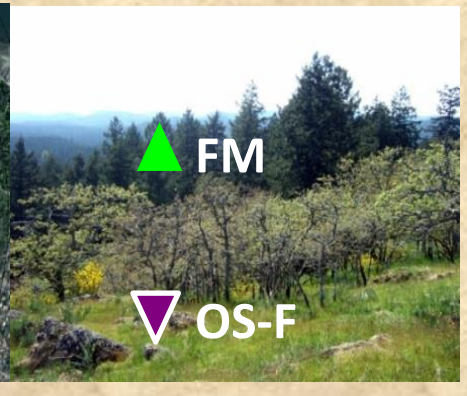
Artificial nest cavities

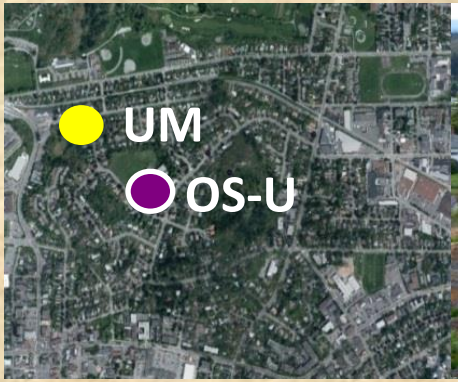

Osmia odontogaster

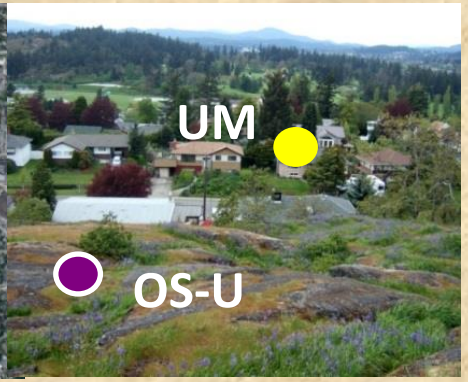

Ceratina acantha

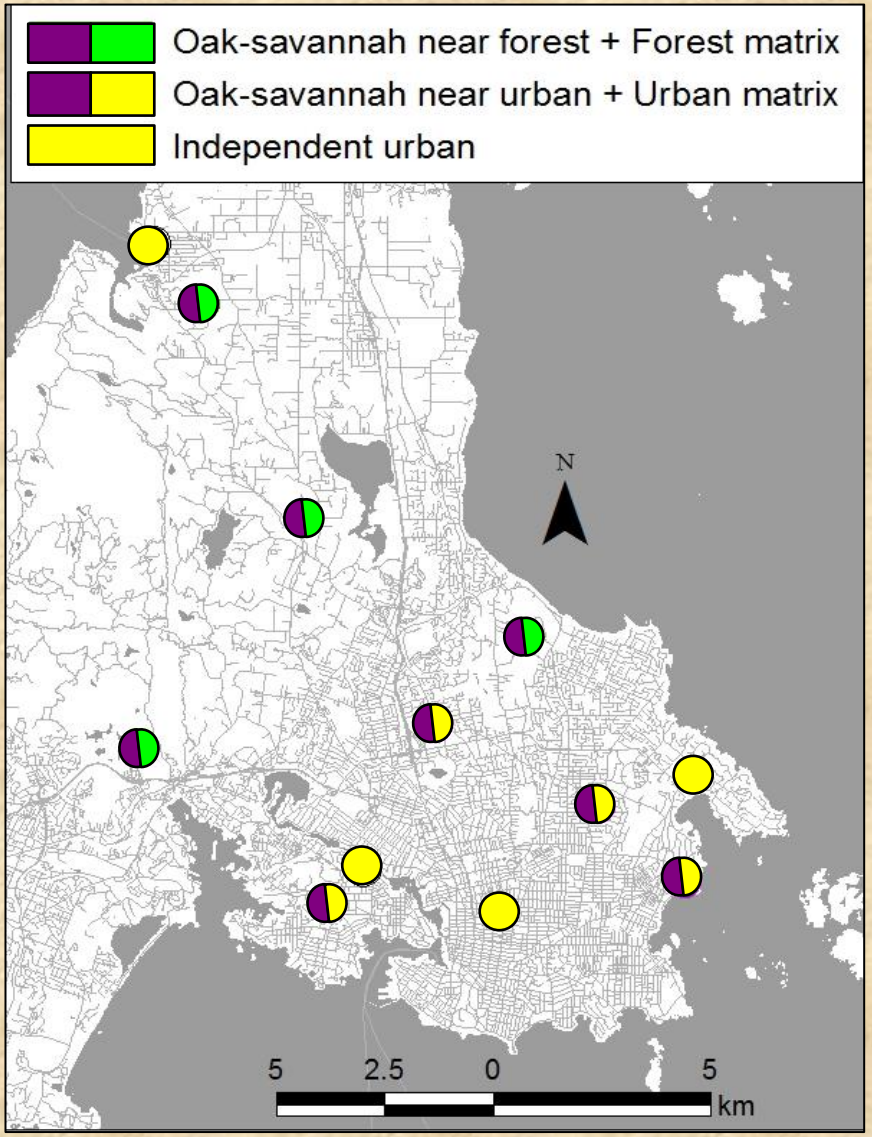
The next step: sampling the matrix



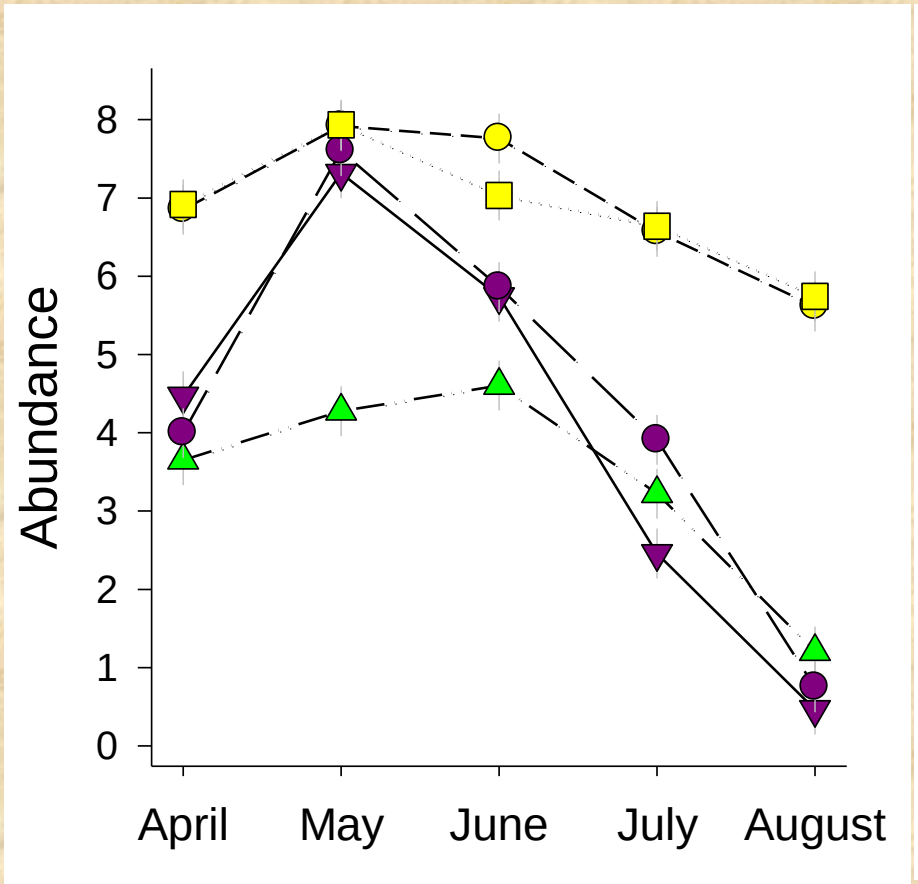


