

# ***Pollinator Response to NRCS Pollinator Practices***

**CEAP Wildlife Component – Charlie Rewa**

**NRCS-Xerces partnership – Kelly Gill**

**NRCS Alabama perspective – Jeff Thurmond**

**Pollinator response study – Anthony Abbate**

**Q&A**



*Photo Credit: Geoff Williams (Auburn University)*



**NRCS Outcomes Webinar – July 22, 2021**

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**USDA**

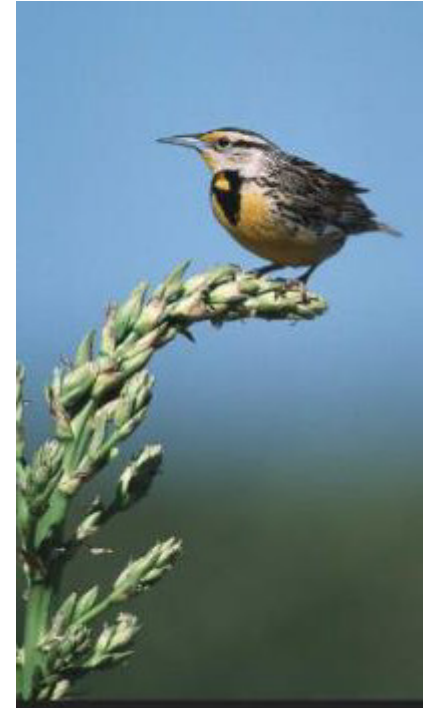
United States Department of Agriculture

Natural Resources  
Conservation Service

# Conservation Effects Assessment Project (CEAP)

## Wildlife Component

- Document F&W outcomes and inform delivery
- Collaborates across NRCS to identify assessment priorities
- Relies on cooperative partnerships with fish and wildlife science community
- NRCS and CEAP Wildlife growing emphasis on pollinator outcomes





# Science-Based Pollinator Conservation and Habitat Enhancement

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The Xerces Society for Invertebrate Conservation  
& Partner Biologist,  
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Photo: Kelly Gill



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# The Xerces Society for Invertebrate Conservation

Protecting wildlife through the conservation of invertebrates and their habitats



Xerces blue butterfly (*Glaucopsyche xerces*), the first U.S. butterfly to go extinct due to human activities

