



# Pollinators & Invasive Plants

## Good or Bad?

A Focus on Chinese Tallow

Dr. Anthony P. Abbate

[apa0011@auburn.edu](mailto:apa0011@auburn.edu)

# What Are Invasive Plants?

- Species introduced outside their native range (Aizen et al. 2008)
- Displace native flora by monopolizing resources (Aizen et al. 2008)
- Disrupt community structure and ecosystem functions (Aizen et al. 2008)

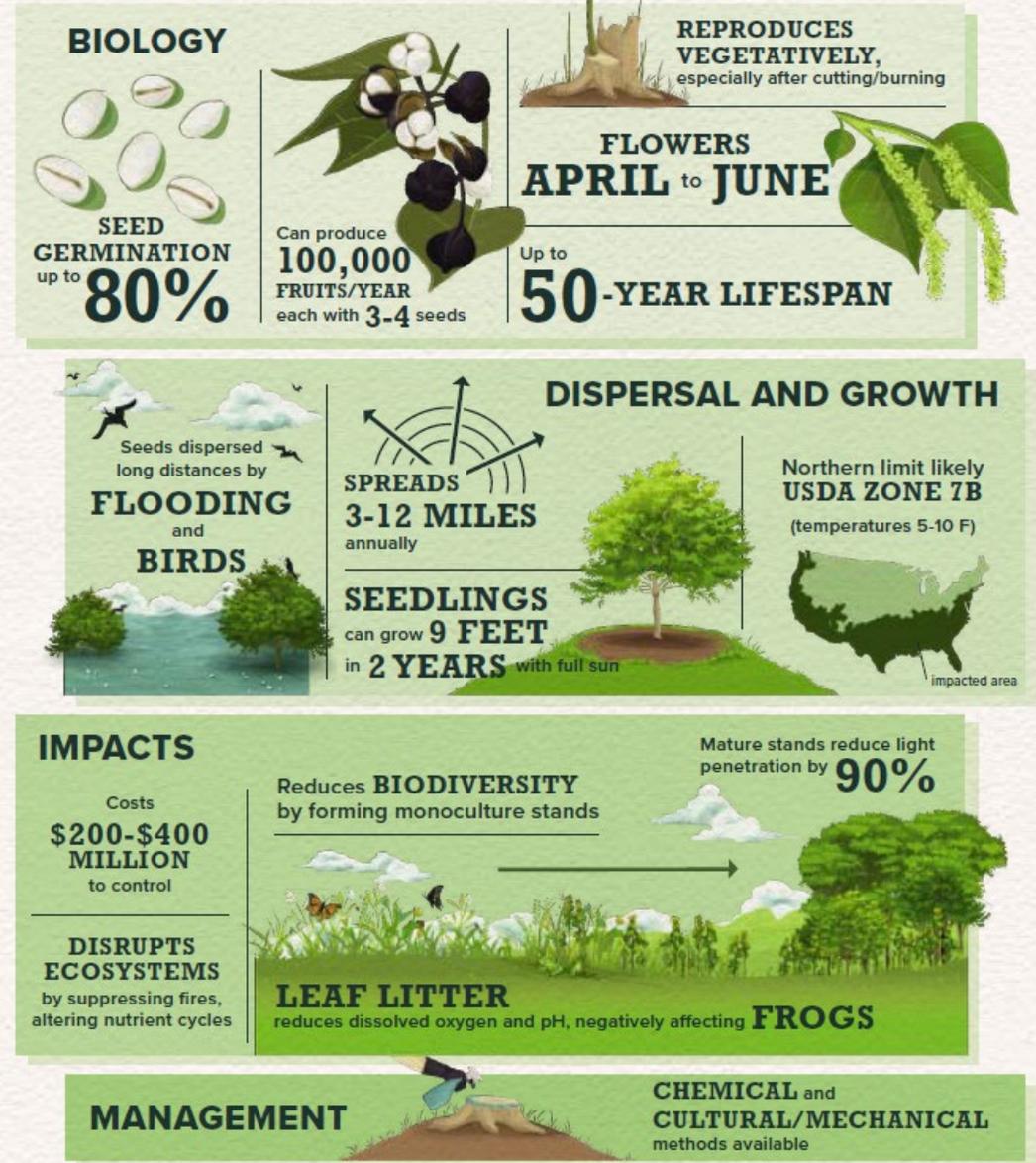


# What Makes Invasive Plants So Successful?

- High reproductive output and long-lived soil seed banks (Bataineh et al. 2024)
- Few to no natural enemies
- Rapid growth and early reproductive maturity (Bataineh et al. 2024)
- Phenotypic plasticity (Bataineh et al. 2024)
- Ability to exploit disturbed habitats (Bataineh et al. 2024)



## CHINESE TALLOW in numbers



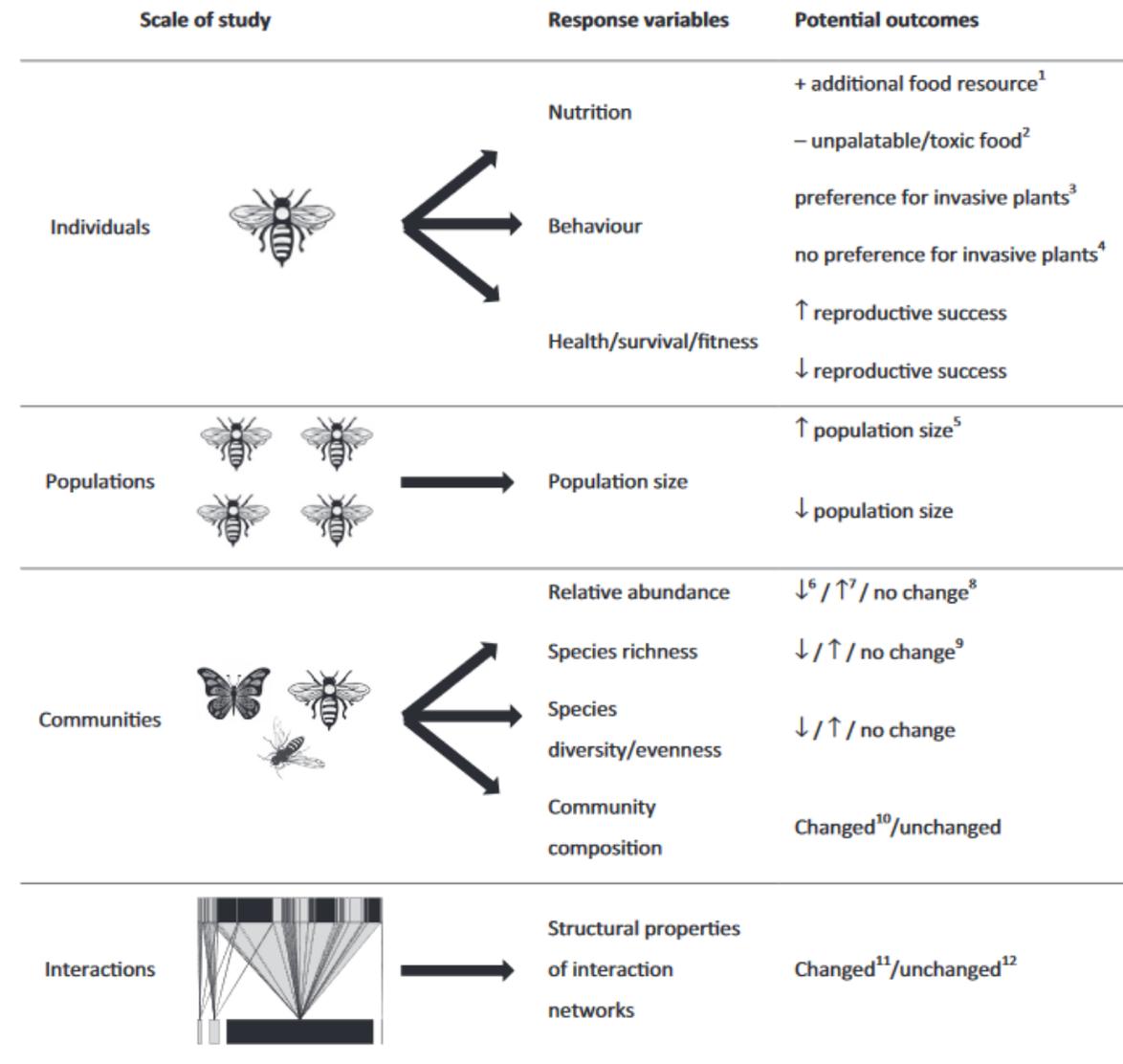
# What Makes Invasive Plants Attractive to Pollinators?

