

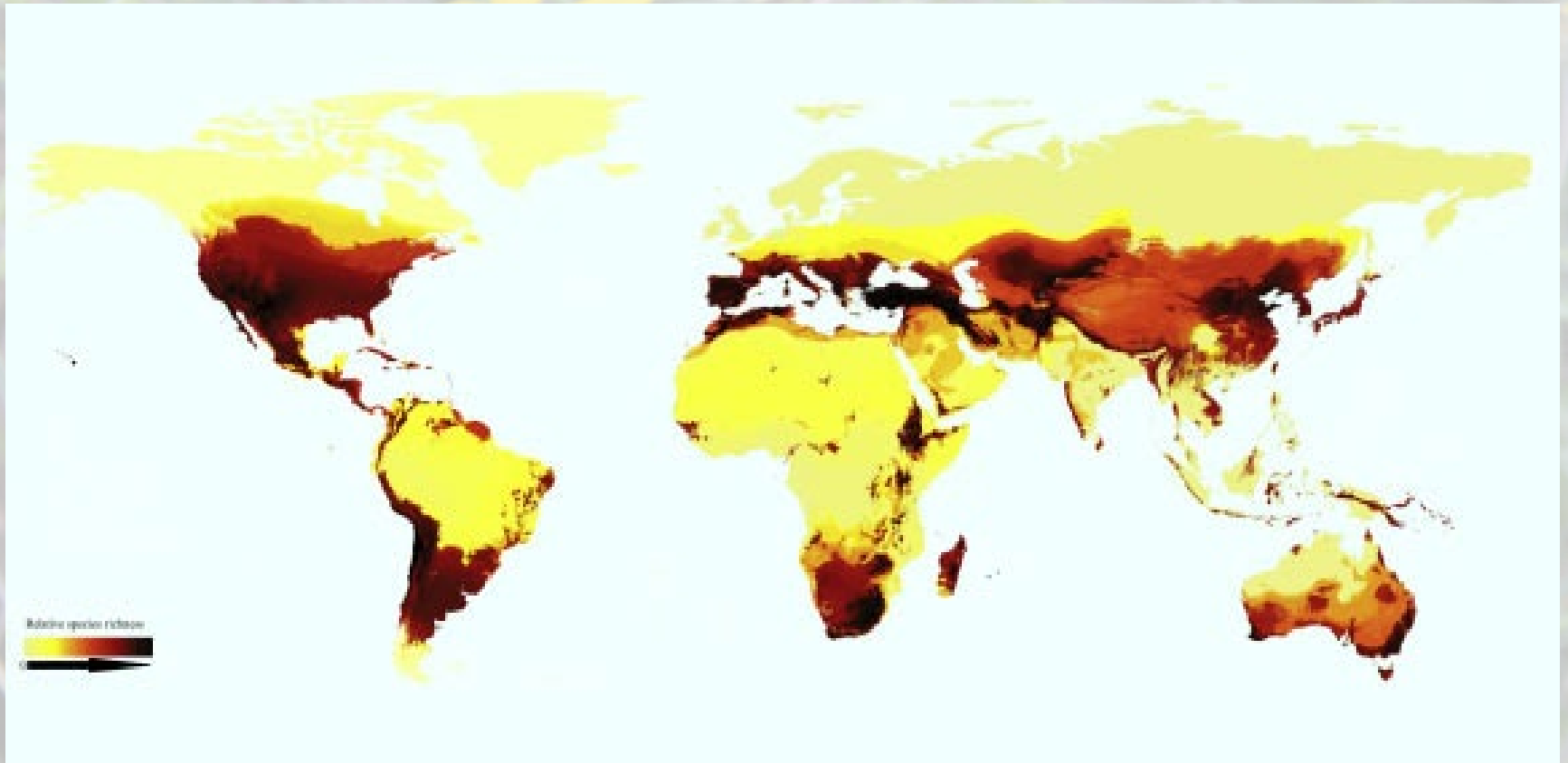


**Pollinators  
for the Future**



# Bees are diverse: nearly 20,000 species

*One in five* of them (about 4,000 species) lives in North America



**Just 8 of all these species are honeybees (0.04%)**

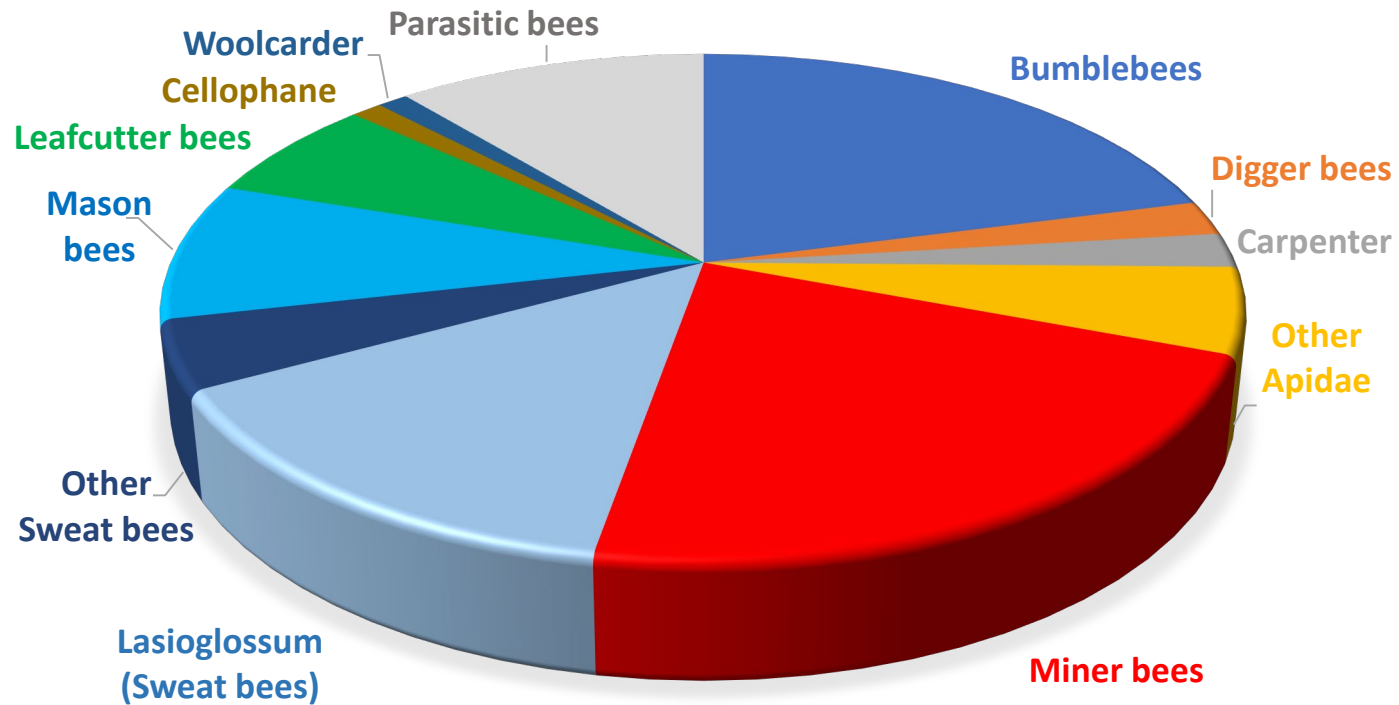


**Native North American bees vary greatly in size, shape, fuzziness, colors.**

**Sadly, many are routinely mistaken for wasps (their distant chiefly carnivorous ancestors) and are simply swatted or sprayed...**

# There are 229+ native bee species in the Salish Sea...

Nearly half (91) of them live in the San Juan Islands:



**Most (79%) wild native island bees are “solitary”:  
they most commonly nest alone in ground tunnels**





*Halictus tripartitus*



*Agapostemon texanus*





***Andrena buckelli***

## The main reasons wild bees have been declining:

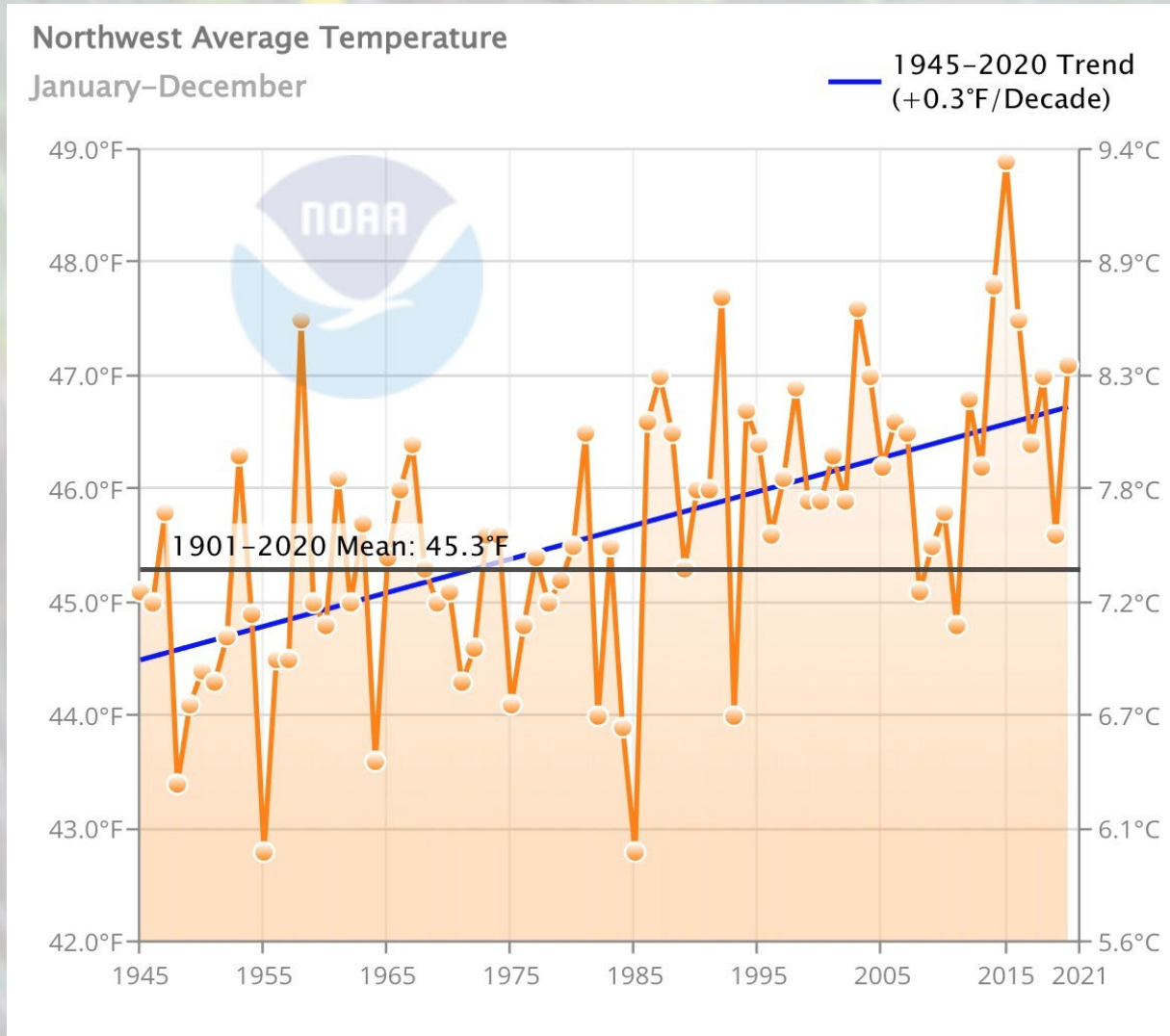


**The islands are a mixed mosaic of small farms, forests, homes and gardens**



**Diverse land uses and lots of edges have preserved bee-o-diversity and wild pollination ... until now**

# The Northwest is getting warmer, on average...