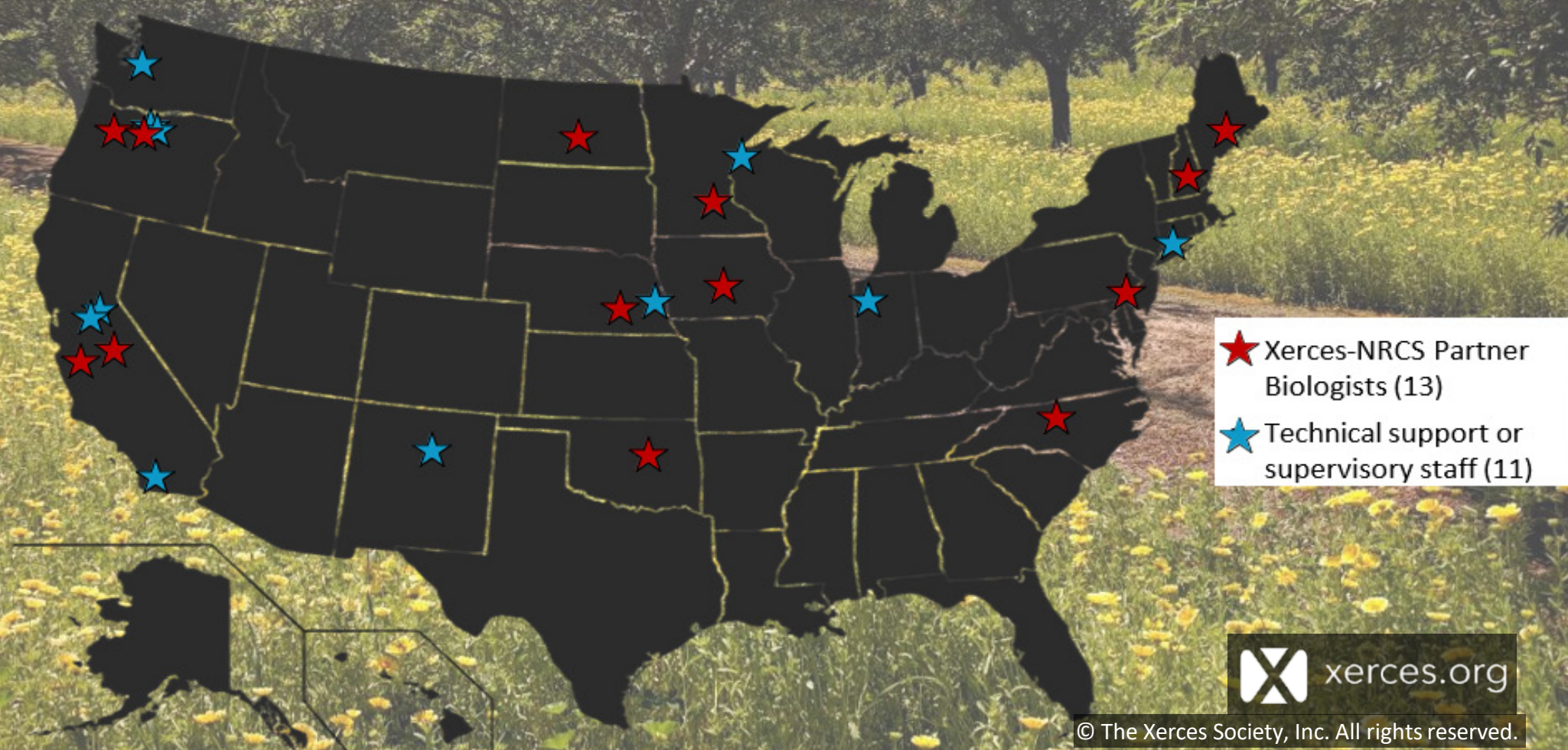


Photos: 2018 Xerces staff by Matthew Shepherd/Xerces Society. Blue butterfly by Dana Ross.

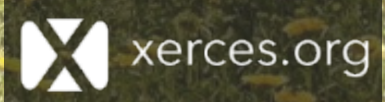
**Main Office:** Portland, Oregon  
**Regional Offices:** California, Connecticut, Indiana, Iowa, Maine, Minnesota, Nebraska, New Hampshire, New Jersey, New Mexico, North Carolina, North Dakota, Oklahoma, Washington

# The Xerces Society

## Pollinator and Ag Biodiversity Conservation Team



★ Xerces-NRCS Partner Biologists (13)  
★ Technical support or supervisory staff (11)



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# On The Ground Conservation

Pollinators • Conservation Biocontrol • Agricultural Biodiversity • Endangered Species • Aquatic Invertebrates  
Pesticide Protection • Urban Conservation • Bee Better Certified • Bee City/Campus USA • Community Science



Photos: The Xerces Society / Sarah Foltz Jordan, Kelly Gill, Adam Varenhorst, Celeste Mazzacano, Sara Morris, Jessa Kay Cruz, Nancy Lee Adamson

# Xerces' Online Library: Visit [xerces.org](http://xerces.org)

National and region-specific resources to aid in the planning, establishment, restoration, maintenance, and protection of pollinator/beneficial insect habitat. Plant lists, habitat installation guides, monitoring protocols, fact sheets, and more!






U.S. DEPARTMENT OF AGRICULTURE

# Alabama NRCS perspective – Jeff Thurmond, NRCS



United States Department of Agriculture

Natural Resources  
Conservation Service



# CEAP Outcomes- Assessing pollinator habitat in the Southeast U.S.

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**Dr. Anthony Abbate**

Auburn University- Research Entomologist

Department of Entomology & Plant Pathology



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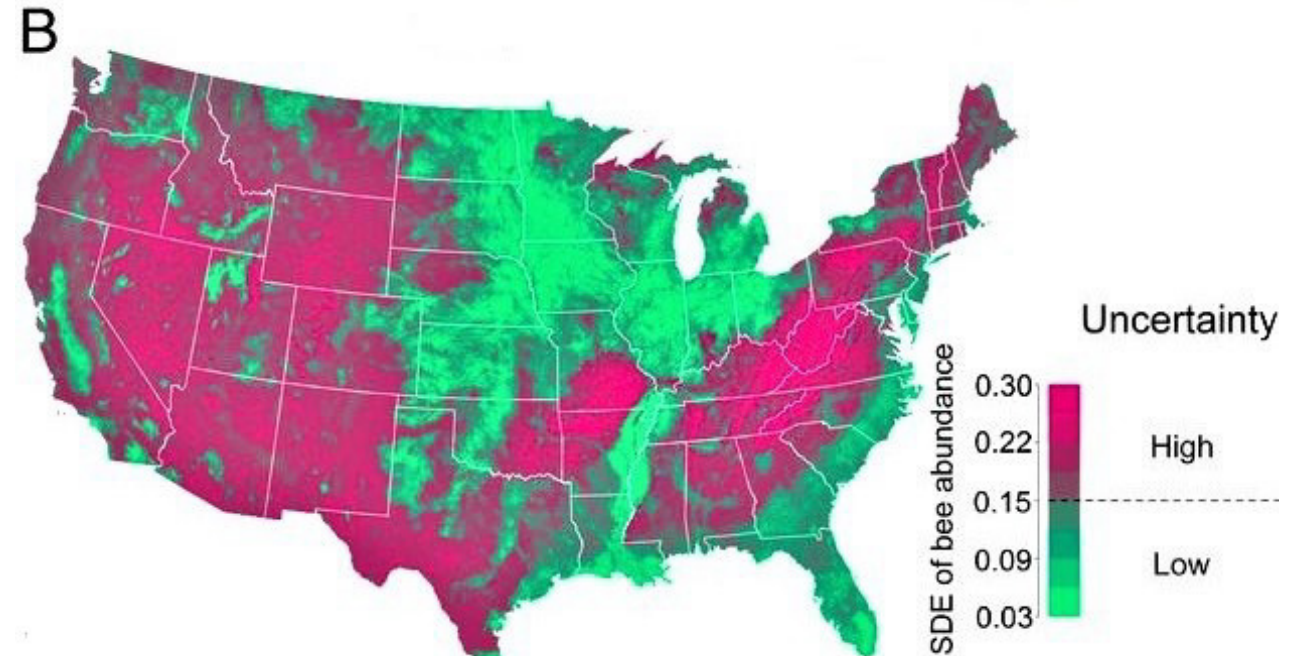
@auburnbees