- Produce abundant nectar with high sugar concentrations compared to natives (Clark & Howard 2019)
- Extended flowering periods provide continuous resources (Clark & Howard 2019)
- Mass floral displays concentrate foraging activity (Goodell & Parker 2017)



# Impacts on Insect Pollinators

- Can affect...
  - Individuals
  - Populations
  - Communities
  - Structural properties of networks



**Fig. 2.** Studies on impacts of invasive plants on native pollinators have encompassed a range of scales and response variables. Potential outcomes and examples are given in the right hand column. <sup>1</sup>Chittka & Schurkens (2001), Olesen, Eskildsen & Venkatasamy (2002), Nienhuis, Dietzsch & Stout (2009); <sup>2</sup>Graves & Shapiro (2003), Tiedeken & Stout (2015); <sup>3</sup>Russo, Nichol & Shea (2015); <sup>4</sup>Williams *et al.* (2011); <sup>5</sup>Dietzsch (2009); <sup>6</sup>Valtonen, Jantunen & Saarinen (2006), Moroi *et al.* (2009), Hanula & Horn (2011a), Fenesi *et al.* (2015); <sup>7</sup>Shapiro (2002), Tepedino, Bradley & Griswold (2008); <sup>8</sup>Nienhuis, Dietzsch & Stout (2009), Fenesi *et al.* (2015); <sup>9</sup>Bartomeus, Bosch & Vila (2008a), Bartomeus, Vilà & Steffan-Dewenter (2010); <sup>10</sup>Novotny *et al.* (2003), Ernst & Cappuccino (2005), Hanula & Horn (2011b), Elleris, Pedersen & Toft (2015); <sup>11</sup>Kaiser-Bunbury *et al.* (2011), Albrecht *et al.* (2014); <sup>12</sup>Padrón *et al.* (2009), Vilà *et al.* (2009), Tiedeken & Stout (2015).

# How Invasive Plants Alter Pollinator Behavior

- Reduced handling time on high-reward exotic flowers (Stewart et al. 2021)
- Sensory biases to invasive visual/olfactory cues override native preferences (Stewart et al. 2021)



## Examples in the Southeastern United States

- Chinese Tallow (*Triadica sebifera*)
- Chinese Privet (*Ligustrum sinense*)
- Callery Pear (*Pyrus calleryana*)
- Autumn Olive (*Elaeagnus umbellata*)
- And many others



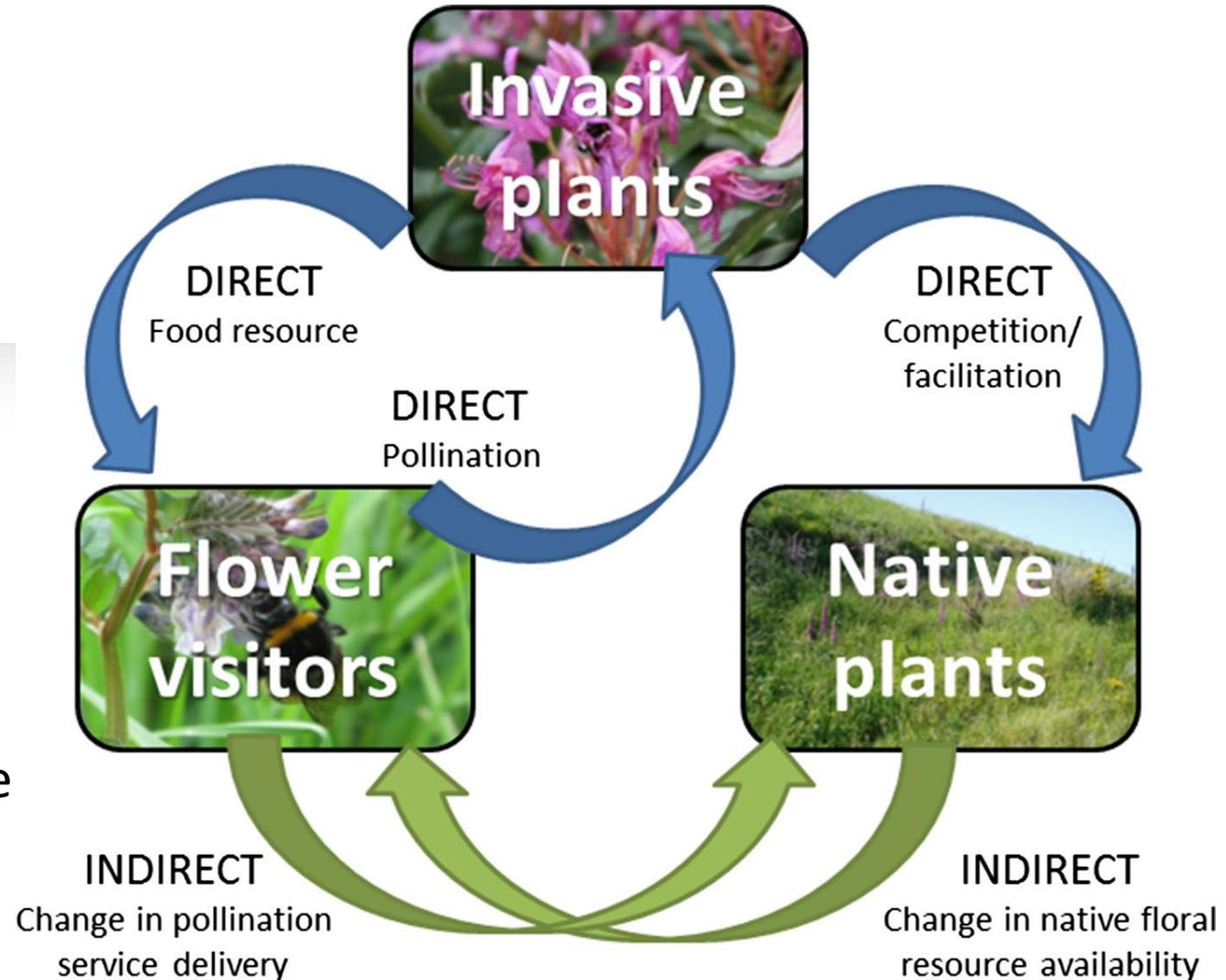
# Positive Aspects of Invasive Plants

- Support high-yield honey production in early spring
- Provide floral resources in anthropogenically disturbed areas where floral resources for pollinators are already scarce.