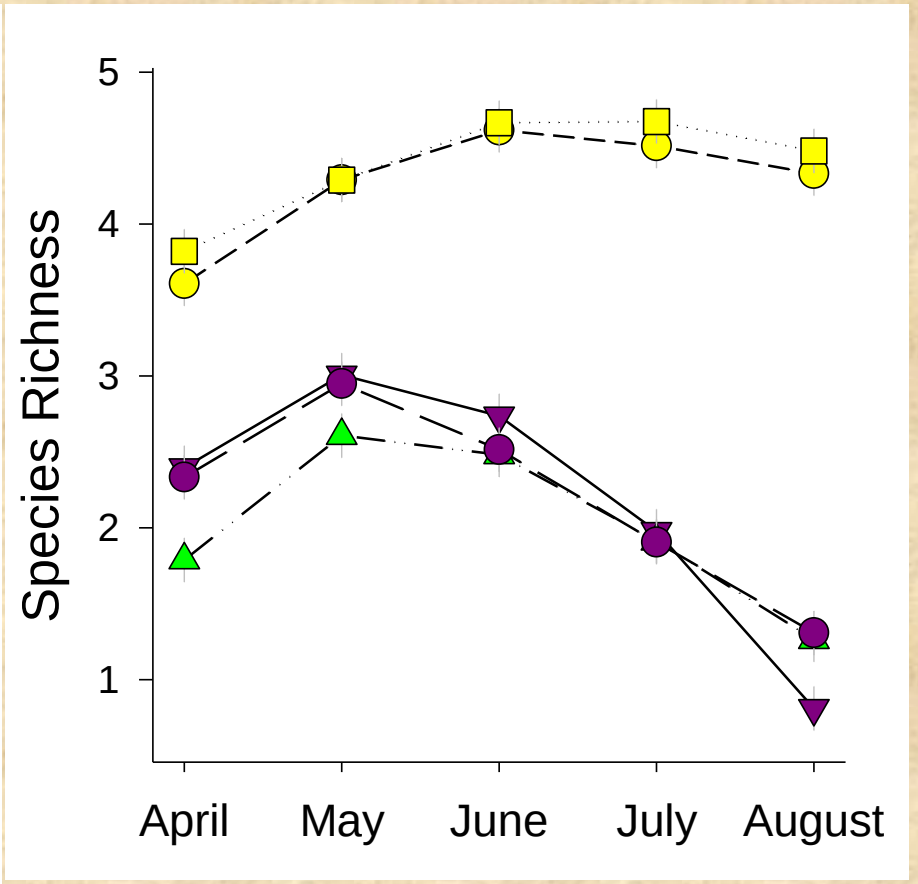


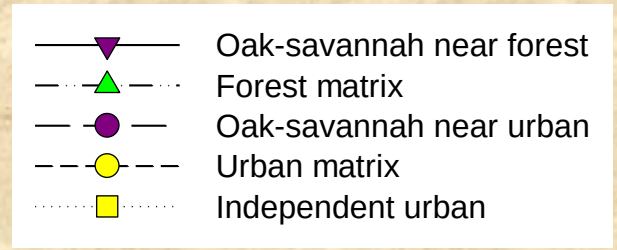




Floral abundance and richness high in urban areas

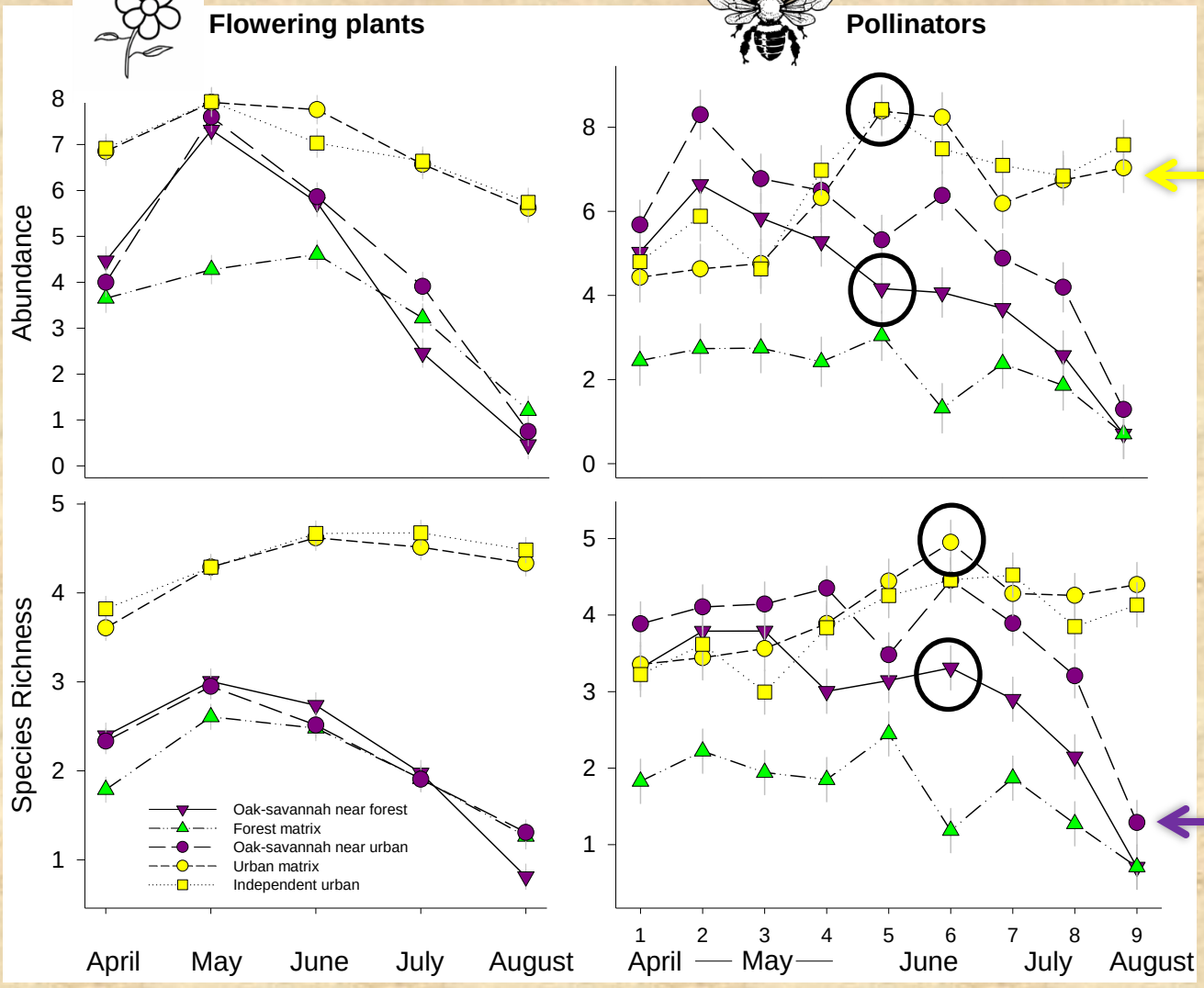






Pollinators respond to resource availability

both at the site and in the surrounding matrix



Wray & Elle 2015. Landscape Ecology