# Importance of Pollinator Habitat

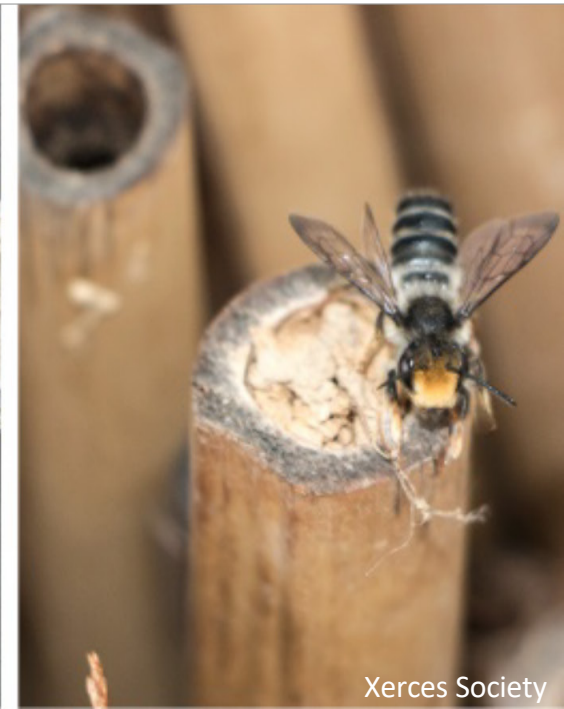
- Bee are important pollinators
  - Pollinate >66% of the world's crop species
- High level of uncertainty of native bee communities
- Declines in bee populations may be due to pesticides, disease, and habitat loss

(Cane and Tepedino 2001, Vanbergen and Initiative 2013, Garbuzov and Ratnieks 2014, Koh et al. 2016)



# Importance of Pollinator Habitat

- Provide floral and nesting resources for pollinators
- Increase pollinator abundance and diversity



# Overview of CEAP Pollinator Study

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- Since 2008, the NRCS and the FSA have promoted pollinators by compensating practices throughout Alabama
- Designed to create suitable habitat for native bees on private lands



# Overview of CEAP Pollinator Study

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## Problem

- Status of plots unknown
  - Which species persist over time?
  - Which native bees are utilizing the plantings?
  - What are the most attractive wildflowers to native bees?





# Research Goals

- **Goal #1** - Investigate the status of pollinator habitat established by the NRCS, FSA, and Farm Bill-supported programs
- **Goal #2** - To determine which native wildflowers are the most attractive to the bees of Alabama and broader southeastern US
- **Long-term Goal**
  - To aid restoration ecologists and **landowners** to determine which wildflower species to include in a seed mixture when seeking to attract and conserve certain pollinators

# Presentation Roadmap



**Goal #1** - Investigate the status of pollinator habitat established by the NRCS, FSA, and Farm Bill-supported programs



# State-Wide Plantings

## *Vegetation Monitoring*

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- To examine vegetative composition
- Summer and fall of 2018 and spring of 2019
- Forty 1 m<sup>2</sup> quadrats per 2.5 acres (Pywell et al. 2014)
  - Scaled for each wildflower plot
  - Quantified bare ground, grass, woody veg, forbs, and wildflowers