# Negative Aspects of Invasive Plants

- Invasives interact with native floral visitors directly (blue arrows) or indirectly (green arrows)
- Create dense canopies that shade out understory plants
- Compete with natives and change native floral resource availability



*Stout and Tiedeken 2016. Functional Ecology*

# Case Study: Chinese Tallow

- Chinese tallow tree native to Asia<sup>1</sup>
- First introduced to USA in 1776 by Ben Franklin

*"I send also a few seeds of the Chinese Tallow Tree, which will I believe grow & thrive with you. 'Tis a most useful plant" – Ben Franklin*

- Spread into coastal forests
- Rapid expansions in the last ~3 decades
- Invasive in USA

# Introduction

## Alabama fears this invasive plant so much we attacked it from the air

Updated: May. 18, 2019, 12:20 p.m. | Published: Jul. 31, 2017, 6:32 p.m.

By [Dennis Pillion](#) | [dpillion@al.com](mailto:dpillion@al.com)

**16** WAPT

## Mississippi trying to stop spread of invasive 'popcorn tree'

The Mississippi Forestry Commission says it is trying to control the spread of the invasive Chinese tallow tree, also known as the popcorn...

Sep 29, 2018



**AL** COM Alabama ▾

NEWS

## 'Plant out of hell' invading south Alabama, feds weigh using Asian insects to fight back

Published: May. 08, 2022, 7:00 a.m.

**nola** NOLA.com

## Volunteers, armed with machetes, hunt down invasive Chinese tallow trees

... trees such as the Chinese tallow gathered en masse. Nine years after the hurricane these seeds have now grown into large trees and taken...

Aug 29, 2014



# Introduction

- Tolerant of many pressures
- Low rates of herbivory
- 100,000 seeds per tree
  - Dispersal = Water & Birds
- Failed control efforts
  - Herbicides
  - Mechanical
  - Rx burns
- Outcompetes native flora
- Creates dense low diversity stands



## CHINESE TALLOW in numbers

**BIOLOGY**

SEED GERMINATION up to **80%**

Can produce **100,000 FRUITS/YEAR** each with **3-4** seeds

REPRODUCES VEGETATIVELY, especially after cutting/burning

FLOWERS **APRIL to JUNE**

Up to **50-YEAR LIFESPAN**

**DISPERSAL AND GROWTH**

Seeds dispersed long distances by **FLOODING and BIRDS**

**SPREADS 3-12 MILES** annually

**SEEDLINGS** can grow **9 FEET** in **2 YEARS** with full sun

Northern limit likely **USDA ZONE 7B** (temperatures 5-10 F)

