Portland's cavity nesting bees: What do we really know?

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UERC March 2021

Bees are in decline:

- Habitat loss
- Agricultural Intensification
- Urbanization

(Sánchez-Bayo and Wyckhuys, 2019); Top photo: (Our Table Cooperative Farm); bottom photos: (Wikipedia – agricultural field; Portland skyline)

Conservation of bees:
Urban habitats can support diverse bees

Cavity nesting locations can be limited in urban areas

30% of bees nest in cavities

(Fetridge et al., 2008); Photos from left: (Sustainability at PSU flickr, PSU Community Orchard); (Log with holes in garden in Portland community garden); (Portland residential garden and nests on post)

How can we best supplement nest sites?

Considerations:

- Preferred Nest Dimensions: What size holes are bees in Portland Metro using?
- Preferred Nest Height: What heights are bees in Portland Metro using?

Photos from left: (Sarah Foltz Jordan/Xerces Society & Heather Holm, 2020 –cut stems for nesting, *Ceratina* sp.) (*Hylaeus* sp. using hole in log); ("Insect house" in garden)

What do we know about cavity nesting bees?

Most natural history data collected through observations, and there is much still unknown about most bee species!

(Krombein, 1965); Photos from left: (*Hoplitis albifrons* collecting balls of dirt); (*Megachile angelarum* at nests); (*Fragaria chiloensis* leaves cut by *Megachile* sp.)

What is known about nest height? Very little

- 1.5 m height has been perpetuated without data
- There is more data on studies of commercial bees, but they are not relevant to the diversity of bees present on Portland

(Budrienė et al., 2003); (Richards, 1984); Photos from left: (Hillsboro Parks & Rec – native pollinator nesting station); (Zac Mazur/WSU, 2018 – Alfalfa leafcutter bee hut); (Boyle & Pitts-Singer, 2017- *Osmia lignaria* nest boxes at 1.5 m)

Research Questions

1. What cavity nesting bee species are present in the Portland area?
2. What cavity nest diameters do bee species use?
3. What nest heights do bee species use?

Nest blocks were created to address these questions

Photo: (*Bombus vosnesenskii* and *Megachile* sp. on *Helianthus annuus* in Portland community garden)

Methods: 5 different diameters of nest cavities to choose from

Nest block:
31 cavities

Cavity Diameter (mm):

Photos from top right: (Nest block entrance with visible nesting material); (Disassembled 5.0 mm nest tray with *Megachile angelarum* larva)