# State-Wide Plantings

## *Vegetation Monitoring*

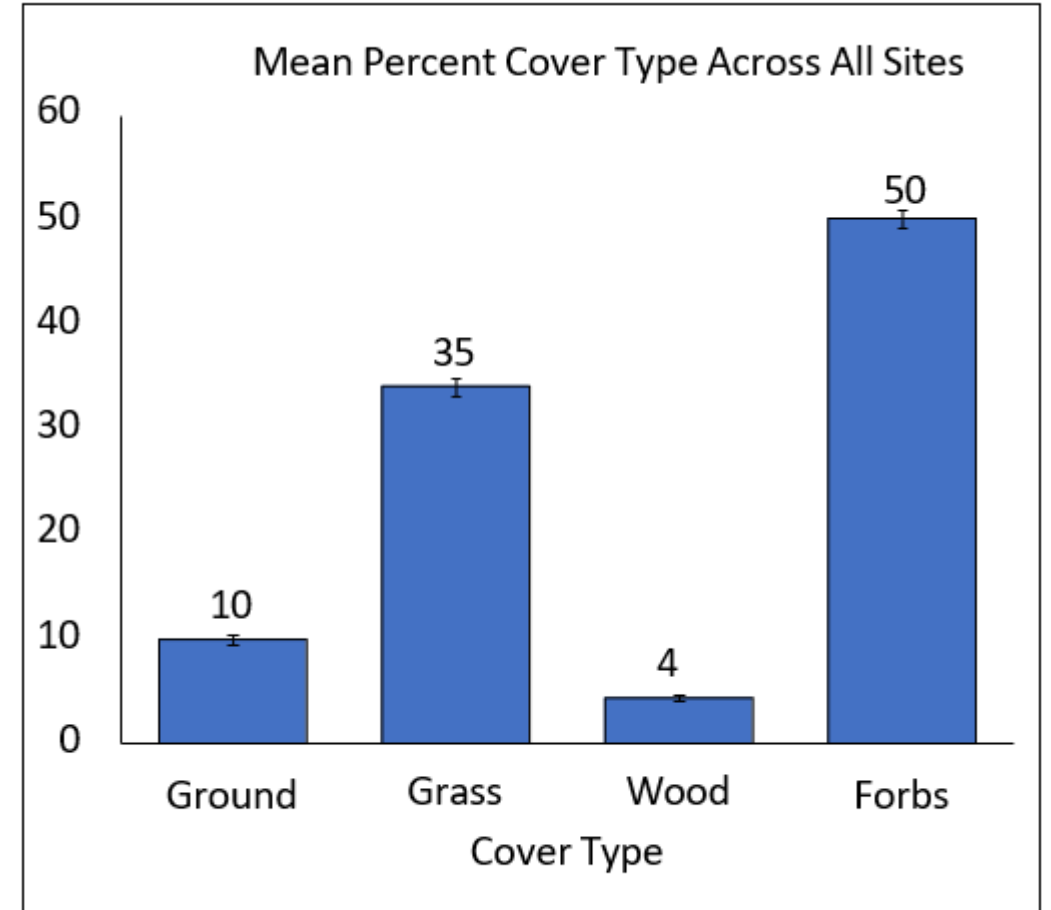
- 59 total species planted by landowners
- 17 observed in bloom across all sites
- \*High rate of success for 13 species (>50% occurrence)

Wildflower Species	Common Name
<i>Asclepias tuberosa</i>	Butterflyweed
<i>Chamaecrista fasciculata</i> *	Partridge Pea
<i>Chamaecrista nictitans</i> *	Sensitive Partridge Pea
<i>Coreopsis tinctoria</i> *	Plains Coreopsis
<i>Coreopsis lanceolata</i> *	Lance-Leaved Coreopsis
<i>Echinacea purpurea</i>	Purple Coneflower
<i>Helianthus angustifolius</i> *	Narrowleaf Sunflower
<i>Liatris</i> sp.	Blazing Star
<i>Monarda citriodora</i> *	Lemon Beebalm
<i>Penstemon digitalis</i> *	Foxglove Beardtongue
<i>Pycnanthemum tenuifolium</i> *	Mountain Mint
<i>Ratibida pinnata</i>	Gray-Head Coneflower
<i>Rudbeckia hirta</i> *	Black-Eyed Susan
<i>Solidago nemoralis</i> *	Gray Goldenrod
<i>Symphyotrichum novae-angliae</i> *	New England Aster
<i>Tephrosia virginiana</i> *	Goat's-Rue
<i>Verbena hastata</i> *	Blue Vervain