impacted area

**IMPACTS**

Costs **\$200-\$400 MILLION** to control

Reduces **BIODIVERSITY** by forming monoculture stands

Mature stands reduce light penetration by **90%**

**DISRUPTS ECOSYSTEMS** by suppressing fires, altering nutrient cycles

**LEAF LITTER** reduces dissolved oxygen and pH, negatively affecting **FROGS**

**MANAGEMENT**

**CHEMICAL and CULTURAL/MECHANICAL** methods available

<sup>1</sup>Mabberly 1987

# Introduction



## **Absence of invasive plants**

- Pollinators visit native plants and pollinate them

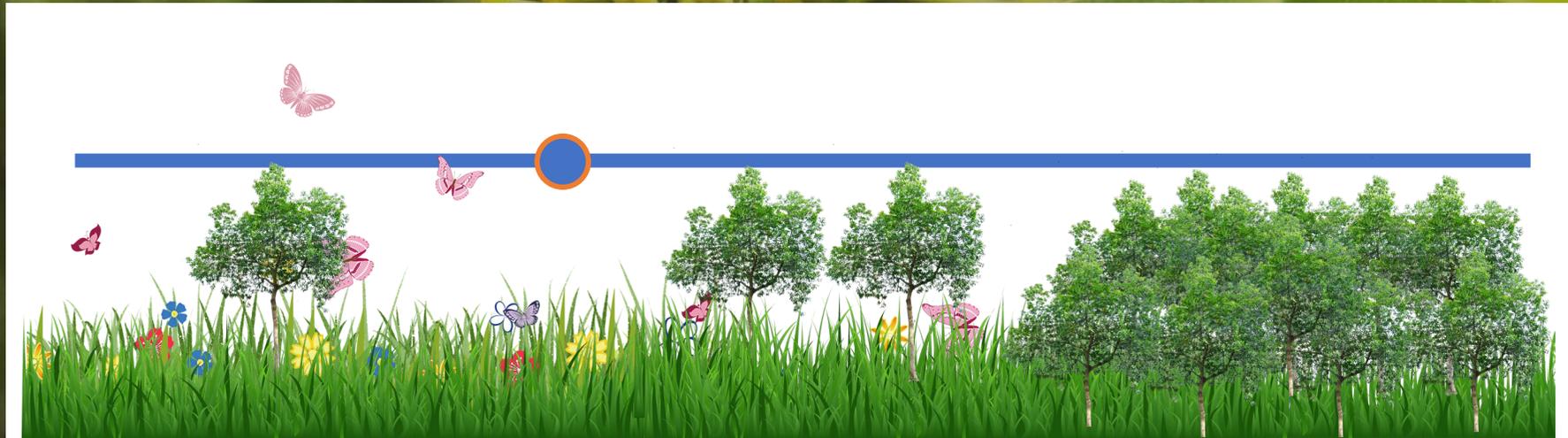
# Introduction



## **Low invasive densities**

- Invasive effects on pollinators may start out as facilitative

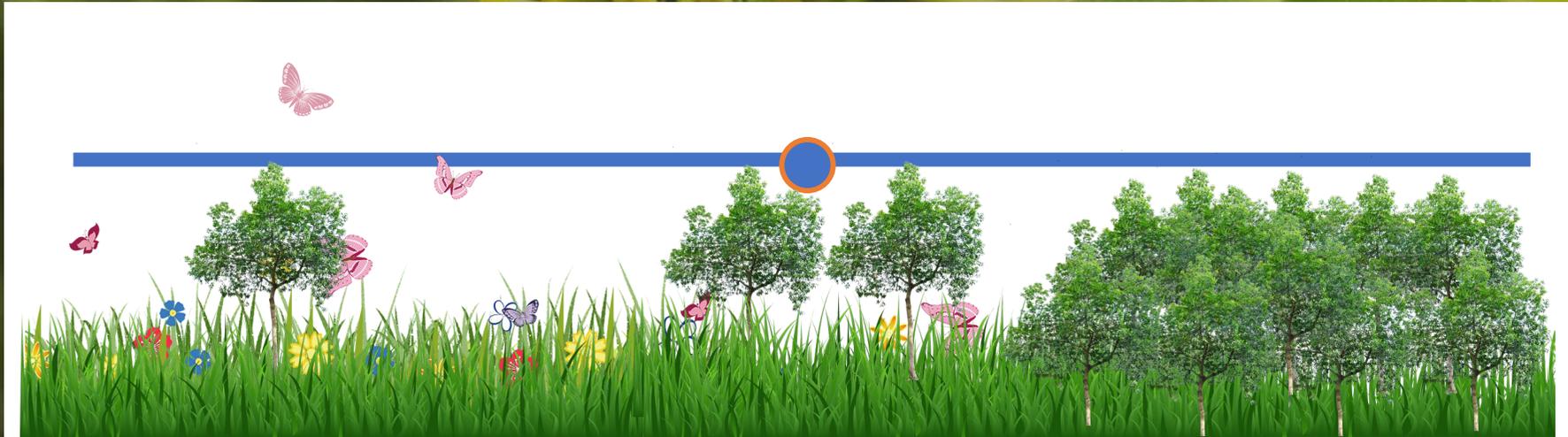
# Introduction



## **Moderate invasive density**

- Pollinator-mediated interactions between natives and invasives may intensify
- Shift from facilitative to competitive
- Invasive acts as “magnet species”

# Introduction



## High invasive density

- Invasives eventually outcompete native flowering plants, and increase in density.
- Leads to a dramatic change in ecosystem composition.
- Specialist pollinators are at high risk if host plant is outcompeted.

# Objectives

## *Problem*

- Poor understanding of what insect pollinators are visiting and likely pollinating / spreading it

## *Objective*

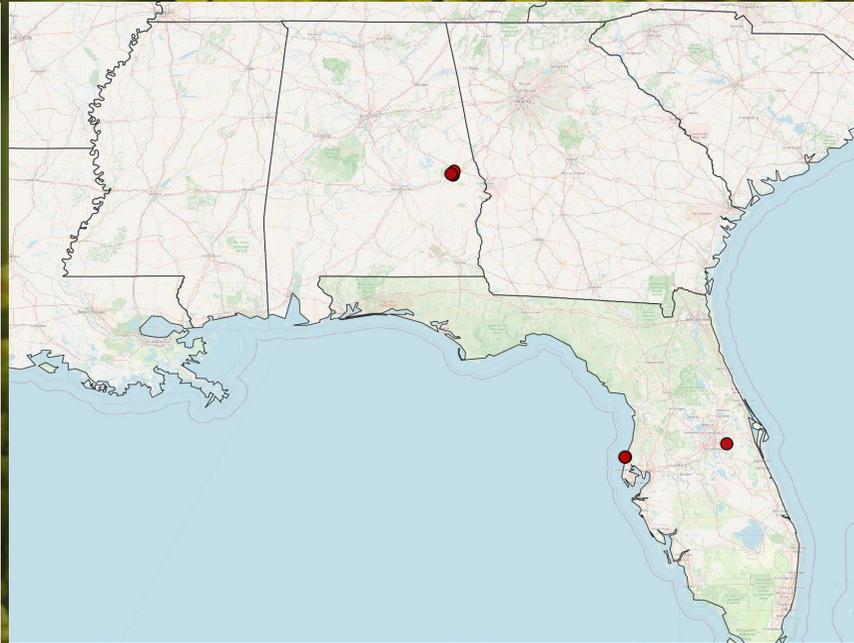
- To evaluate the abundance and diversity of insect visitors of Chinese tallow tree in the southeastern United States

# Methods

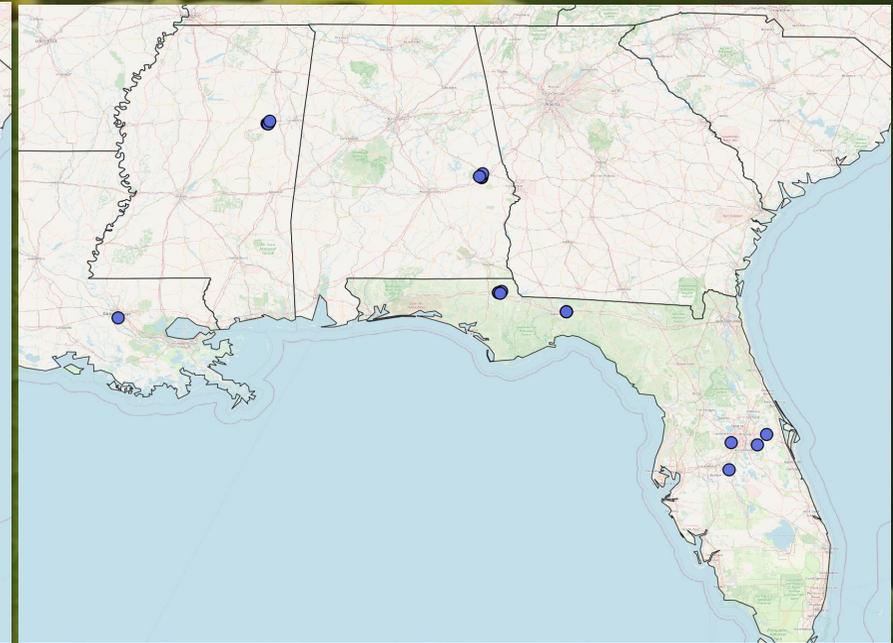
## *Site Selection*

- 2021
  - AL – 4 sites
  - FL – 3 sites
- 2022
  - AL – 4 sites
  - FL – 10 sites
  - LA – 2 sites
  - MS – 4 sites
- 100 total trees