**We expect little change in total annual rainfall ...**

***but***

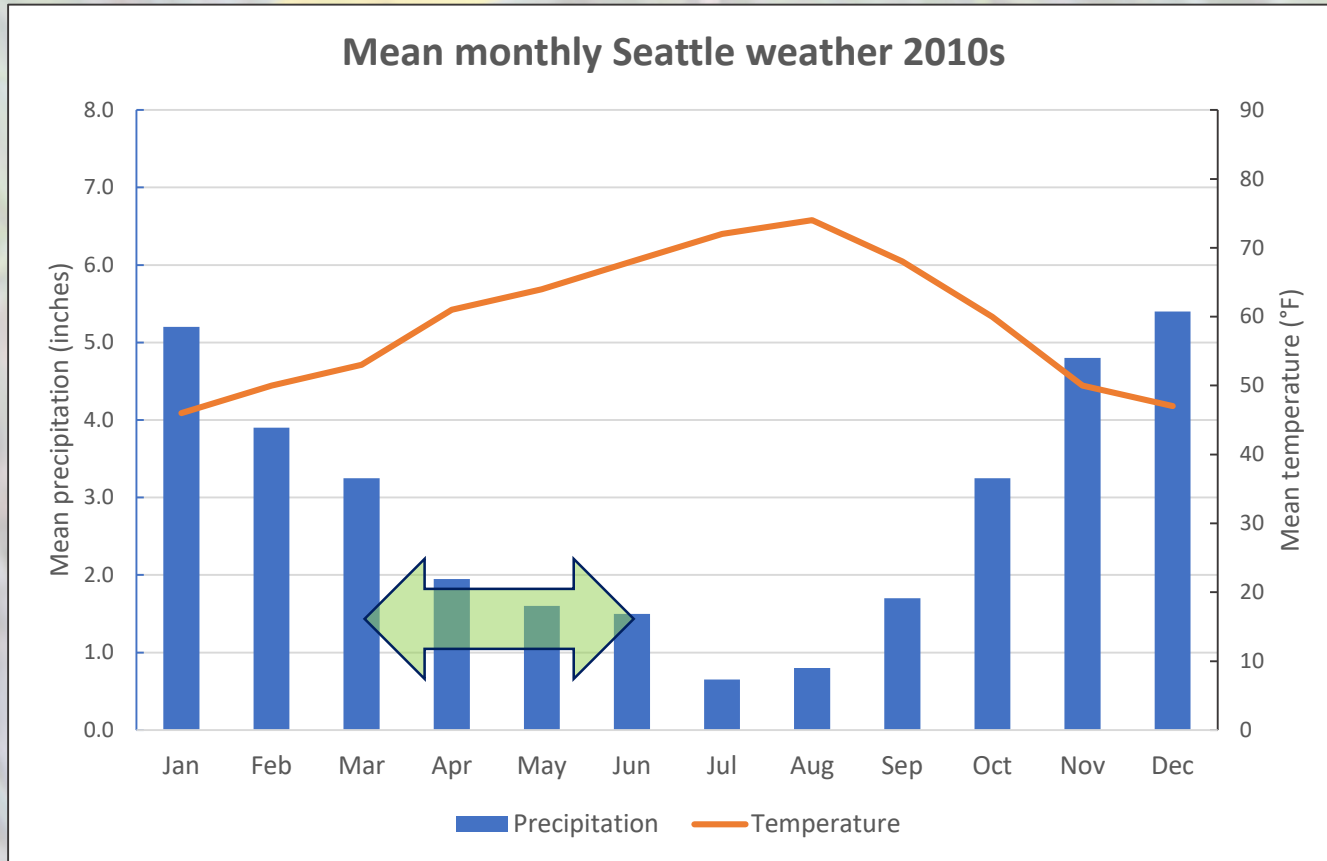
- **More severe storms**
- **More extreme precipitation events**
- **Earlier spring, longer droughty summer**



**Flowering times are determined by species- specific combinations of vernalization (chill period), day/length, and growing days after breaking dormancy (driven by temperature).**