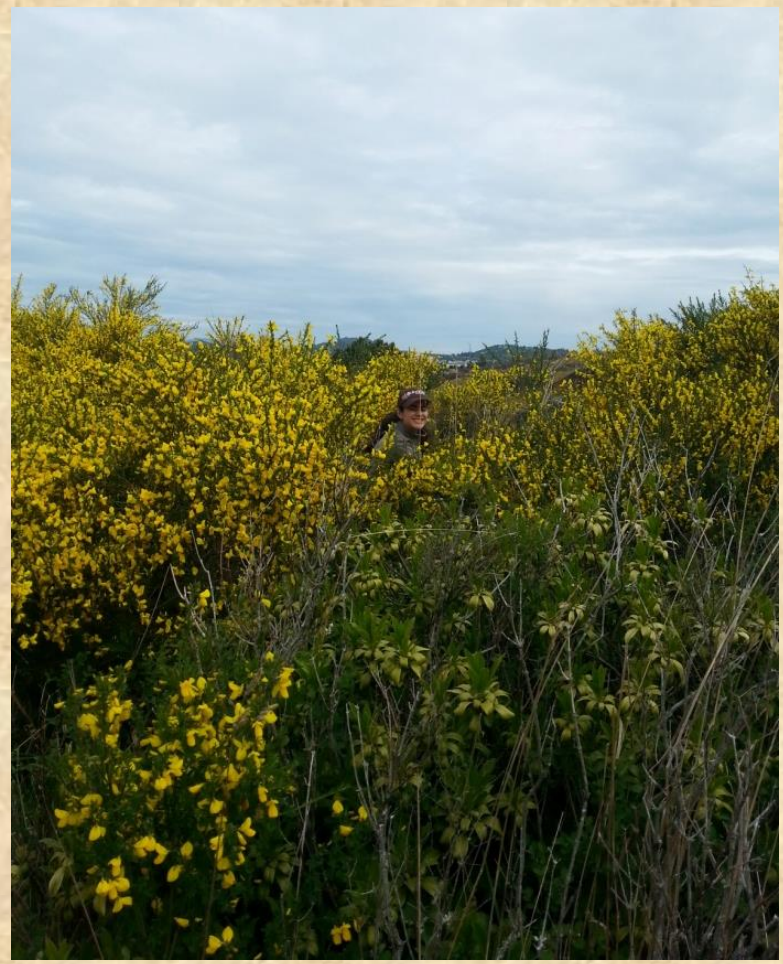
Pattern: summary

- Landscape context more important than fragment size
- Pollinator community generally tracks the plant community

Conservation message 1:

- Plant a garden!

2. Local: How does invasion by scotch broom change plant-pollinator interactions?