2021



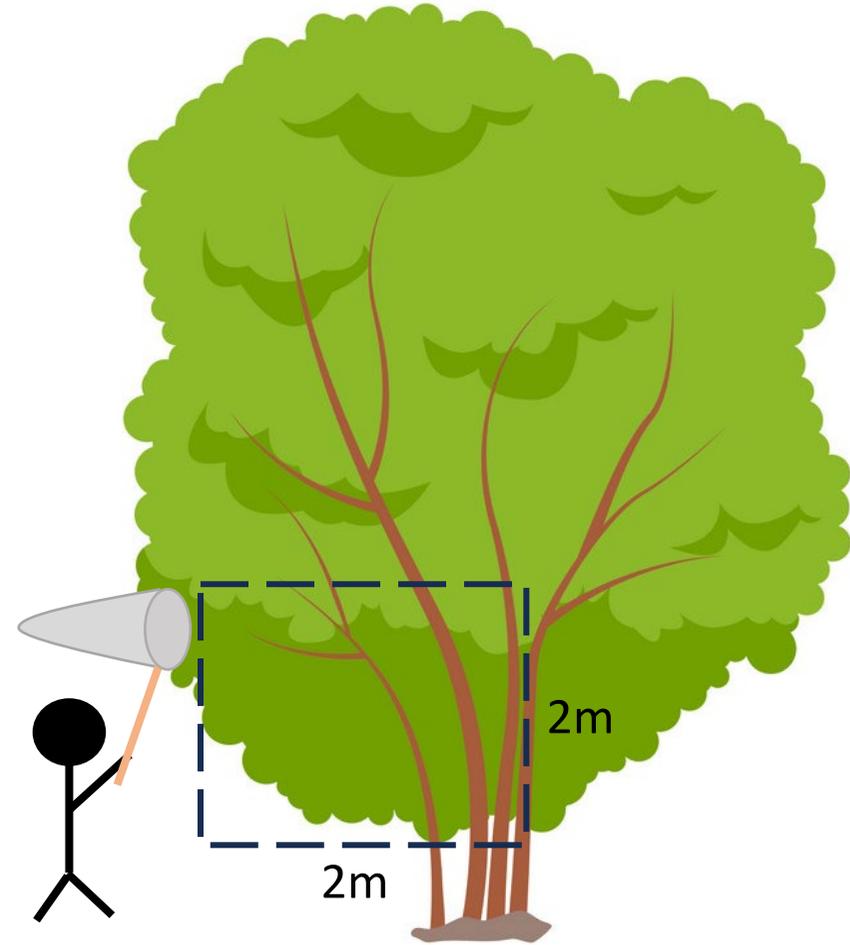
2022



# Methods

## *Insect Collecting*

- 2021
  - 4 May – 1 July
- 2022
  - 11 May – 22 June
- Protocols
  - $\geq 2$  sites per state
  - $\geq 3$  trees / site
  - Targeted sweep netting
    - Morning, midday, afternoon
    - Daily, during favorable conditions

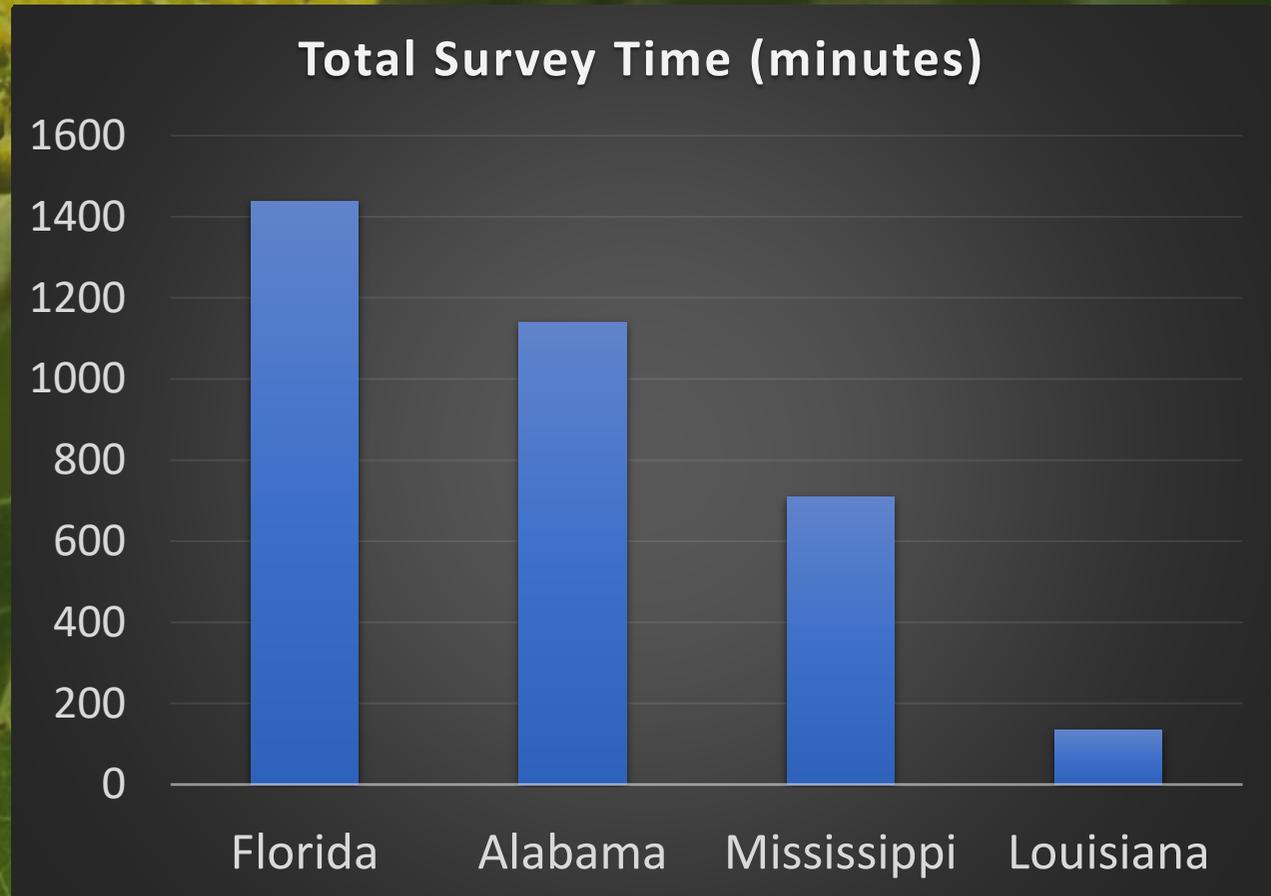


C: Adobe Stock

# Results

## *Sweep-netting*

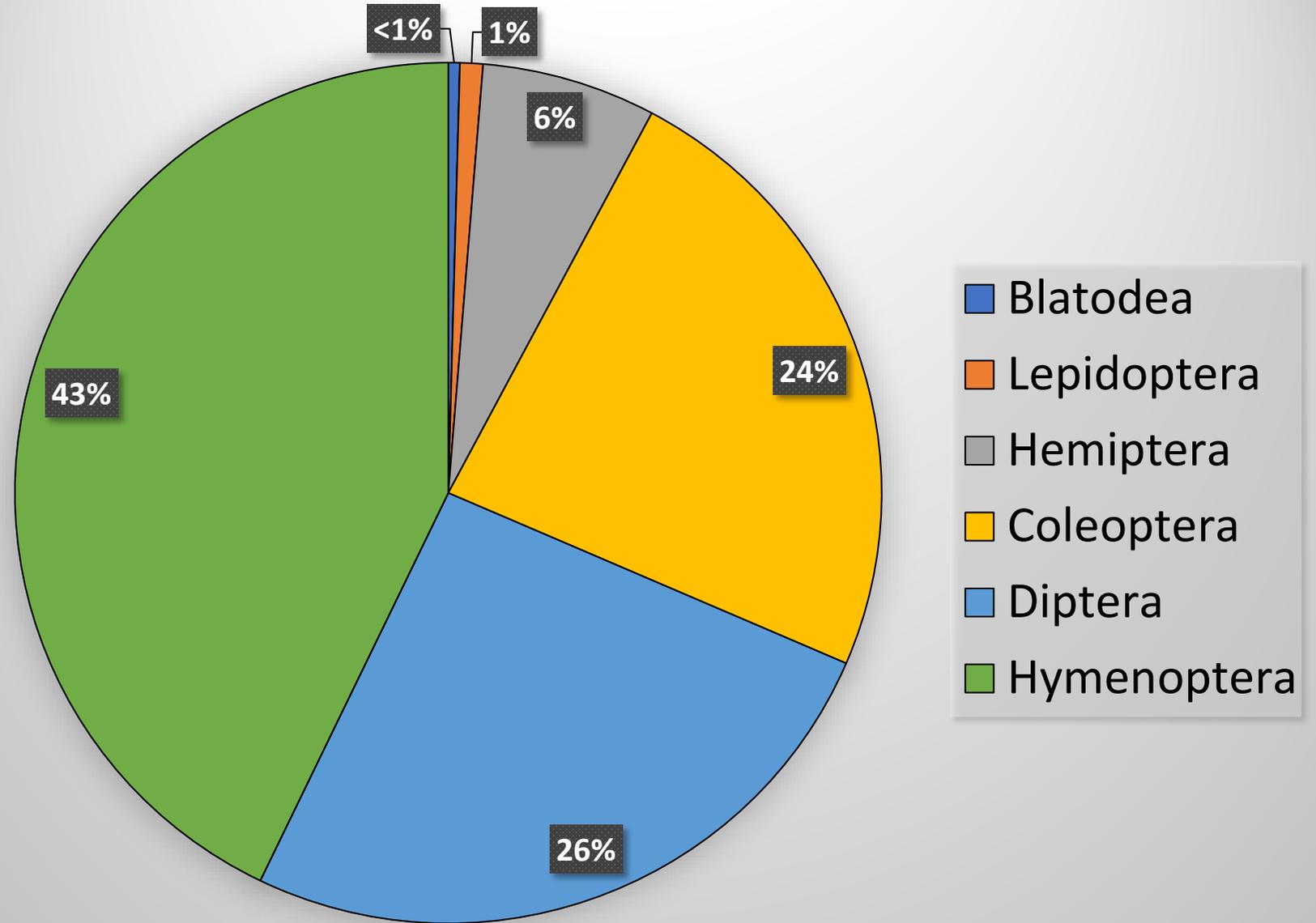
- Total
  - 3425 sweep-netting minutes
- 2021
  - 1090 sweep-netting minutes
- 2022
  - 2335 sweep-netting minutes