# State-Wide Plantings

## *Vegetation Monitoring*

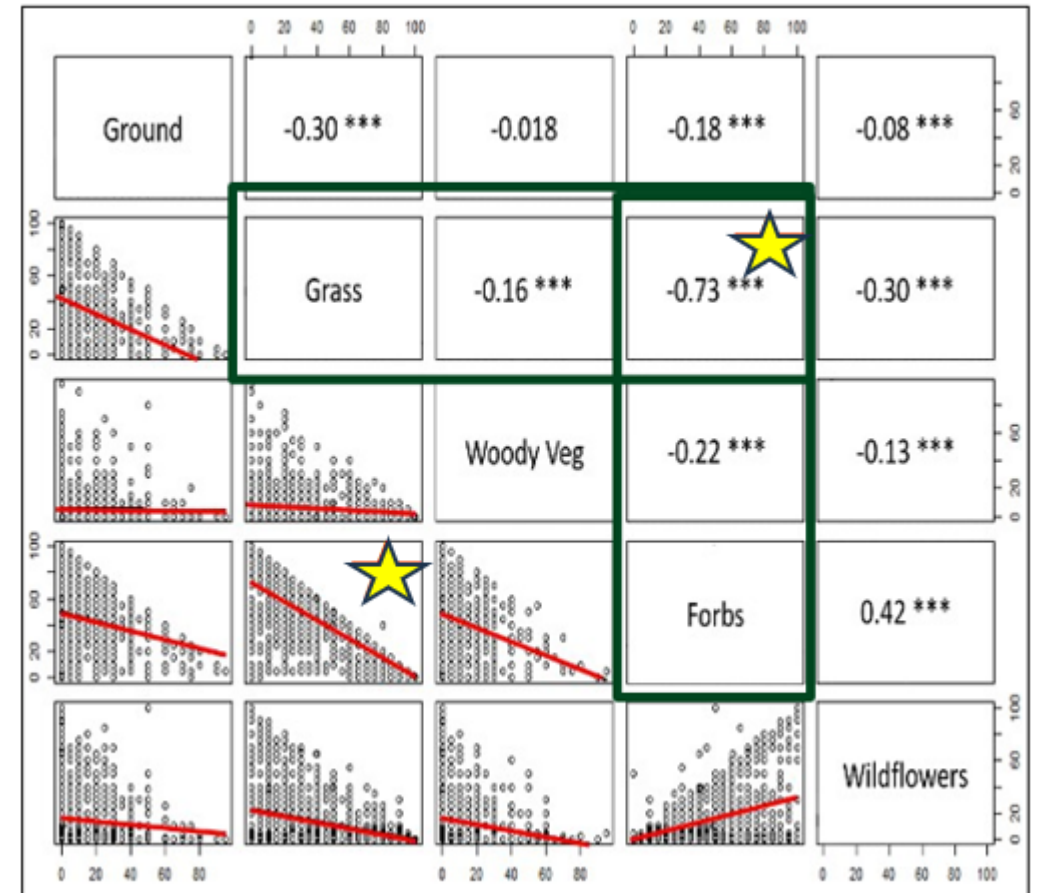
- 59 total species planted by landowners
- 17 observed in bloom across all sites
- \*High rate of success for 13 species (>50% occurrence)
- High mean percentage of forbs across all sites



# State-Wide Plantings

## *Vegetation Monitoring*

- 59 total species planted by landowners
- 17 observed in bloom across all sites
- \*High rate of success for 13 species (>50% occurrence)
- High mean percentage of forbs across all sites
- Grasses strongly influenced the percent coverage of forbs (wildflowers)



# State-Wide Plantings

## *Bee Monitoring*

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- To examine bee communities
- Summer and fall of 2018 and spring of 2019
- Netted bees while walking along a transect (Pywell et al. 2014)
  - 2.5 acres = 20 minutes of netting
  - Bees were netted off wildflowers



# State-Wide Planting

## *Bee Monitoring*

- 589 total bees netted off wildflowers
  - 44 taxa
- Most abundant bee taxa
  - *Bombus impatiens*
  - *Lasioglossum* spp.
  - *Apis mellifera*
  - *Halictus poeyi*



*Bombus impatiens* - The Common Eastern Bumble Bee



*Lasioglossum* spp. - Sweat Bee



*Apis mellifera* - Western Honey Bee




*Halictus poeyi* - Poey's Furrow Bee


# State-Wide Planting

## *Bee Monitoring*


- Which wildflowers attracted the greatest **abundance** of bees?
  - Goldenrod
  - Lance-leaf Coreopsis
  - Verbena
  - Purple Passionflower




Goldenrod



Lance-leaf Coreopsis



Verbena



Passionflower

# State-Wide Planting

## *Bee Monitoring*

- Which wildflowers attracted the greatest **diversity** of bees?
  - Lance-leaf Coreopsis
  - Verbena spp.
  - Goldenrod
  - Black-eyed Susan
  - Narrowleaf Sunflower



Lance-leaf Coreopsis



Verbena



Goldenrod



Black-eyed Susan

# Presentation Roadmap



**Goal #2** - To determine which native wildflowers are the most attractive to the bees of Alabama and broader southeastern US

# Experimental Plantings

## *Hypothesis*

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- Wildflowers vary in floral characteristics such as...
  - Flower size
  - Color
  - Scent
  - Nutritional quality
  - Time of bloom (Garbuzov and Ratnieks 2014)
- Different bee species might have innate floral preferences to these characteristics (Pellmyr 2002, Rowe et al. 2020)
- Preferences could be learned (Gegeer and Thomson 2004)



# Experimental Plantings

## *Plant Selection*

- Chose 18 species of wildflowers to assess their attractiveness for native bees

### **Criteria for Selection**

1. Recommended by USDA/NRCS
2. Bloom during spring, summer, or fall
3. Easily available for purchase

Common Name	Growth Habit
Butterfly Milkweed	Perennial
Frost Aster	Perennial
White Wild Indigo	Perennial
Partridge Pea	Annual
Sensitive Partridge Pea	Annual
Lance-leaf Coreopsis	Perennial
Illinois Bundleflower	Perennial
Florida Ticktrefoil	Perennial
Purple Coneflower	Perennial
Rattlesnake Master	Perennial
Blanket Flower	Annual
Narrow-Leaved Sunflower	Perennial
Bergamot	Perennial
Spotted Beebalm	Perennial
Greyheaded Coneflower	Perennial
Black-eyed Susan	Annual
Wrinkled-Leaved Goldenrod	Annual
Blue Vervain	Perennial