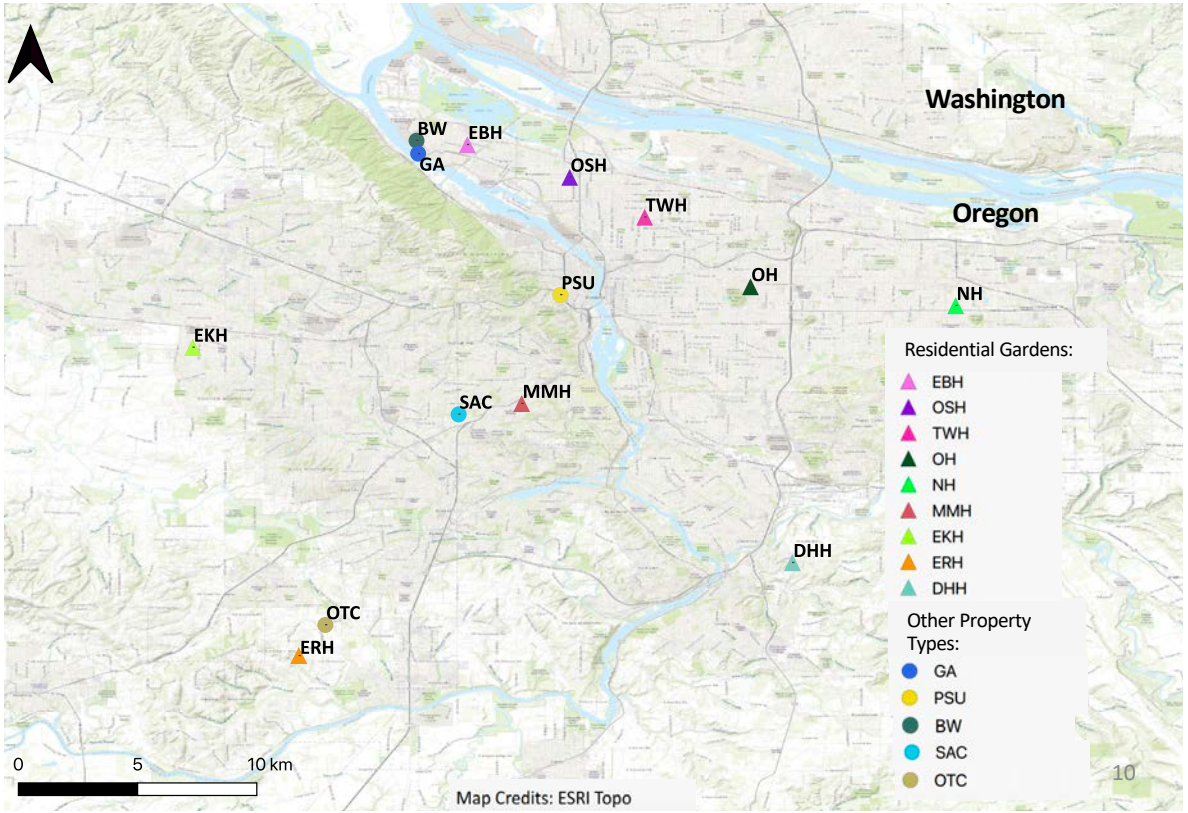
Methods: 3 nest block heights to choose from

Photos from left: (Volunteers with nests attached to post at 3 treatment heights); (*Hoplitis albifrons* returning to 5.0 mm nest cavity at 2.3 m height)

Methods: Nest blocks placed at 14 locations in the Greater Portland Metro Area

Nest Blocks: n = 54

Posts: n = 18



Question 1 results: What cavity nesting bee species were present? **16 species in 2 families**

Family	Genus	Subgenus	Species
Megachilidae	*Osmia*	*Osmia*	*lignaria propinqua*
	Osmia	*Melanosmia*	*proxima*
	Osmia		sp. A
	Megachile	*Chelostomoides*	*angelarum*
	Megachile	*Sayapis*	*fidelis*
	Megachile		sp. A
	Megachile		sp. B
	Megachile		sp. C
	Pseudoanthidium	*Pseudoanthidium*	*nanum*
	Heriades	*Neotrypetes*	*carinata*
	Ashmeadiella	*Ashmeadiella*	*cactorum cactorum*
	Hoplitis	*Alcidamea*	*albifrons*
	Stelis **(Cleptoparasitoid)**	*Dolichostelis*	*laticincta*
	Coelioxys **(Cleptoparasitoid)**		sp. A
Colletidae	*Hylaeus*	*Paraprosopis*	*coloradensis*
	Hylaeus		sp. A