# Results

*Total Insects*

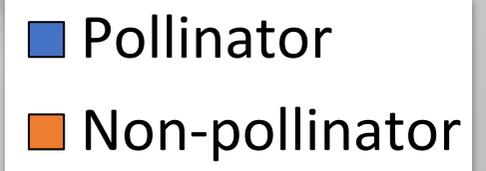
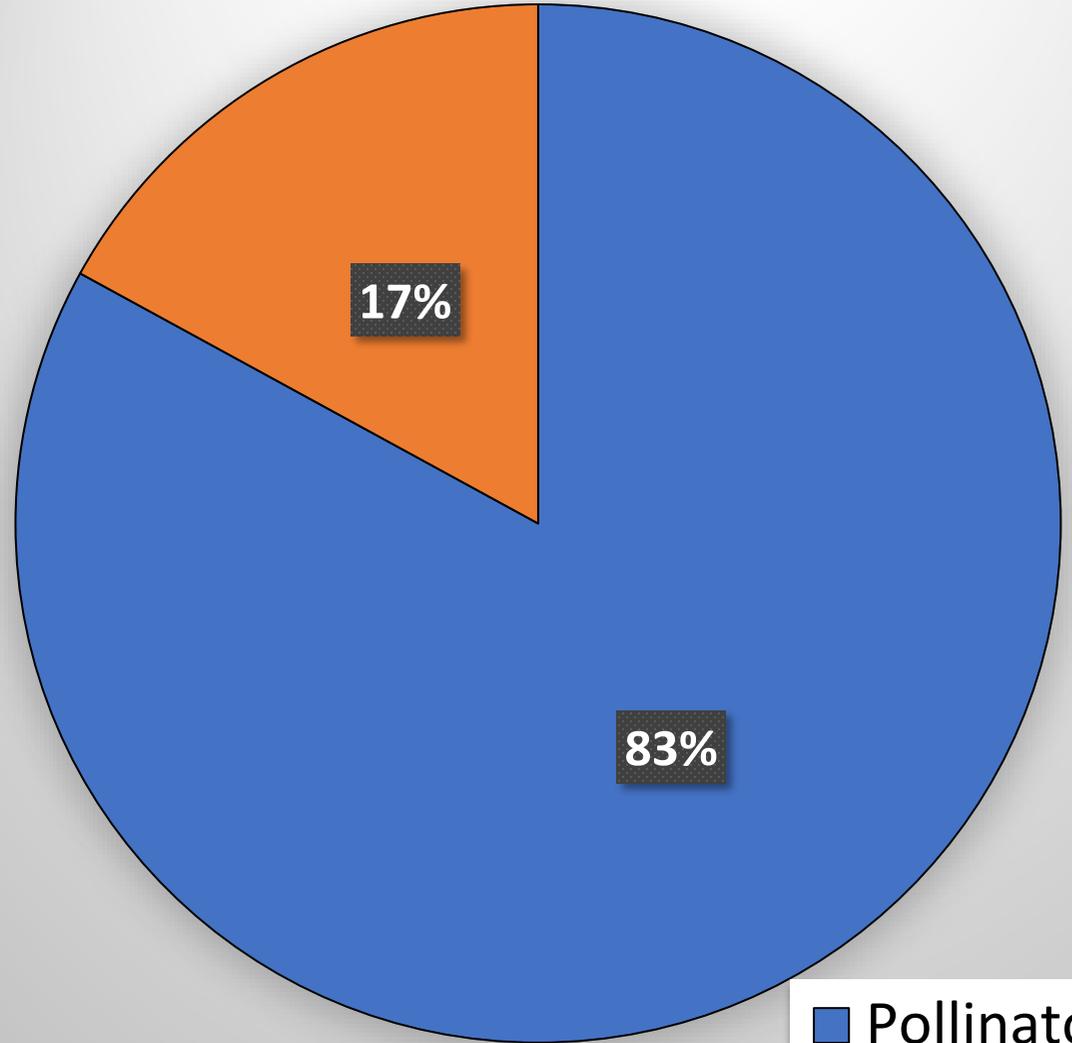
- 1168 insects
- 6 orders