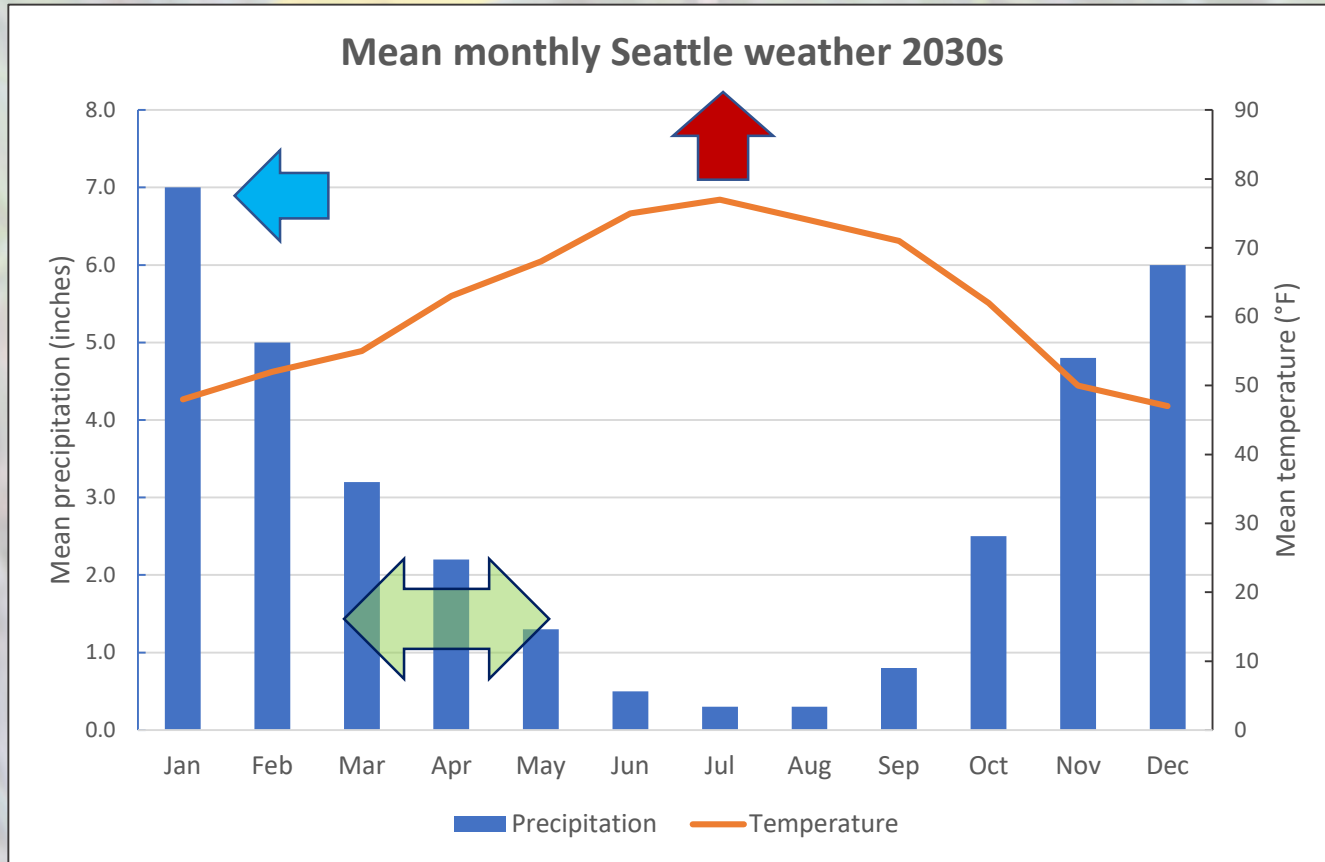


# Native Northwest plants have adapted to flowering after the Equinox as the air warms and rains taper off



# Native Northwest plants have adapted to flowering after the Equinox as the air warms and rains taper off

1.5 degrees Celsius warmer; no change in total precipitation





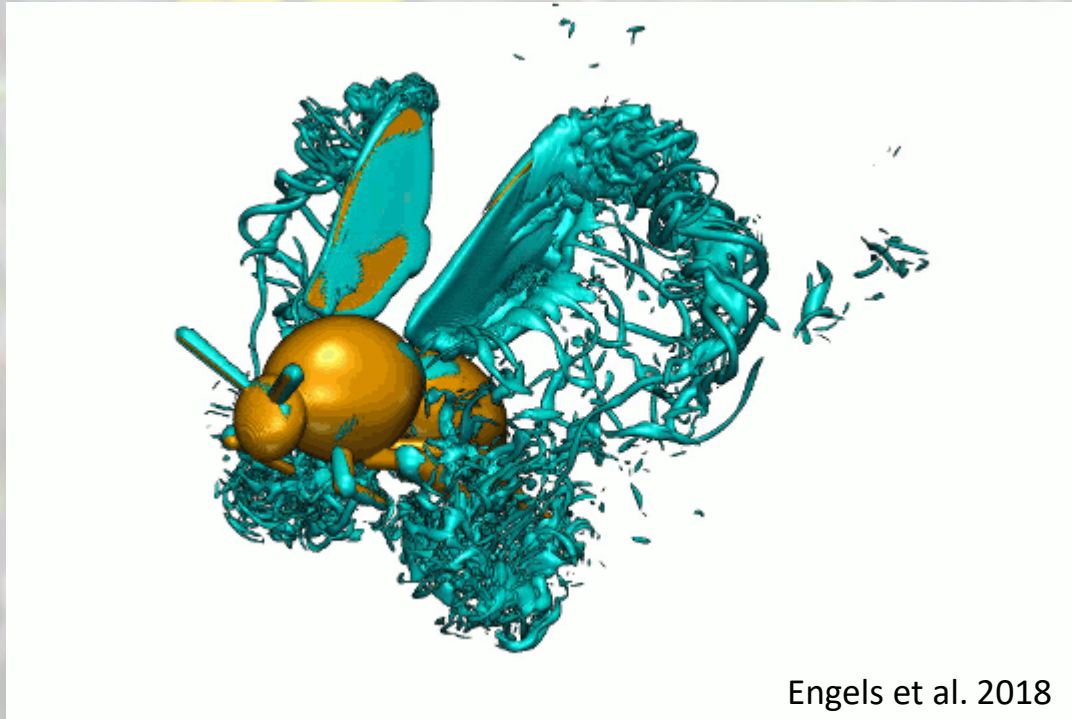
**Early-flowering plants (such as Eurasian fruit trees) are more likely to flower *before* stormy wet spring weather has passed**



