

# Introduction

## Bees support all forms of life because:

- "One of every three bites of food eaten worldwide depends on pollinators"<sup>1</sup>
- Bees pollinate over 90 different types of plants, providing 80% of agricultural pollination<sup>2</sup>
- Bees contribute over 15 billion dollars to the US economy<sup>3</sup>



### Problem

- 2014-2015 bee population declined by over 42%<sup>2</sup>
- Since the 1980's, hives of honeybees have decreased<sup>2</sup>
- Stressors include larvae-eating mites, diseases, habitat loss, and pesticide exposure \*(specifically neonicotinoids)<sup>2</sup>

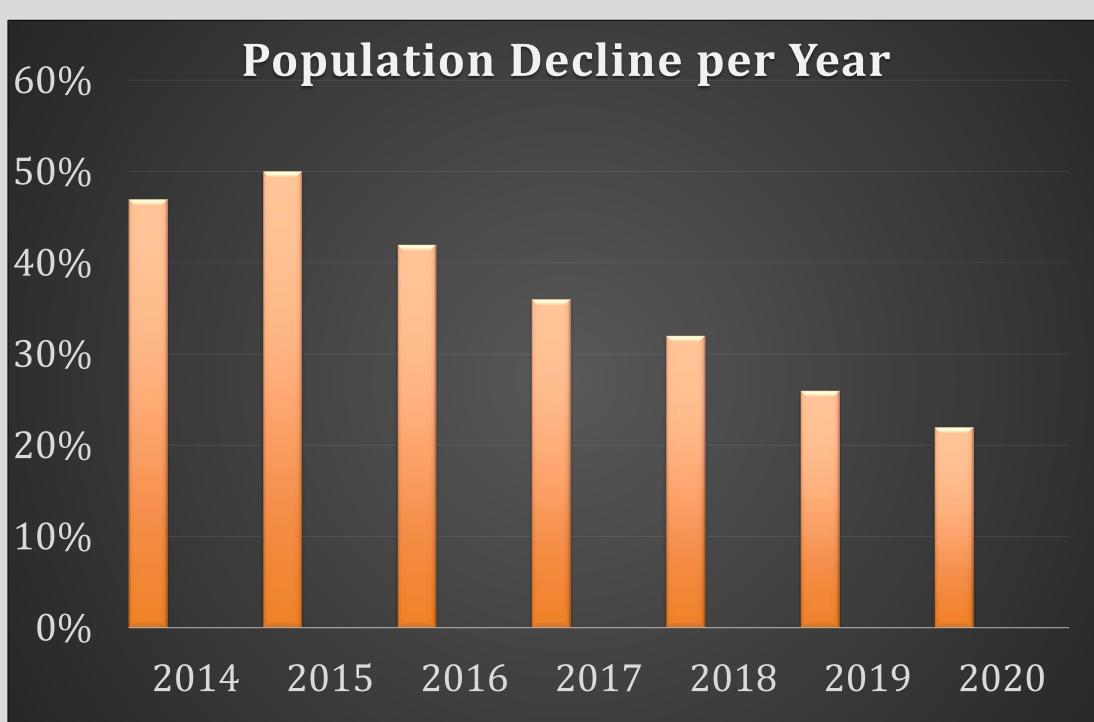


### **To Bee Determined** Dylan Baker-Flynn (M.E.), Dan Duff (C.S.), Mackenzie Karnilaw (C.E.), Brianna Owen (B.M.E.), Brandon Waugh (E.C.E.) Advisors: Professor Jill Rulfs (Biology), Helen Vassallo (Business)

### **Conservation Program**

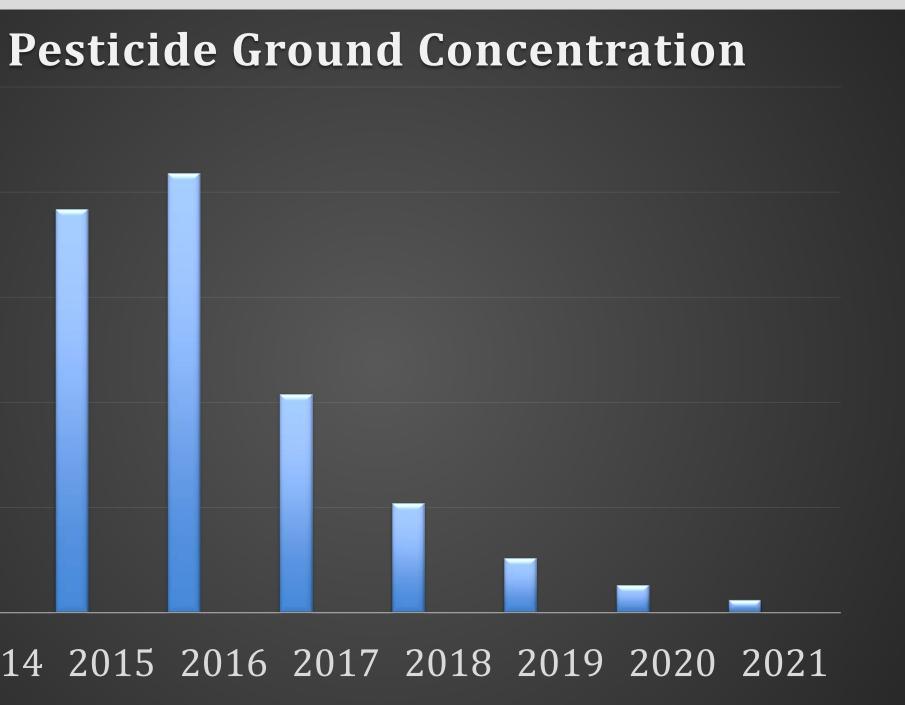
- Focus: Worcester bumblebees
- Environmental Quality Incentive Program
- Banning the pesticide imidacloprid • Surveying of bees and habitats
- Volunteers check hives every 8 months
- Test soil for imidacloprid concentrations
- Survey bees through "no kill" methods<sup>5</sup>
- Handheld bee vacuum
- Netting