# Results

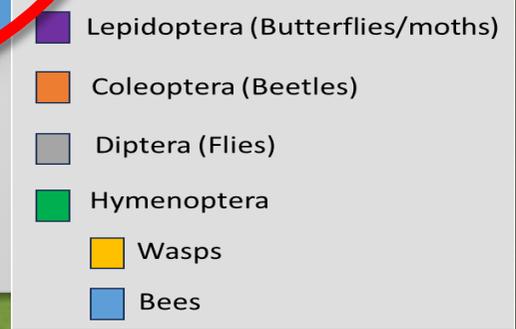
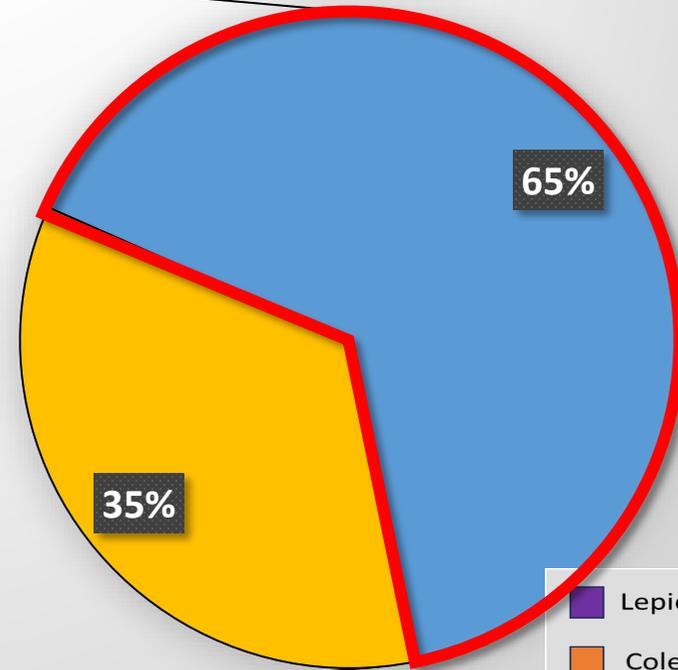
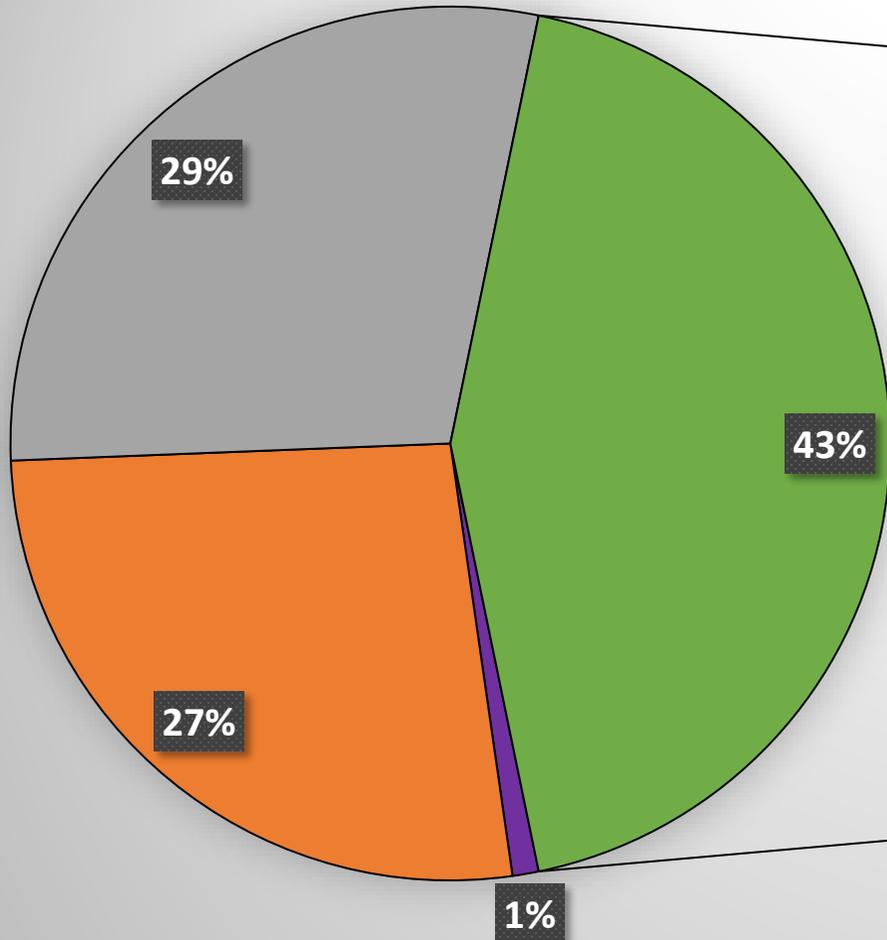
*Pollinators vs. non-pollinators*

- Pollinators = 965
  - 4 orders; 33 families; 128 taxa
- Non-pollinators = 203
  - 5 orders; 22 families; 17 taxa



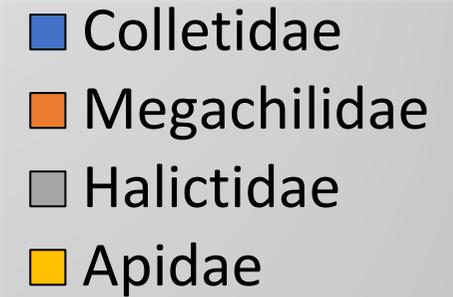
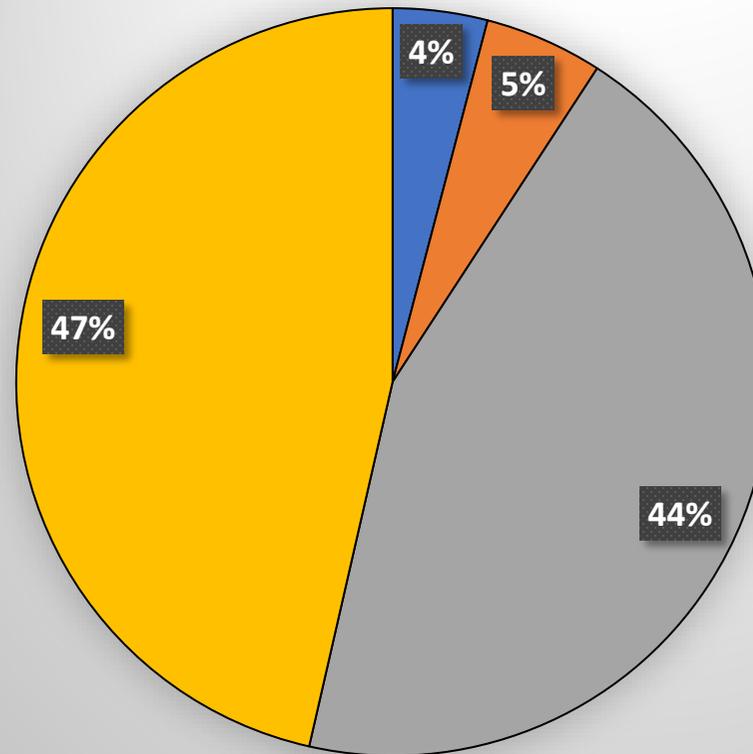
# Results