**Most bees' emergence times are driven by soil temperature. Ideally, this awakens them when flowers are blooming, but climate change can “de-synchronize” the clocks of bees and plants**



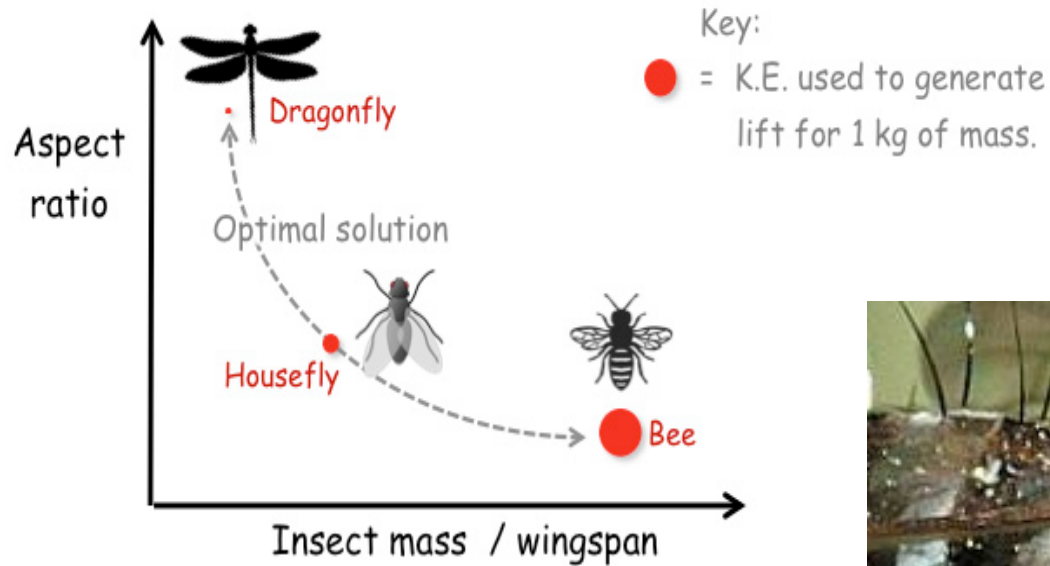
**After emergence, pollinators differ in their ability to fly in cold, wet, windy conditions.**



Engels et al. 2018

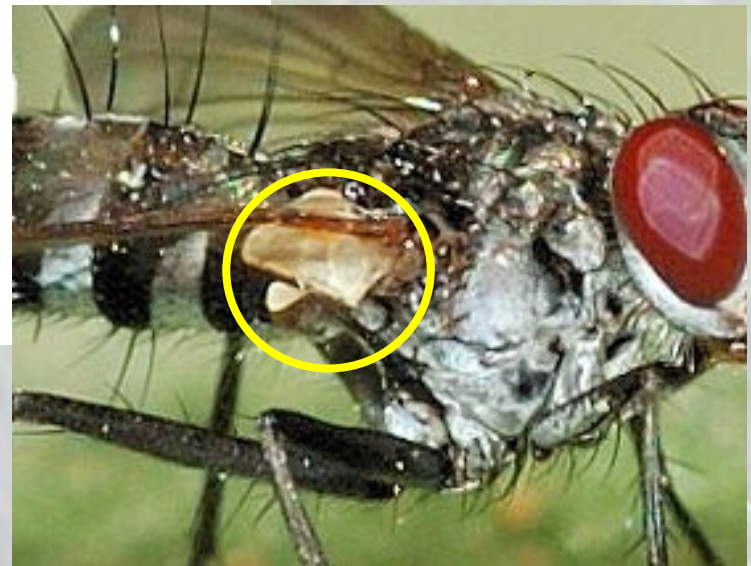
**Solitary bees start flying at about 60°F, honeybees at 54°F, bumblebees at 50°F or lower, and the flies at 45°F or lower. Bumblebees can “shiver” to warm themselves, like humans**

Flies are more recently evolved, with *one* pair of wings (bees have two), and faster flight muscles.



N. Landell-Mills 2019

*Calypters* and *halteres* like trim tabs and pitot tubes in modern airplanes enable flies to maintain stability in high winds.