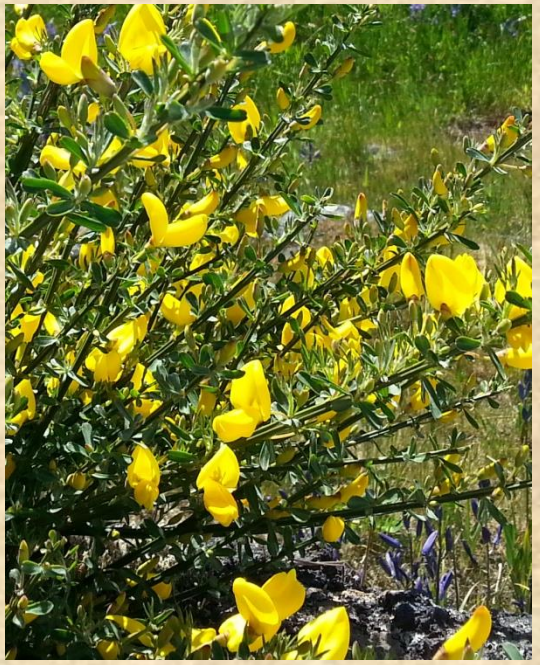


Focal plants:

Camassia leichtlinii
“great camas”

Camassia quamash
“common camas”

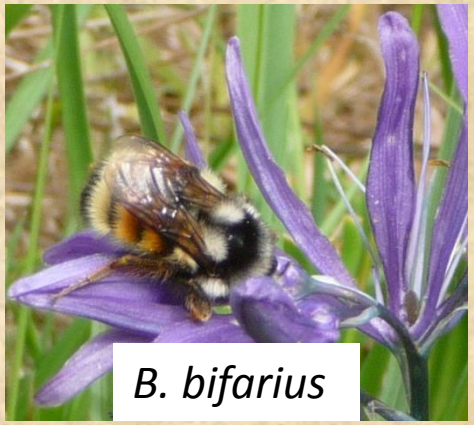
Cytisus scoparius
“scotch broom”

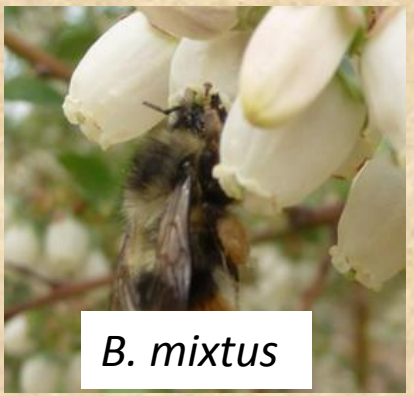


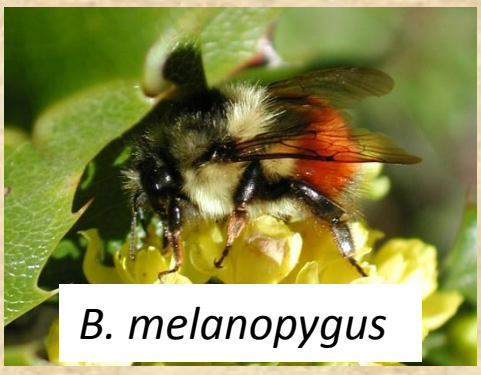
Common, pollinator dependent native perennials