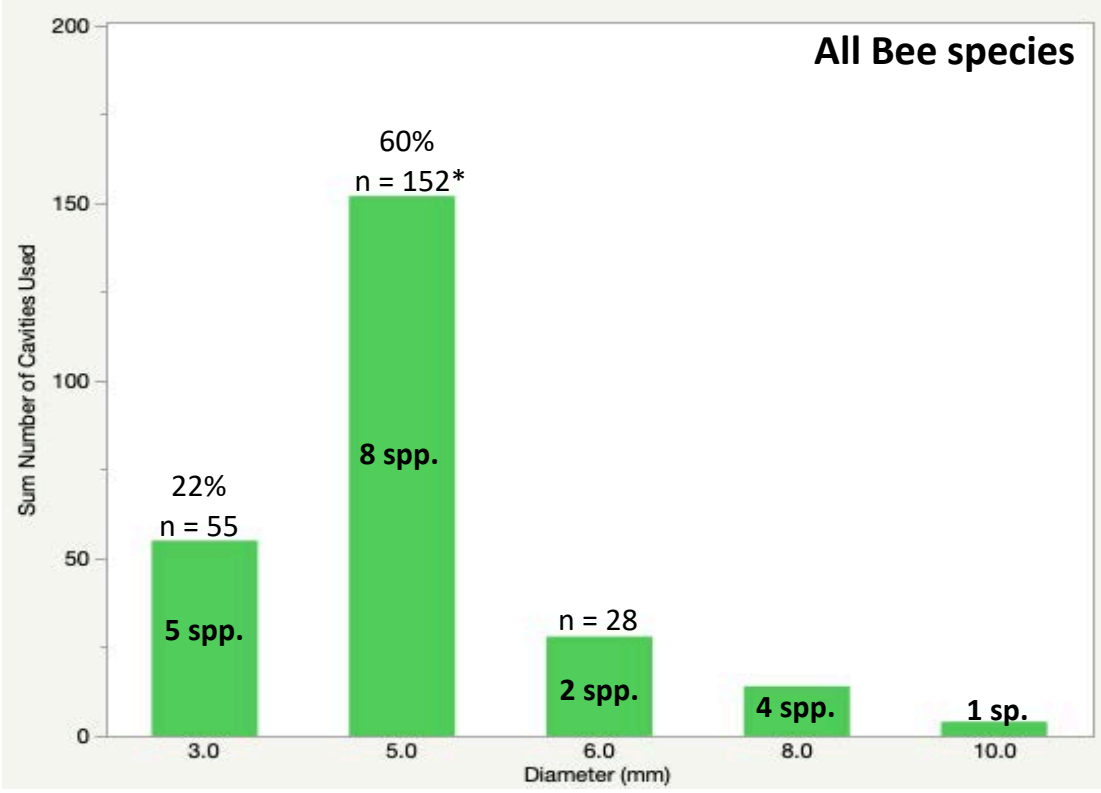
Osmia lignaria

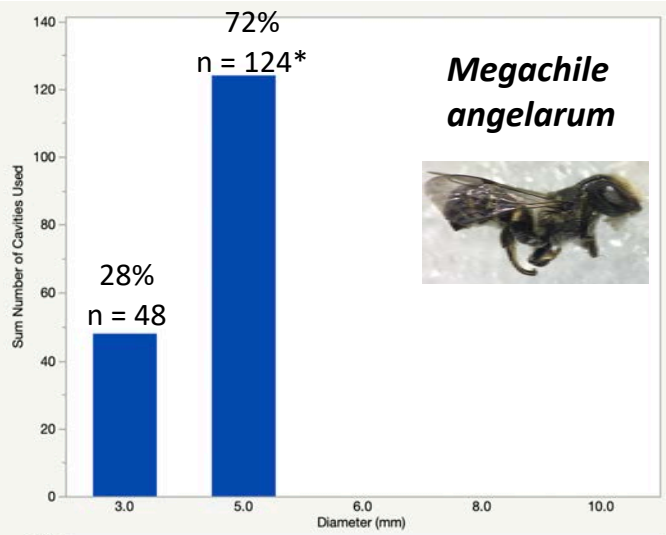
Heriades carinata

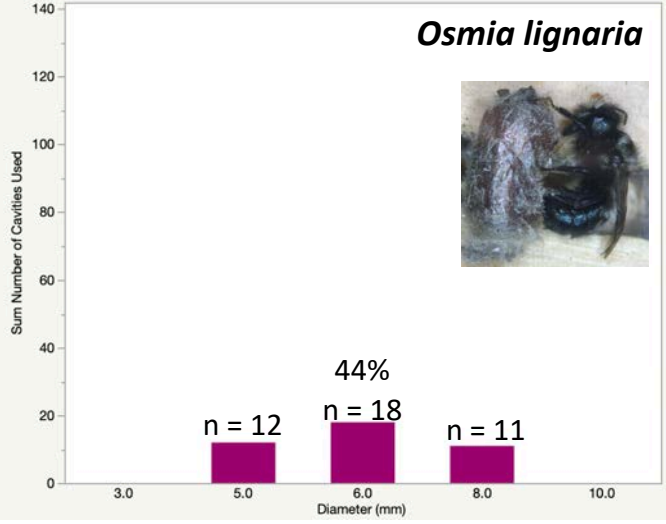
Hoplitis albifrons

Photos from USGS Bee Inventory and Monitoring Lab Flickr

Question 2 results: What cavity diameters were used?