**Can flies pollinate? Yes... More or less!**



Muscid with Chocolate Lily pollen, American Camp

**Flies are not very fuzzy, however; they pick up fewer pollen grains at each flower than bees.**



**Flies are also capricious about where they feed next: pollen is often delivered to the wrong address.**

**But there far more flies than bees!**  
Worldwide, about *10 times* more



One fly family, the *Syrphidae* (*flower or hover flies*)  
*eat pollen like bees*



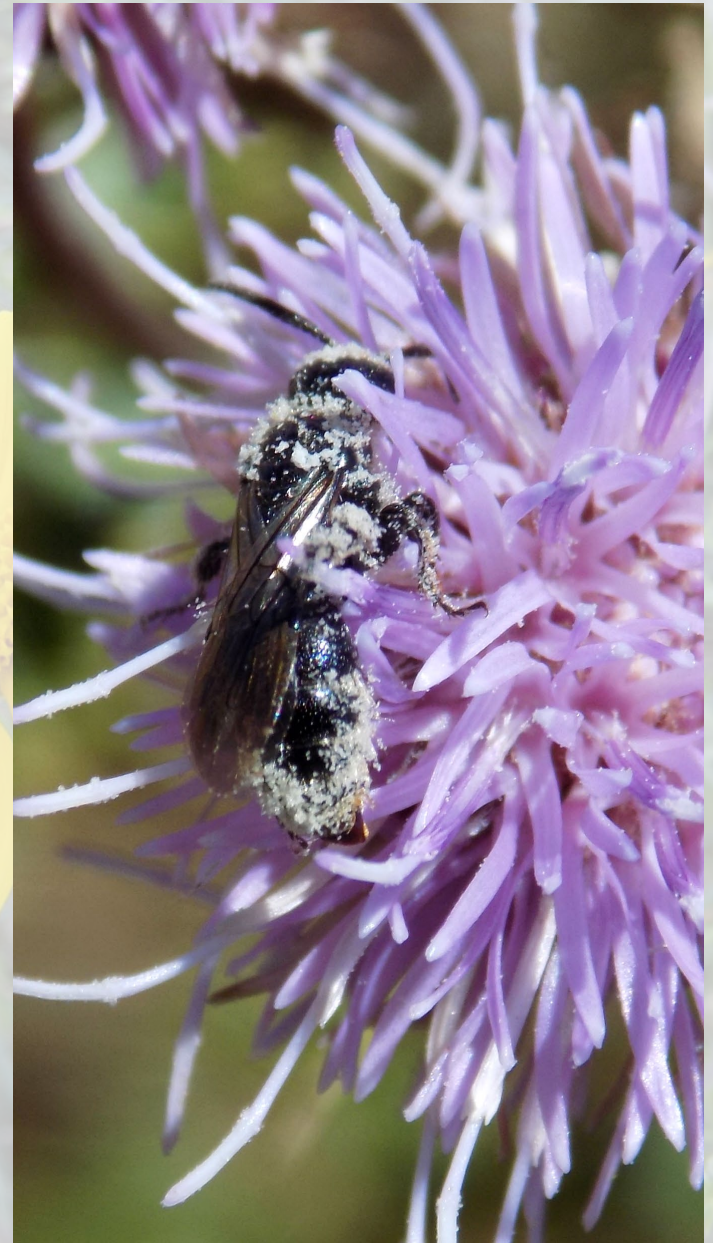
Flower flies migrate for weeks to months, and can produce  
2-3 generations every summer (they are *multivoltine*)



**Flies have another advantage; they do not make nests and do not have to collect extra pollen and nectar to provision their eggs.**

Bees must carry loads of pollen and nectar on each trip from their nest; this can be nearly half the weight of a bee in flight, and can compromise lift in stormy weather.

Bees must store provisions, seal up, and go dormant within a few weeks. Some flies can wander for months, laying eggs whenever and wherever conditions are favorable.



**Flower flies do not nest, but many of them lay their eggs on aphid infestations. Their larvae are ferocious predators, eating hundreds of aphids as they develop!**