# Experimental Plantings

## *Site Selection*

- In 2019 a 388 m<sup>2</sup> field was prepped for planting in Auburn, Alabama
- Each species planted in four 1 m<sup>2</sup> sub-plots surrounded by a 1.5 m<sup>2</sup> buffer



# Experimental Plantings

## *Site Selection*

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- Mature potted plants were transplanted into each 1 m<sup>2</sup> sub-plot



# Experimental Plantings

## *Site Selection*

---

- Mature potted plants were transplanted into each 1 m<sup>2</sup> sub-plot



# Experimental Plantings

## *Wildflower & Bee Monitoring*

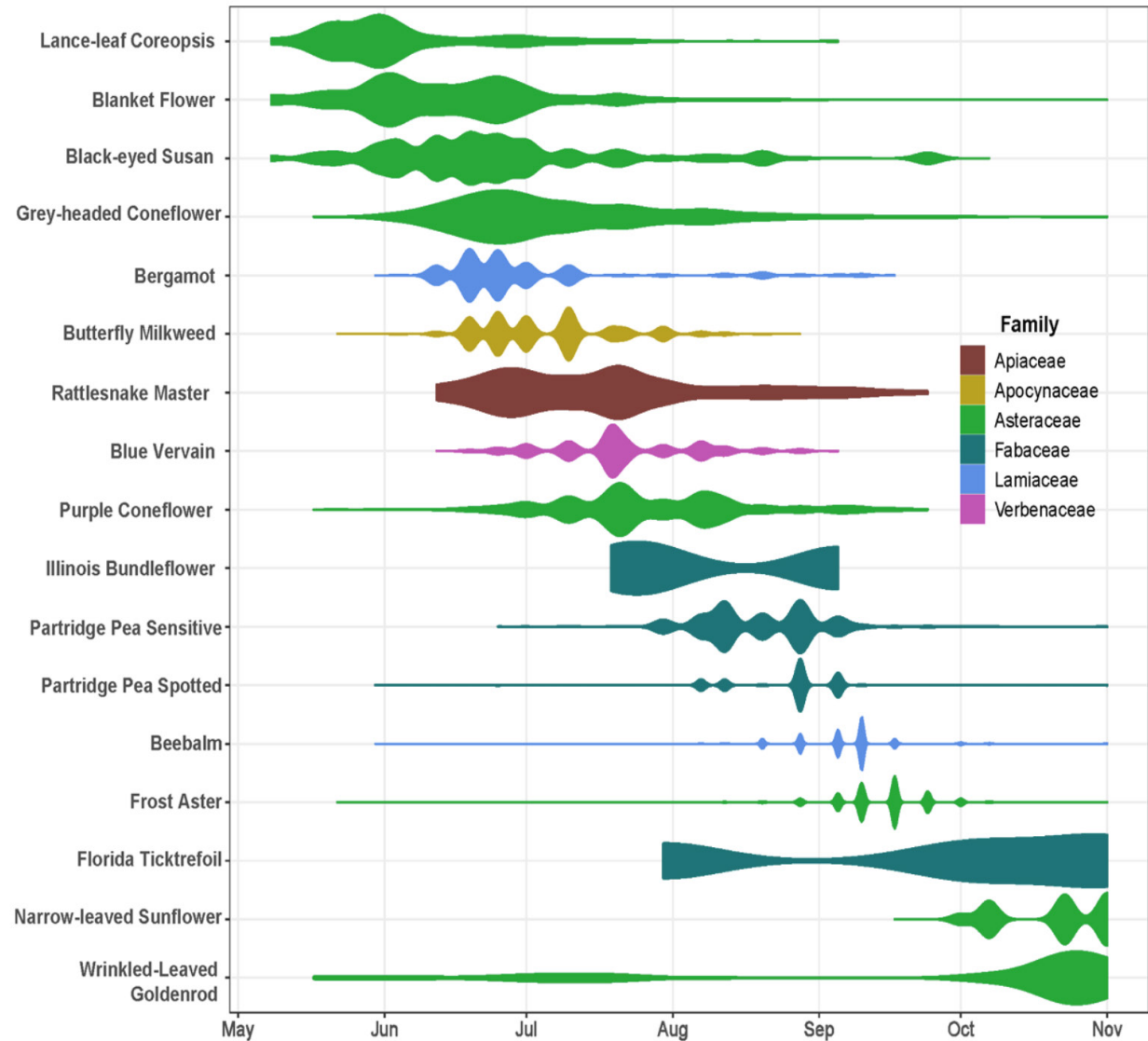
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- Quantified floral blooms  
May-November 2019
- Sweep netting surveys  
occurred during Morning,  
Midday and Afternoon
- Bees visiting blooms were  
netted and an identified



# Experimental Plantings *Wildflower Monitoring*

- Total of 155,185 flowers were counted across all wildflower species from May-November 2019
- *B. alba* failed to flower