25% 20% 15% 10% 5% 2014 2015 2016 2017 2018 2019 2020 2021





### **Expected Results**



- cities.
- additional neonicotinoids

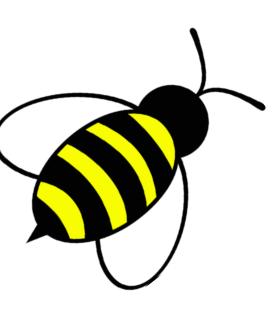
**Other current initiatives** Xerces Society and the Bumblebee Conservation Trust preserve bee population by<sup>4</sup>:

- Creating bee friendly gardens
- Introducing bee friendly crops
- Raising awareness
- Rewarding financial stipends

Acknowledgements Special thanks to Robert J. Gegear for his help in answering our questions and helping us narrow our goals.

1: Yale, Grossman, Elizabeth. (2013, April 13). Declining bee populations pose a threat to global agriculture. Yale. Retrieved from <a href="http://e360.yale.edu/feature/declining\_bee\_populations\_pose\_a\_threat\_to\_global\_agriculture/2645/">http://e360.yale.edu/feature/declining\_bee\_populations\_pose\_a\_threat\_to\_global\_agriculture/2645/</a> 2: Accessscience, AccessScience Editors. (2015). Die-off of bees. In AccessScience. McGraw-Hill Education. http://dx.doi.org/10.1036/1097-8542.BR0526151 3: White House, Office of the Press Secretary. (2014, June 20). Fact sheet: The economic challenge posed by declining pollinator populations. White House. Retrieved from https://www.whitehouse.gov/the-press-office/2014/06/20/fact-<u>sheet-economic-challenge-posed-declining-pollinator-populations</u>
4: Mader, E., Shepherd, M., Vaughan, M., & Black, S. (2011). *Attracting Native Pollinators*. North Adams, MA: Storey Publishing

Bees and Manage a Collection. Retrieved from http://www.pwrc.usgs.gov/nativebees/Handy%20Bee%20Manual/The%20Very%20Handy%20Manual%20-%202015.pdf 6. Scheidegger, C. (2009, September 7). Bumblebee [Digital image]. Licensed under Creative Commons CC BY-SA. Flickr. https://www.flickr.com/photos/cscheid/3898282173/in/photolist-6WtHtB-kAtfEq-kAtnt5-kAqquH-kAqUKP-kAqRuFkAr3JV-kAt4hA-kAqgsV-kAqm6k-stWUf-nSkHia-odeCQf-aSxy3D-iRoDG-aSxxxK-aSxx36-6TmukK-8ktcuW-cagbRC-4RZ9kE a7RESH-7PVacw-3Yn53V-HqjqU-8hdQ4H-6DFsri-4BpY9S-4nC2oa-qAVT2o-7xnNqZ-2j3hCG-odeCVW-cw1V3s-23RaYZ-oUPXNif76mjx-wS488-4jqTKw-kk3Xhh-53MVsW-ookWGg-7gx9V1-66AtT8-aChocV-asjex8-e7Yyur-oWpokA-6zhK8v-qk1kYS/ 7. Bauer Scott. (2003, March 12). [digital image] Retrieved from: https://commons.wikimedia.org/wiki/File:Apis\_mellifera\_scutellata\_1322051.jpg 8. U.S. Department of Agriculture. (2009, February 20). [digital image] Retrieved from: https://www.flickr.com/photos/usdagov/14211811813



### Expansion

 Success in Worcester could mean the expansion of the program across adjacent

Potential to broaden the ban across





### References

5: Dave and Janice Green, Gene Scarpulla, Liz Sellers, and Tracy Zarrillo (September 2015). How to Catch and Identify