Recommendation: Provide a range of cavity diameter sizes, with a greater percent of small sizes

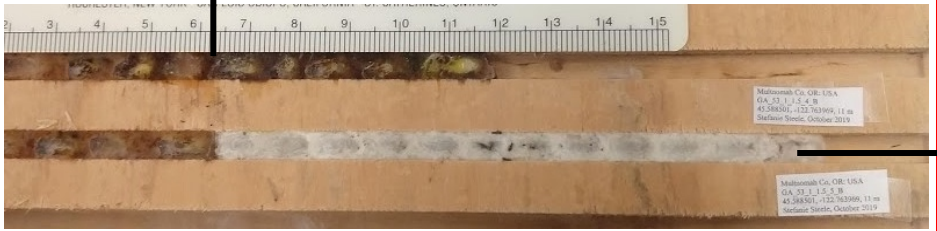
3.0 mm Cavities

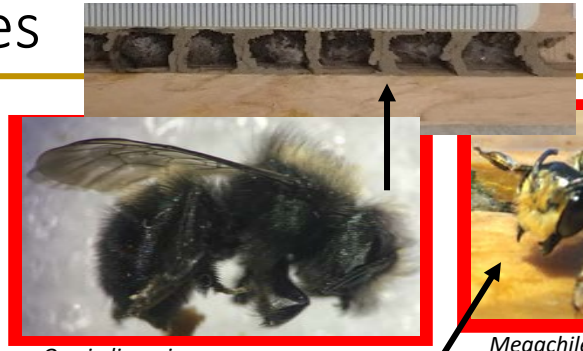
5.0 mm Cavities

Hylaeus coloradensis

Megachile angelarum

Heriades carinata





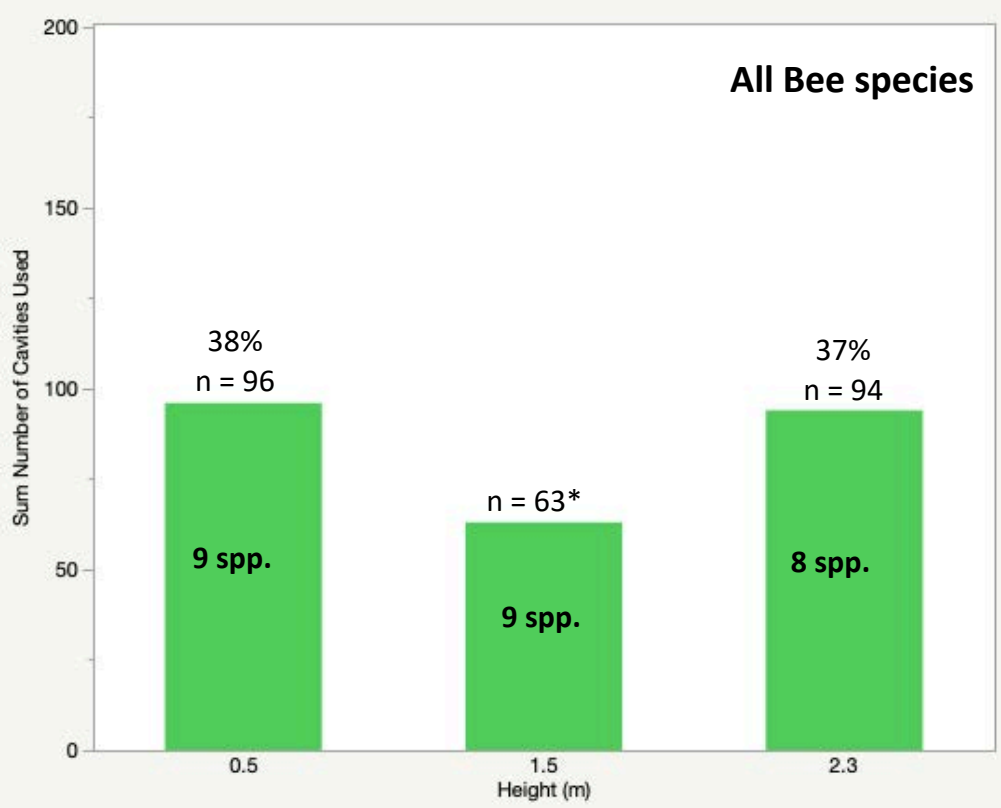
Osmia lignaria