# Experimental Plantings

## *Bee Monitoring*

- 7,740 total sweep netting minutes from May-November 2019
- 1,024 total bees
- 26 genera and 3 families
  - Halictidae 63%
  - Apidae 34%
  - Megachilidae 3%

Family	Genus/Species	Total
Apidae	<i>Apis mellifera</i>	60
	<i>Bombus bimaculatus</i>	28
	<i>Bombus fraternus</i>	5
	<i>Bombus griseocollis</i>	84
	<i>Bombus impatiens</i>	93
	<i>Bombus</i> sp.	12
	<i>Melissodes agilis</i>	1
	<i>Melissodes communis</i>	4
	<i>Melissodes comptoides</i>	1
	<i>Svastra obliqua</i>	18
	<i>Xylocopa micans</i>	5
	<i>Xylocopa virginica</i>	35
	Halictidae	<i>Agapostemon splendens</i>
<i>Augochloropsis metalica</i>		1
<i>Halictus parallelus</i>		13
<i>Halictus poeyii</i>		563
<i>Halictus rubicundus</i>		9
<i>Lasioglossum</i> spp.		58
Megachilidae		<i>Megachile albitarsis</i>
	<i>Megachile brevis</i>	1
	<i>Megachile inimica</i>	1
	<i>Megachile mendica</i>	12
	<i>Megachile parallela</i>	1
	<i>Megachile policularis</i>	1
	<i>Megachile sculpturalis</i>	11
	<i>Megachile xylocopoides</i>	2
<b>Total</b>		<b>1024</b>

# Experimental Planting

## *Bee Monitoring*

- The **most abundant** bee species were
  - *Halictus poeyi*
  - *Bombus impatiens*
  - *Bombus griseocollis*
  - *Apis mellifera*