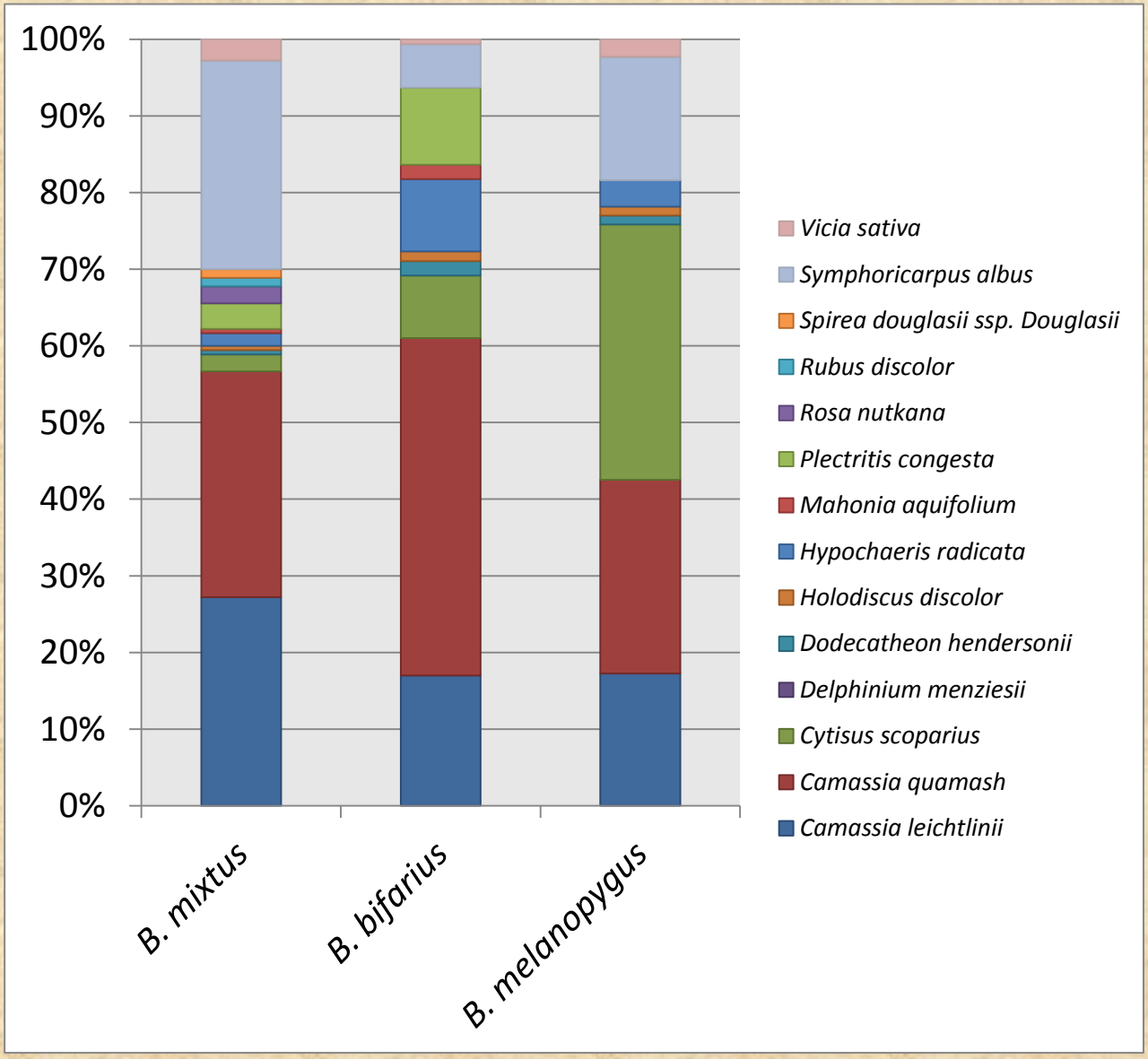
Pollinator dependent, highly invasive shrub

Short-tongued bumblebees in oak savannah









Questions

(1) How does the abundance of wild bees on native plants change with Broom abundance?