## Pollinator Orders



# Results

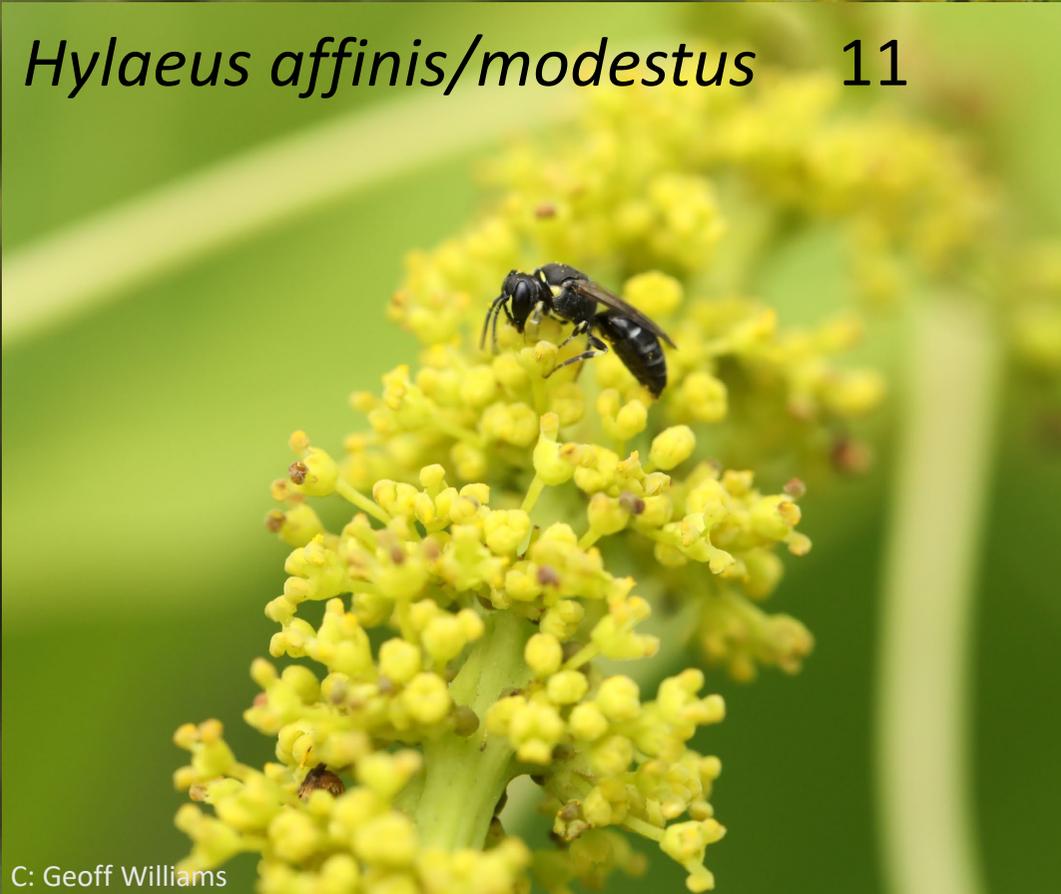
- Colletidae
  - 12 individuals
  - 2 species
- Megachilidae
  - 15 individuals
  - 7 species
- Halictidae
  - 131 individuals
  - 15 species
- Apidae
  - 137 individuals
  - 8 species



# Results

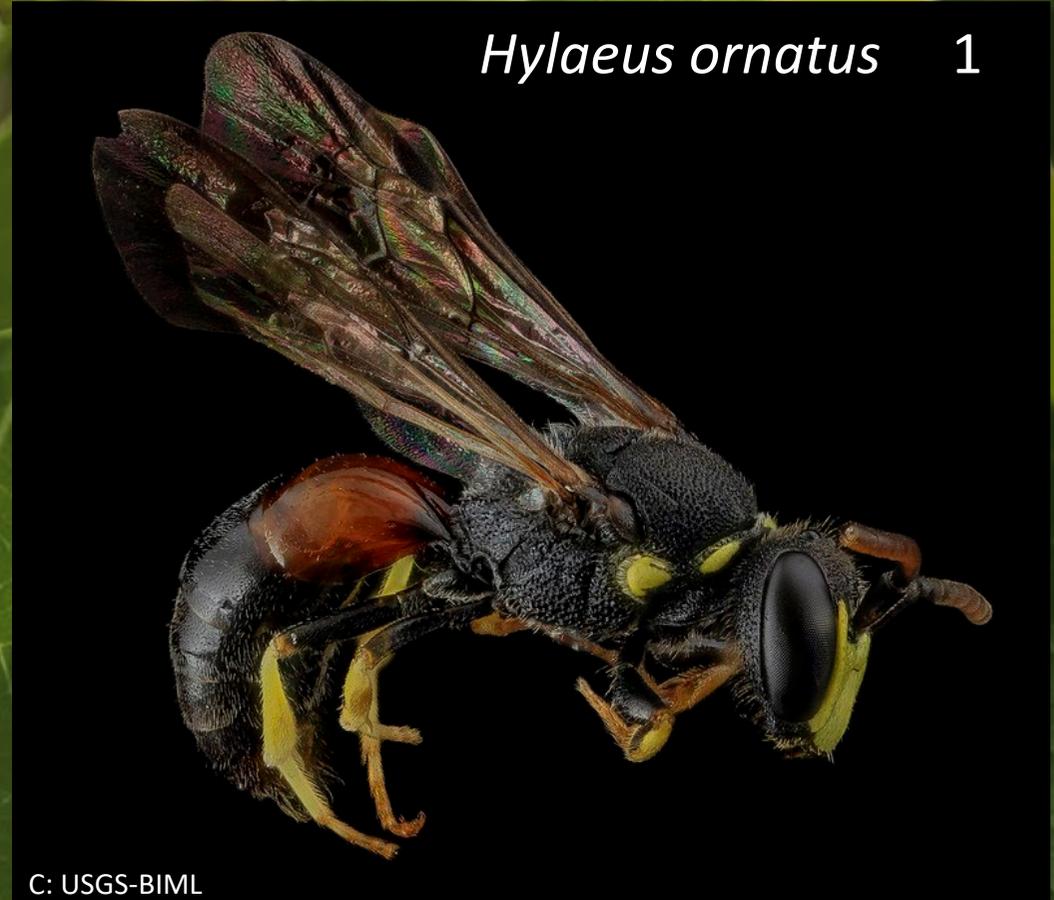
*Colletidae*

*Hylaeus affinis/modestus* 11



C: Geoff Williams

*Hylaeus ornatus* 1



C: USGS-BIML

# Results

*Megachilidae*

<i>Megachile mendica</i>	7
<i>Megachile sculpturalis</i>	2
<i>Megachile xylocopoides</i> *	2
<i>Coelioxys sayi</i>	1
<i>Megachile rotundata</i>	1
<i>Megachile texana</i>	1
<i>Megachile campanule</i>	1

\* Pollen specialist on Asteraceae



C: USGS-BIML



C: USGS-BIML

# Results - Halictidae

<i>Lasioglossum imitaum</i>	33
<i>Augochloroa pura</i>	23
<i>Lasioglossum callidum</i>	21
<i>Lasioglossum sp.</i>	18
<i>Agapostemon splendens</i>	6
<i>Halictus rubicundus</i>	6
<i>Augochlorella aurata</i>	4
<i>Halictus poeyi/ligatus</i>	4
<i>Lasioglossum mitchelli</i>	4
<i>Lasioglossum reticulatum</i>	3
<i>Augochlorella gratiosa</i>	2
<i>Augochloropsis metallica</i>	2
<i>Lasioglossum pilosum</i>	2
<i>Lasioglossum zephyrum</i>	2
<i>Lasioglossum tegulare</i>	1



# Results

*Apidae*

<i>Bombus impatiens</i>	81
<i>Xylocopa virginica</i>	23
<i>Bombus griseocollis</i>	14
<i>Bombus bimaculatus</i>	8
<i>Bombus fraternus</i>	5
<i>Xylocopa micans</i>	3
<i>Ceratina strenua</i>	2
<i>Bombus pensylvanicus</i>	1



C: Geoff Williams



# Conclusions

- Tallow attracts a high abundance and diversity of generalist pollinators
- Native pollinators likely contribute to Tallow's pollination success and spread
- Tallow is likely pulling native pollinators away from native flowering plants

For most invasives, including Chinese Tallow, the cons outweigh the pros.

# Conclusions

- Tallow attracts a high abundance and diversity of generalist pollinators
- Native pollinators likely contribute to Tallow's pollination success and seed production
- Tallow is likely displacing native pollinators away from native flowering plants

For most invasives, including Chinese tallow, the cons outweigh the pros.



Thank you!