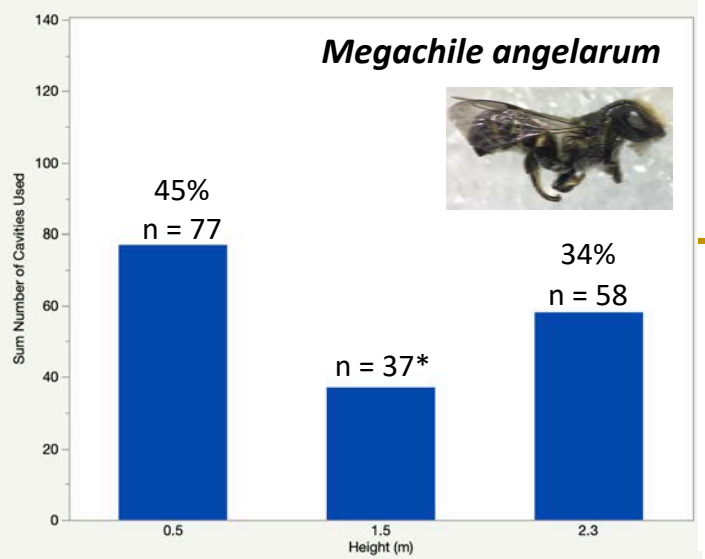
Megachile fidelis

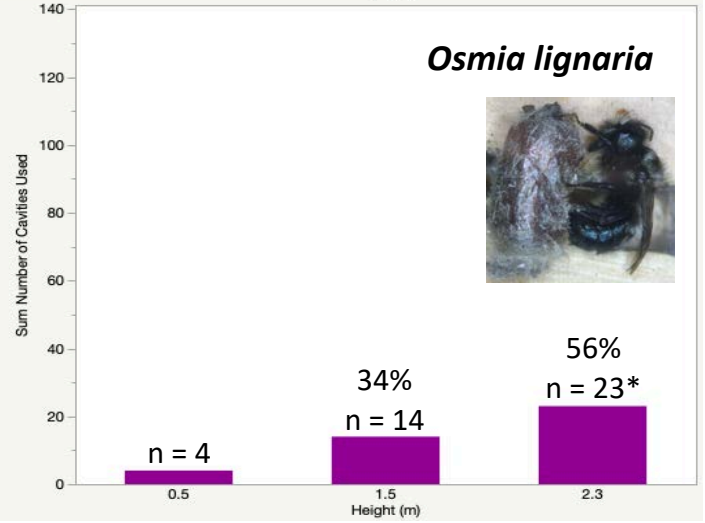
Hoplitis albifrons

Pseudoanthidium nanum

Question 3 results: What nest heights were used?







Solitary wasps are also cavity nesters:
~ 12 species in 4 families **built** nests

- Beneficial insects
- Prey on garden pests

Pemphredoninae sp.