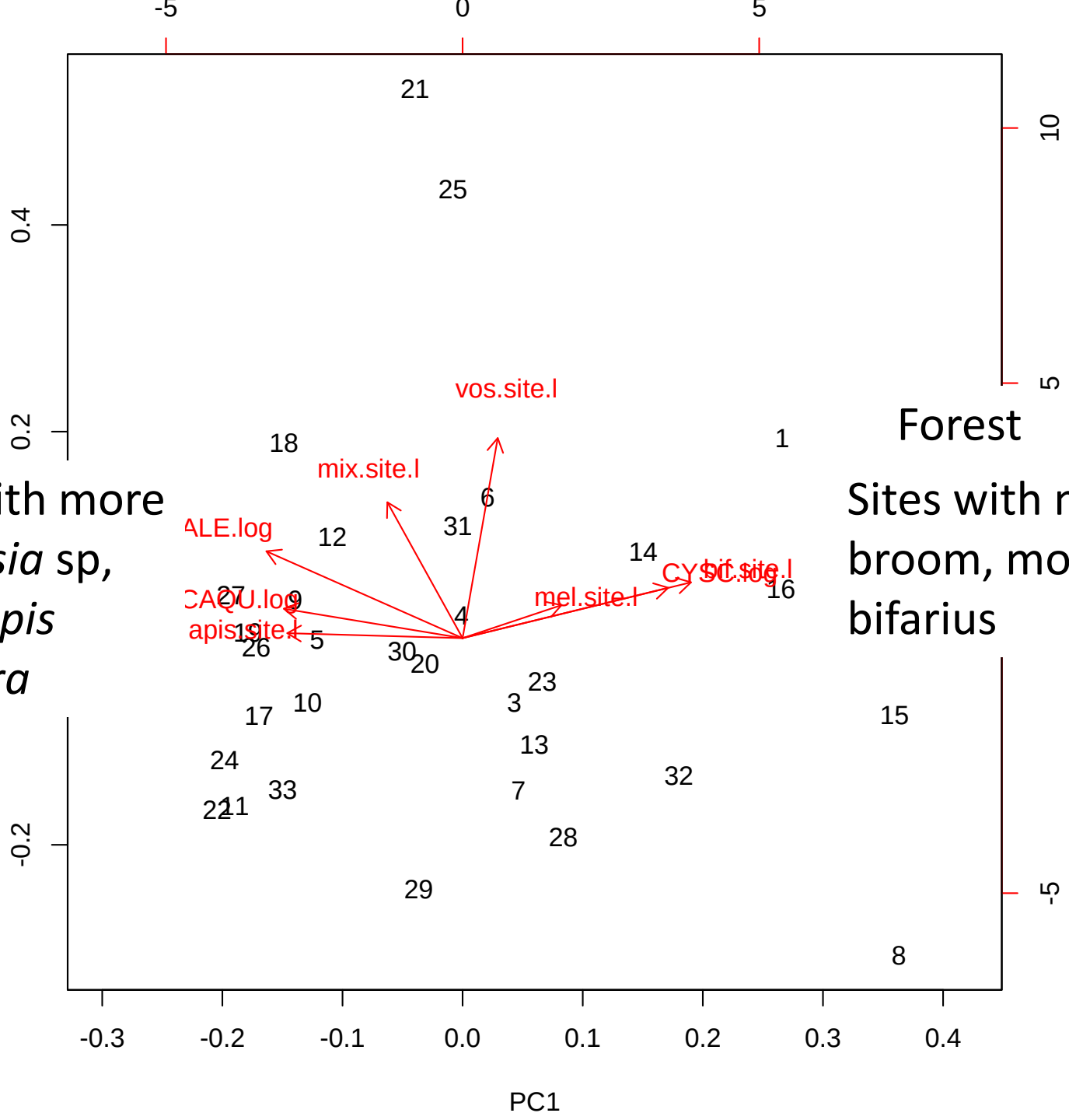
(2) Can interactions between bumblebees change broom pollination?

2014/2015 data

- 18 sites that varied in broom invasion
- Sampled 5-6 times in May and June, during peak bloom of focal plants
- Collected pollinator community data by netting
- Observed visit rates to focal plant species – 2 x 10 min observations per plant species per observation date

Urban

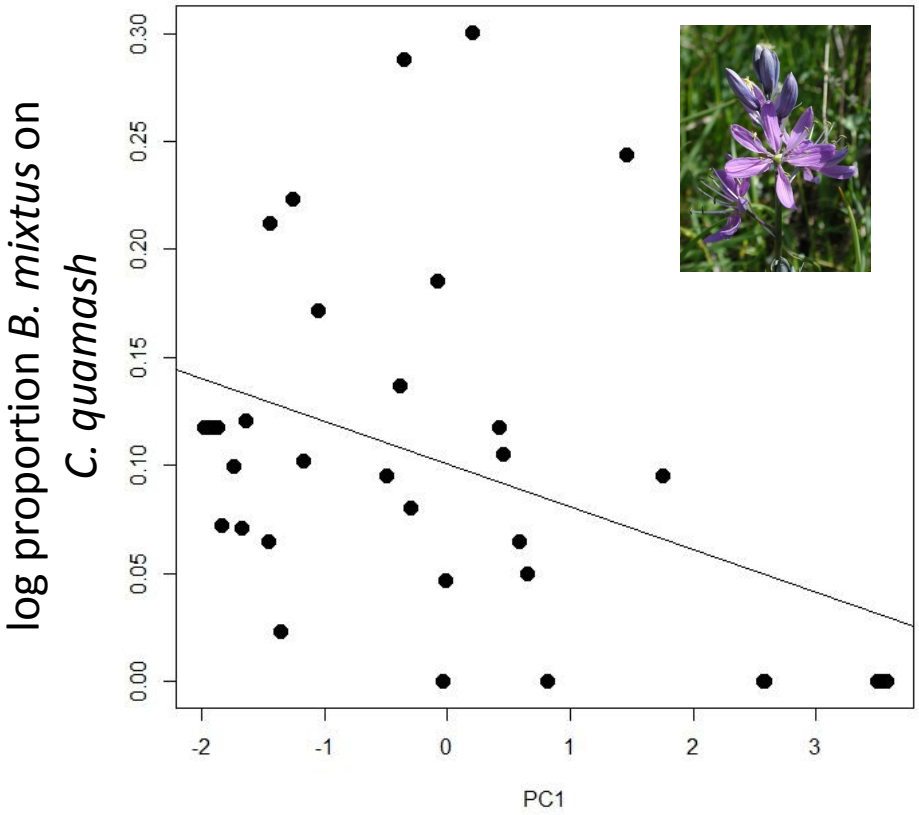
Sites with more *Camassia* sp, more *Apis mellifera*