D. Cappaert, Michigan State University

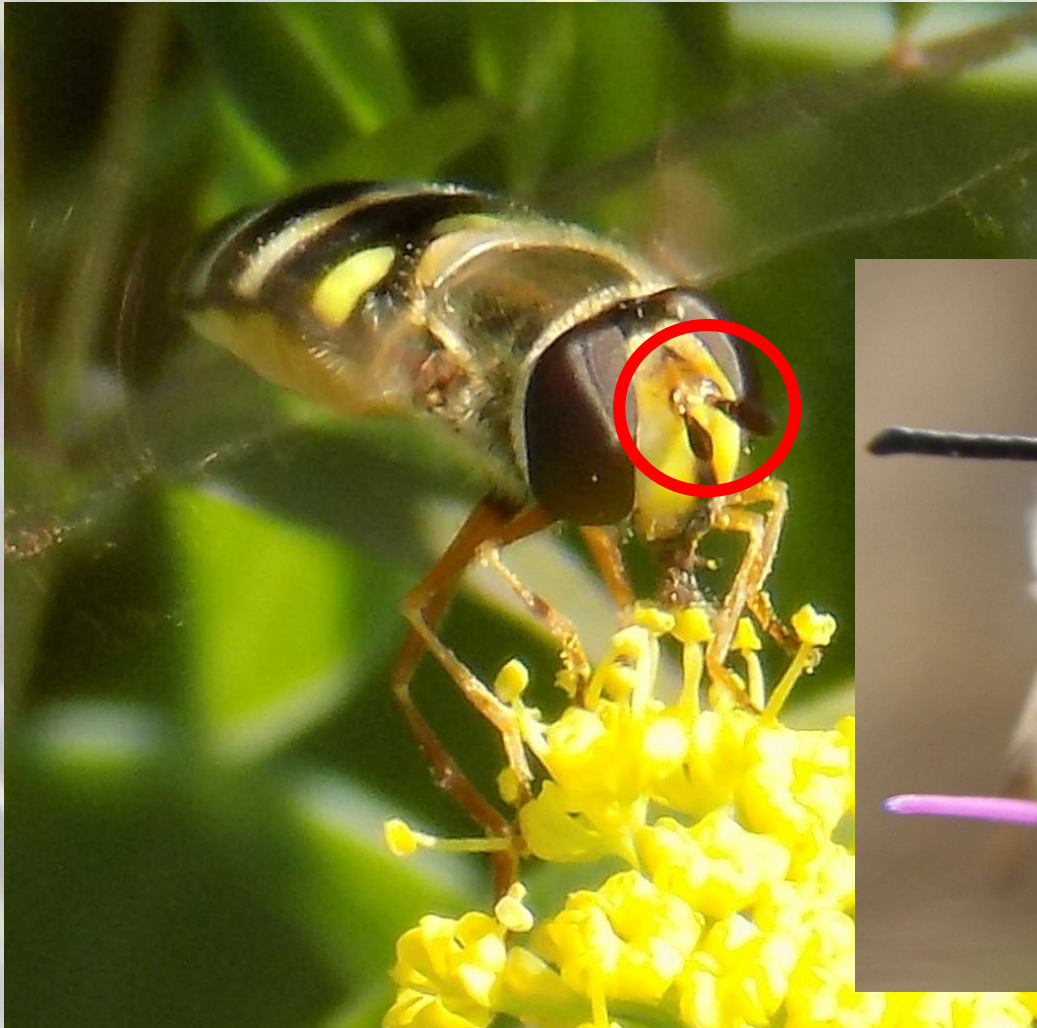
Most flower flies evolved Batesian mimicry: they look like fierce stinging wasps or bees and some even buzz--but they neither sting nor bite



*Bautias*, a bumblebee mimic

**Look into my eyes!**

**Huge eyes  
Club-shaped antennae  
Lapping tongue**



**Wide forehead  
Chewing mandibles**



**Flies can be fuzzy**



*Criorhina*, a bumblebee mimic

Though most seem hairless and shiny



*Parasyrphus maculatus*

**Flower flies prefer composite flowers (short tongues)**



*Lejops lineatus*

Flower flies can hover and eat *on the fly!*



*Scaeva pyrastris* on camas





*Scaeva pyrastris* on camas

**Many flower flies are showy**



*Sphaerophoria philanthes*

**Some are tiny and easily overlooked**



*Platycheirus*

**A few of our common flower flies are non-native**



*Eristalis tenax*, the common “drone fly”

**There are flower flies that parasitize other flower flies!**



*Bombylius*, a beefly, with a dusting of pollen

**In a warmer, stormier future, flower flies will become more important than bees for early spring pollination services: plums, cherries, even apples**



*Dasysyrphus intrudens*

# Threats to flower flies...

Pesticides applied to wetlands, flowers, and aphid infestations

Uninspected and/or poorly managed honeybees or mason bees  
(viral sharing on flowers) \*

Removing rotting wood, draining wetlands, or removing shady hedgerows



\* E. Bailes et al. 2018, *Biol. Lett.* 14(2); A. Davis et al. 2021

A background image of a field with thin green grasses and several bright yellow flowers. One large yellow flower is in the foreground, slightly to the right of center. Another smaller yellow flower is to its left. The background is filled with more green grass and some out-of-focus yellow flowers.

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