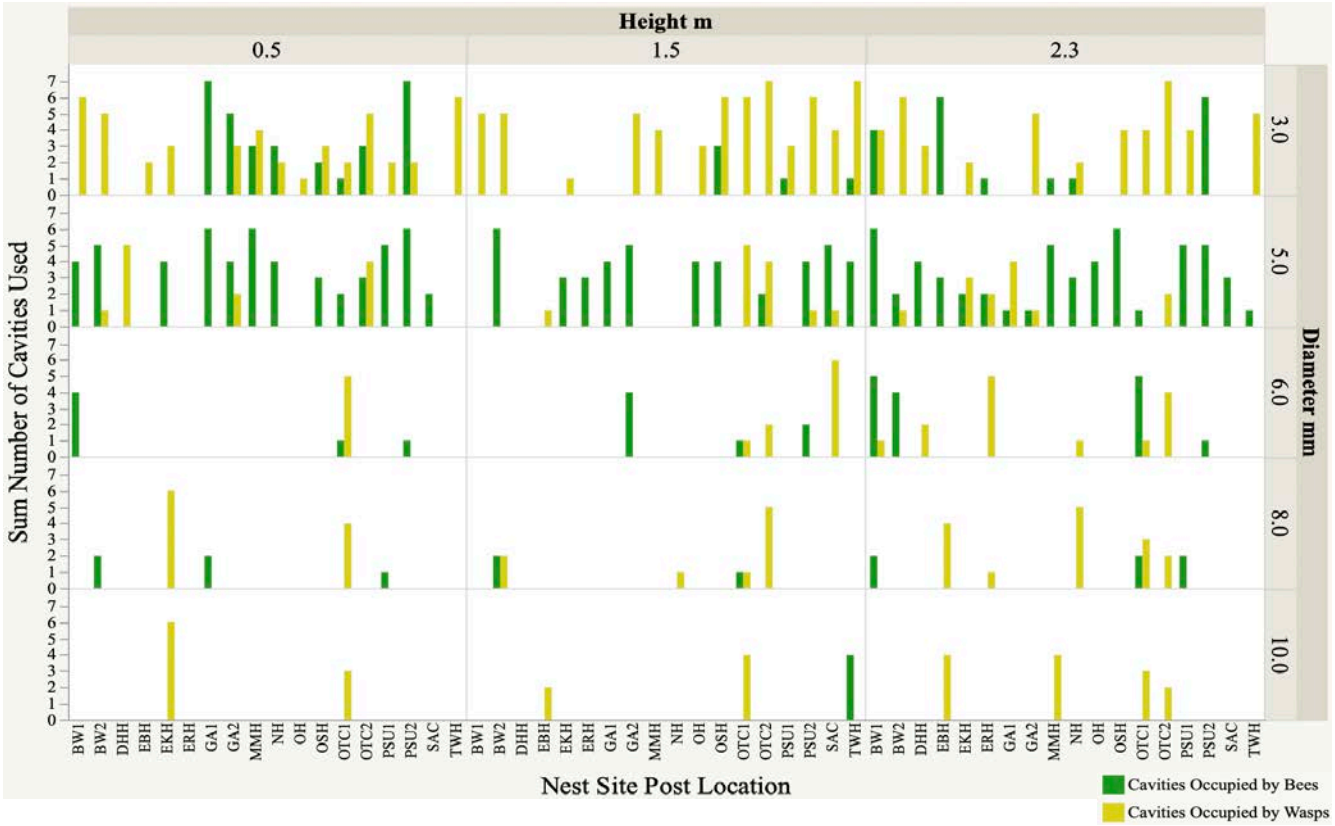
Trypoxylini sp.