Forest

Sites with more broom, more bifarius

B. mixtus was a greater proportion of visitors to both *Camassia* species at sites with less bifarius, more *Camassia*

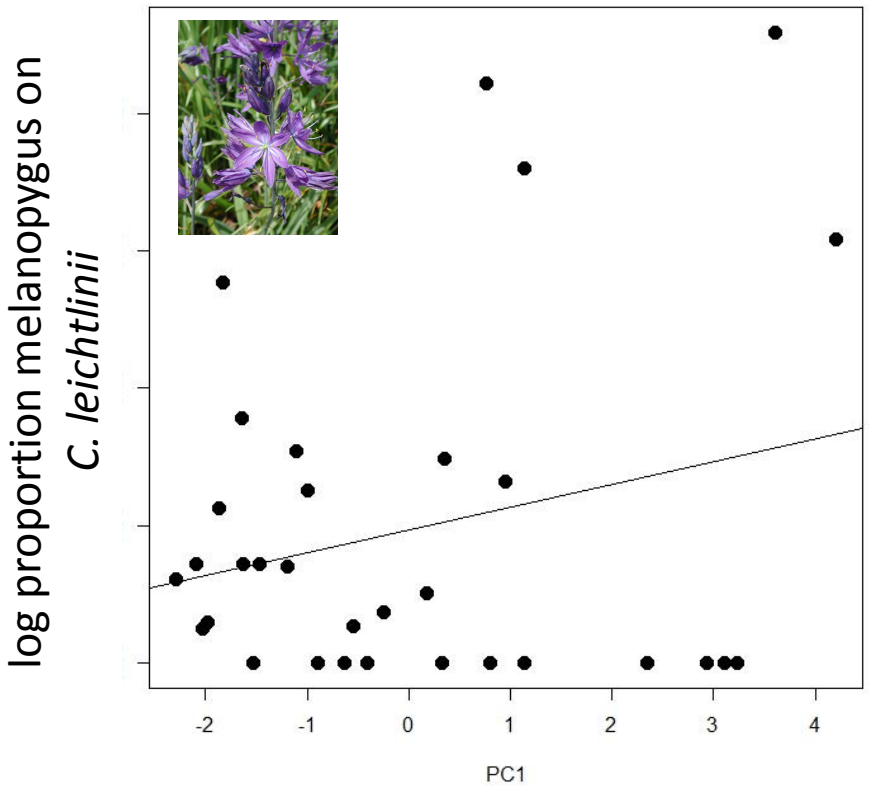


More *Camassia*
More *Apis mellifera*

More *B. bifarius*, *C. scoparius*

B. melanopygus

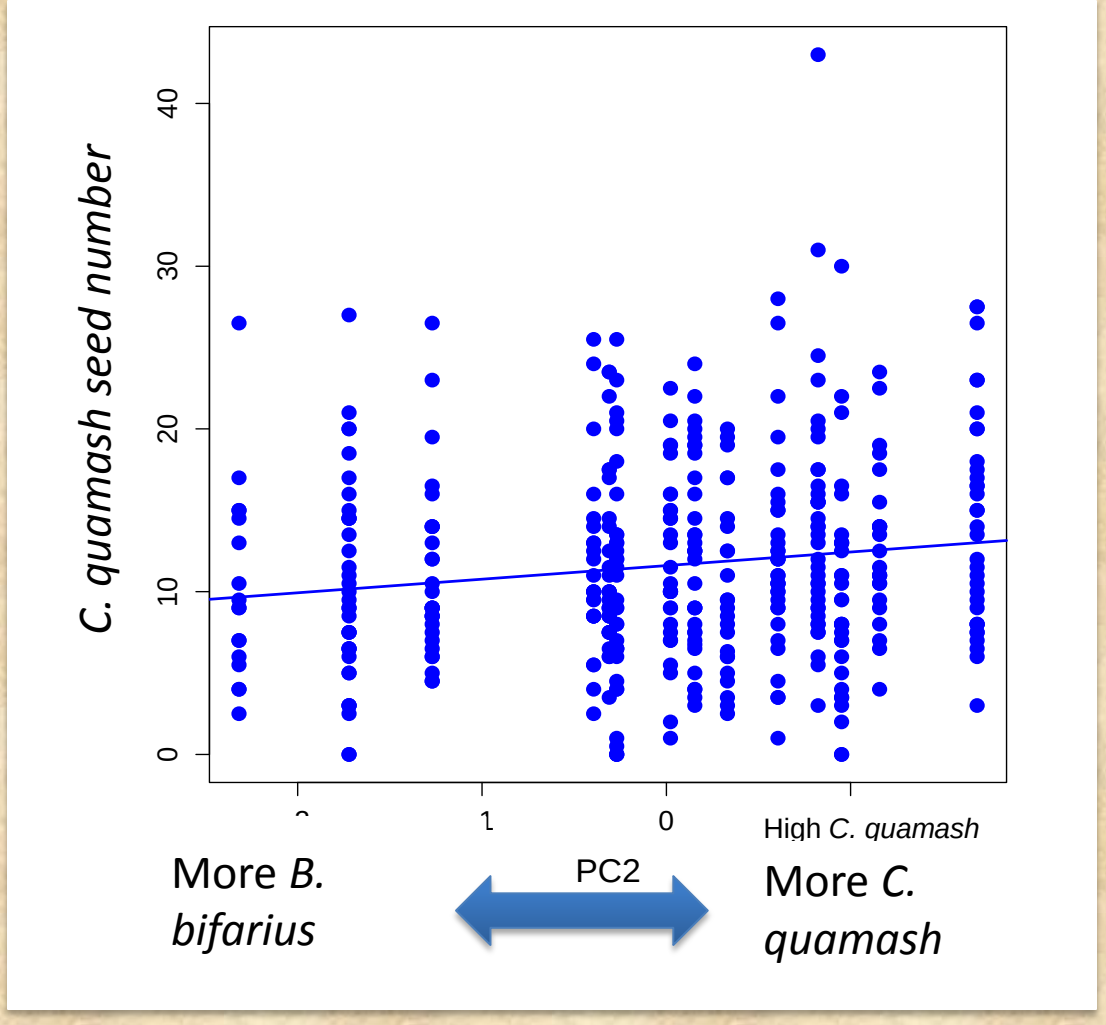
- greater proportion of visitors to *C. leichtlinii* at sites with more *B. bifarius,* less *Camassia*
- *C. scoparius* at sites with more *C. scoparious,* other bee competitors



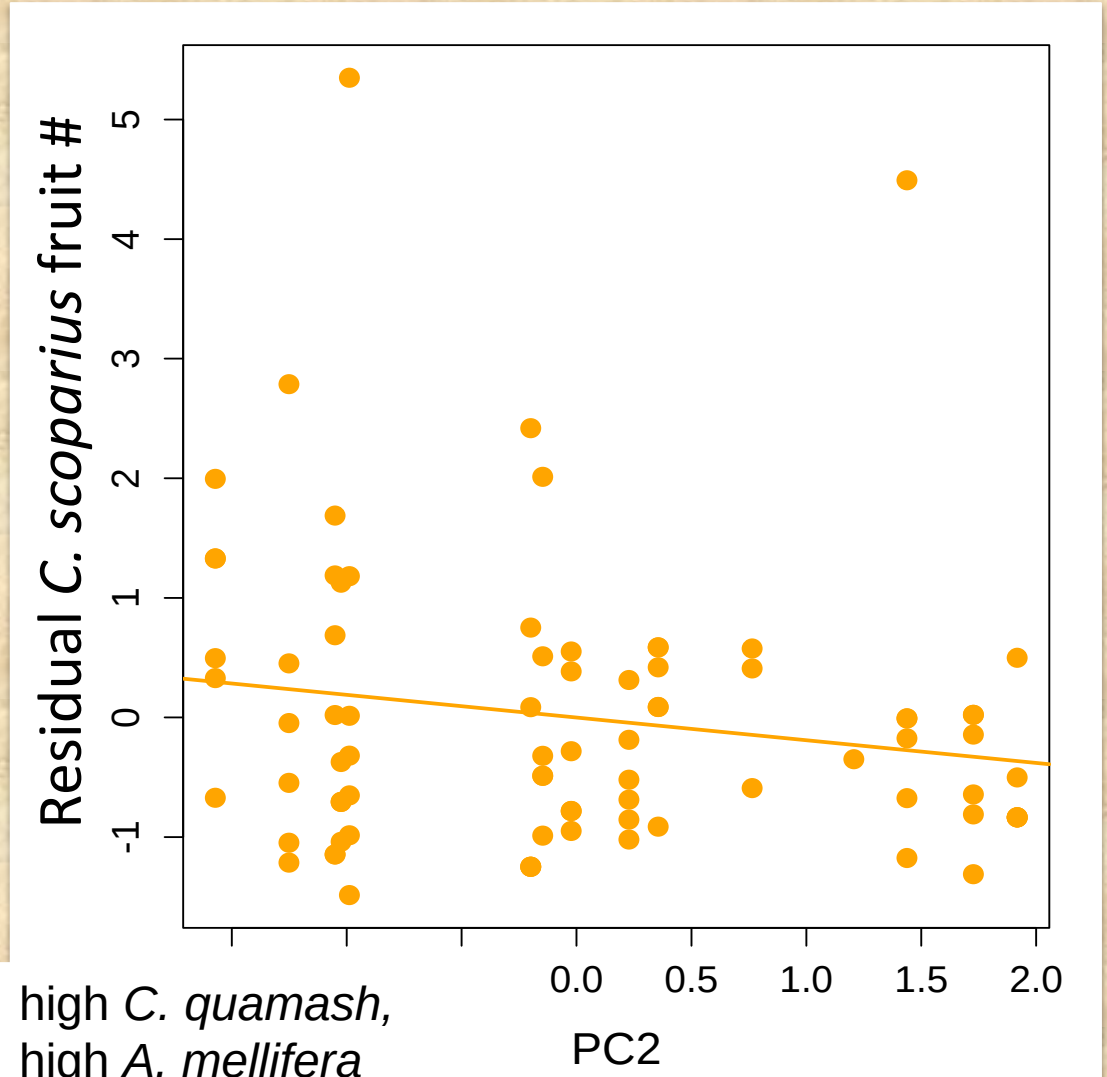
More *Camassia*
More *Apis mellifera*

More *B. bifarius*, *C. scoparius*

C. quamash set more seeds at sites with conspecifics, low visit rates by *B. bifarius*



C. scoparius set more seed at sites with more *C. quamash*, more honeybees and more *B. bifarius*



high *C. quamash,*
high *A. mellifera*
higher *B. bifarius*

Pattern: summary

1. *Bombus bifarius* prevalence on focal plants related to the landscape, not local factors.

2. Other *Bombus* may respond to both focal plant density and competitor abundance

3. Low seed set by *C. quamash* at sites with abundant *B. bifarius* could reflect negative impacts of this bee on reproduction or habitat differences

4. Broom pollination may increase at sites with high *B. bifaruis,* be facilitated by abundance of native plants

Conservation message 2:

- Bring broom bashing to isolated fragments!