T. Trypargilum sp.

Isodontia elegans

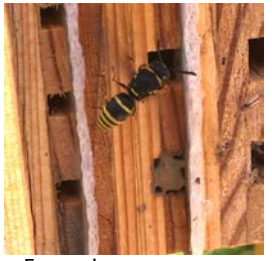
Nest Use by Bees and Wasps

3 Heights Used



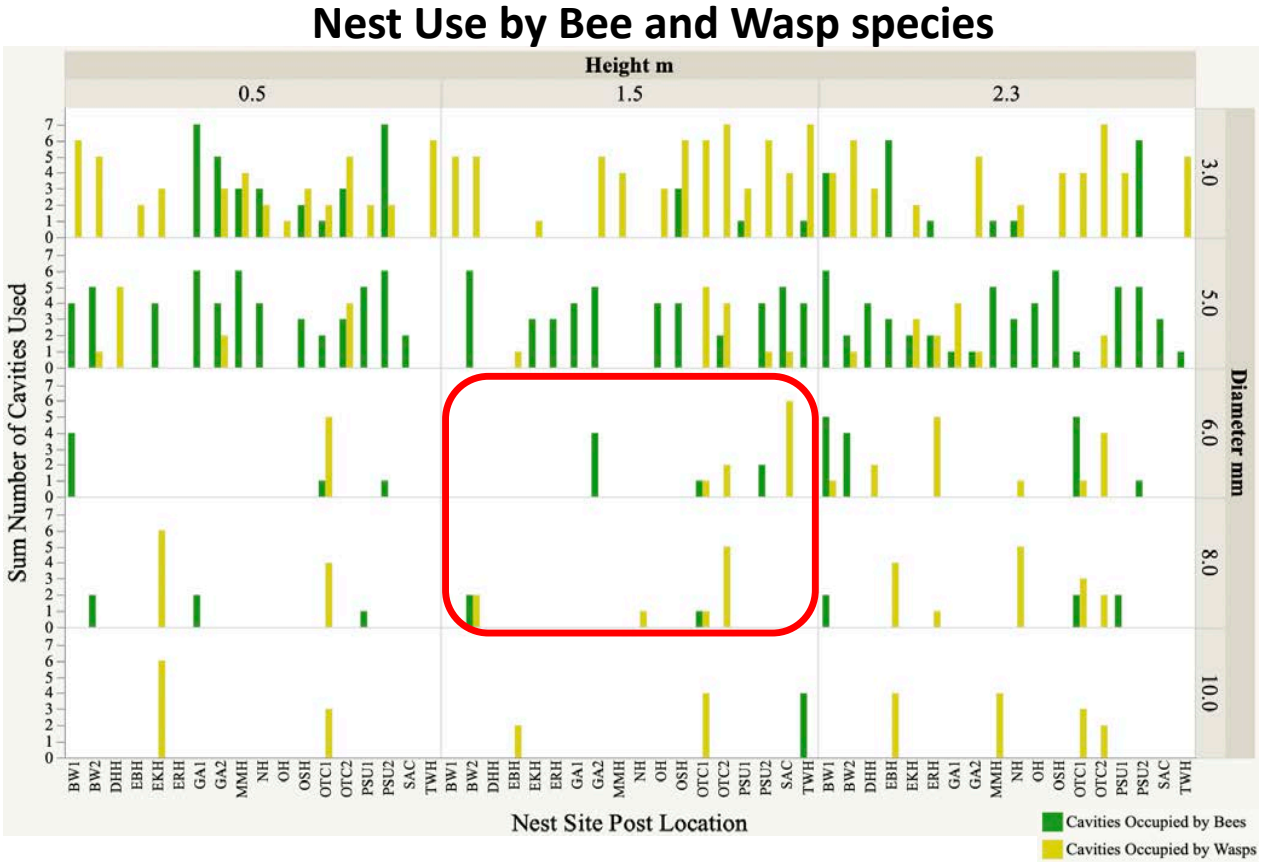
Megachile angelarum

5 diameters present, BUT the smallest diameters primarily used



Eumeninae wasp

Recommendation: Provide cavities in different diameters and heights



Common recommendation:

- Nest height: 1.5 m
- Cavity diameter: 6 & 8 mm

Yielded **low** occupancy!

Conclusions

- Urban areas: manage properties to provide more inclusive habitat.
- Bees of Portland: there is still more to be learned on our cavity nesting bees.
- Cavity diameter is most important: smaller diameter sizes accommodate a greater diversity of bees!

From left photos: (Geoff/CobraHead, 2013 – stump with drilled holes); (MacIvor,2016 – different nest block styles)

Acknowledgements

Thank you to the members of the Masta Lab for your continued support, my family and friends who helped build the nest blocks, the volunteers that provided a space to install my nests and for their time spent monitoring. The Oregon Bee Atlas and Green Anchors for providing nest blocks, and to those who funded this research: PSU Forbes-Lea Research Fund and Oregon Zoo Future for Wildlife Pacific Northwest Fund.