*Halictus poeyi* – Poey's Furrow Bee



*Bombus impatiens* - The Common Eastern Bumble Bee



*Bombus griseocollis* –Brown- Belted Bumble Bee

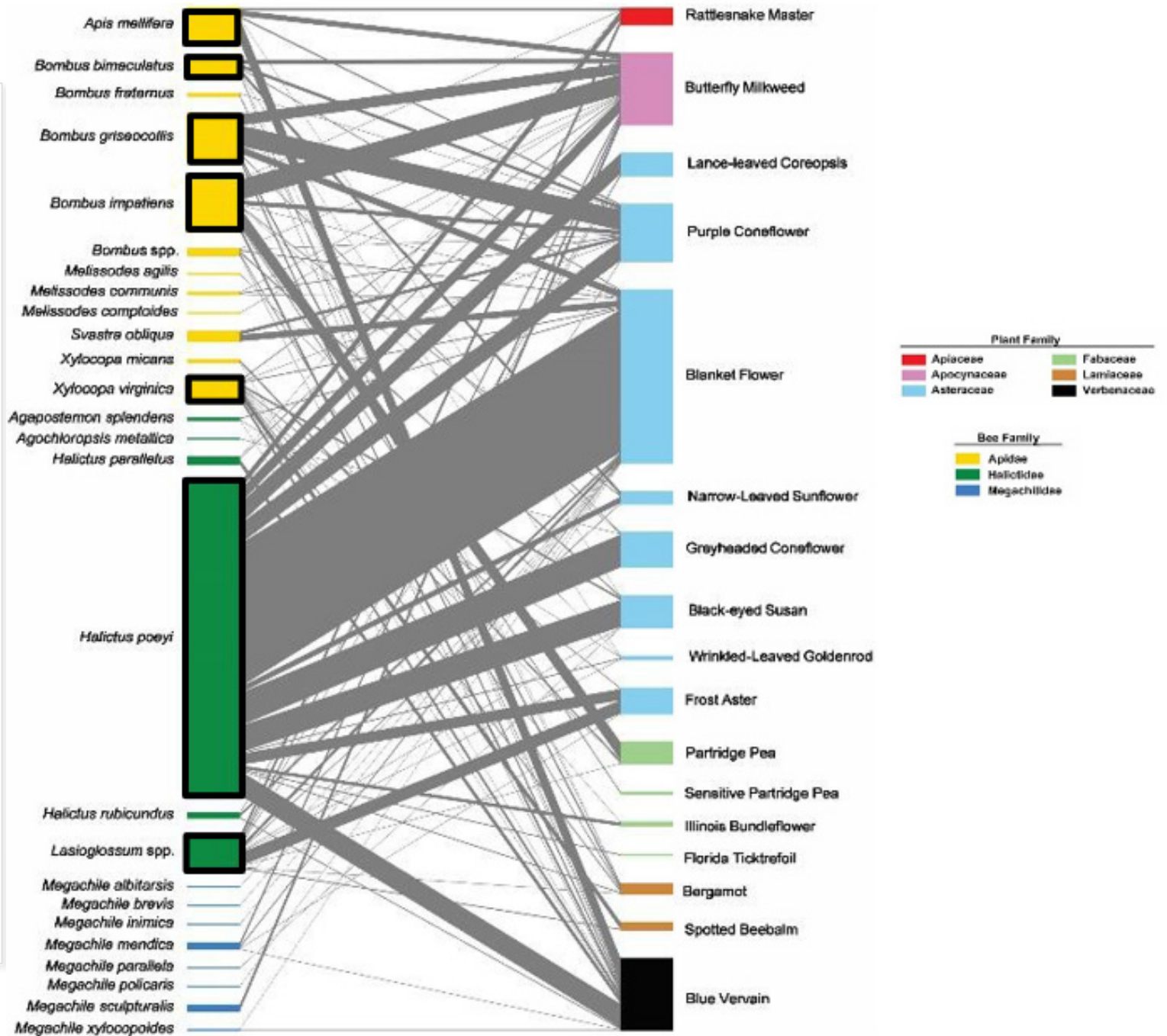


*Apis mellifera* – Western Honey Bee

## Experimental Plantings

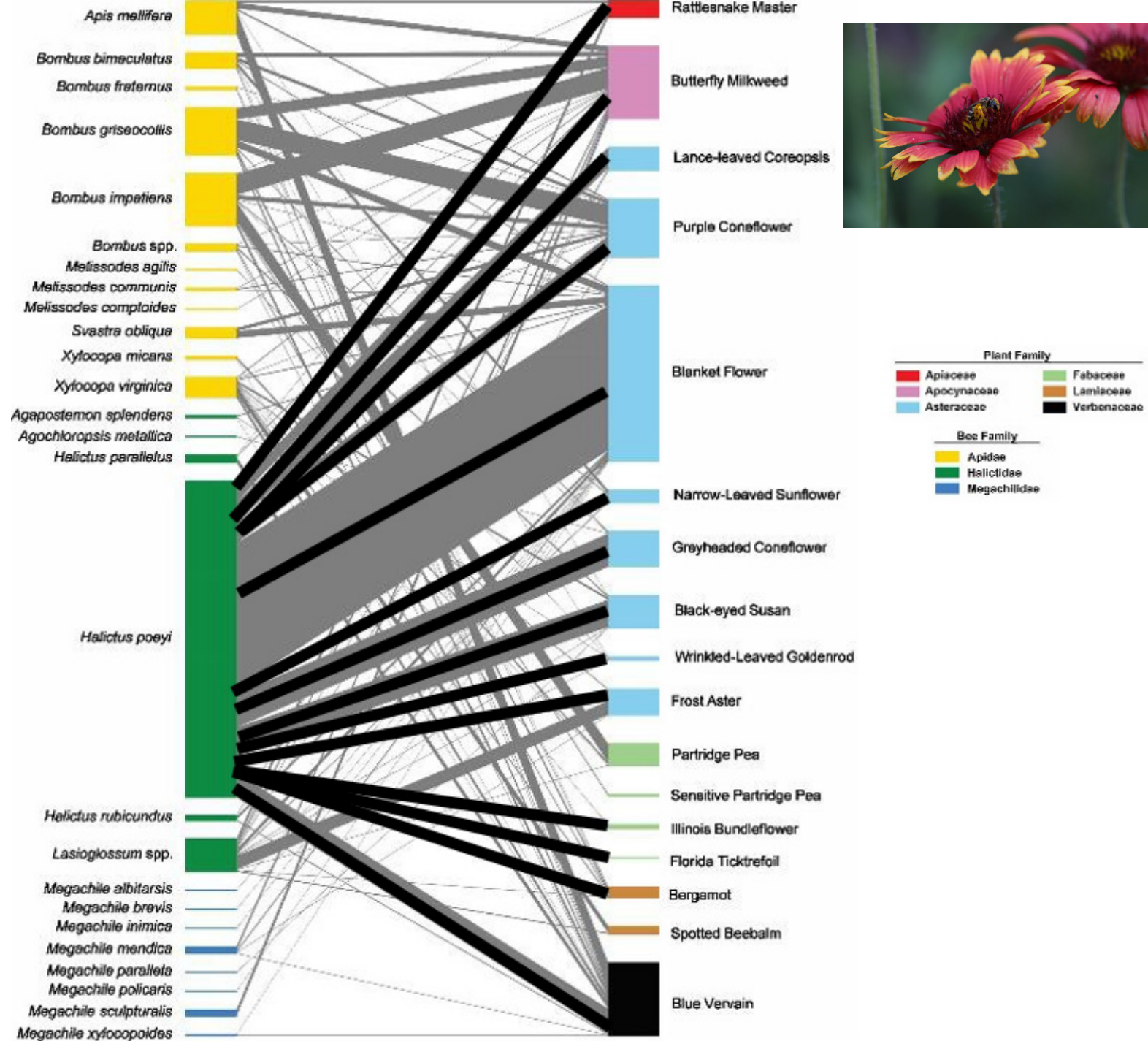
### *Bee-Wildflower Interactions*

- Each wildflower species was visited by an average of six bee species
- Each bee species/genus visited an average of four wildflower species
- Most common bees
  - *Halictus poeyi*
  - *Lasioglossum* spp.
  - *Xylocopa virginica*



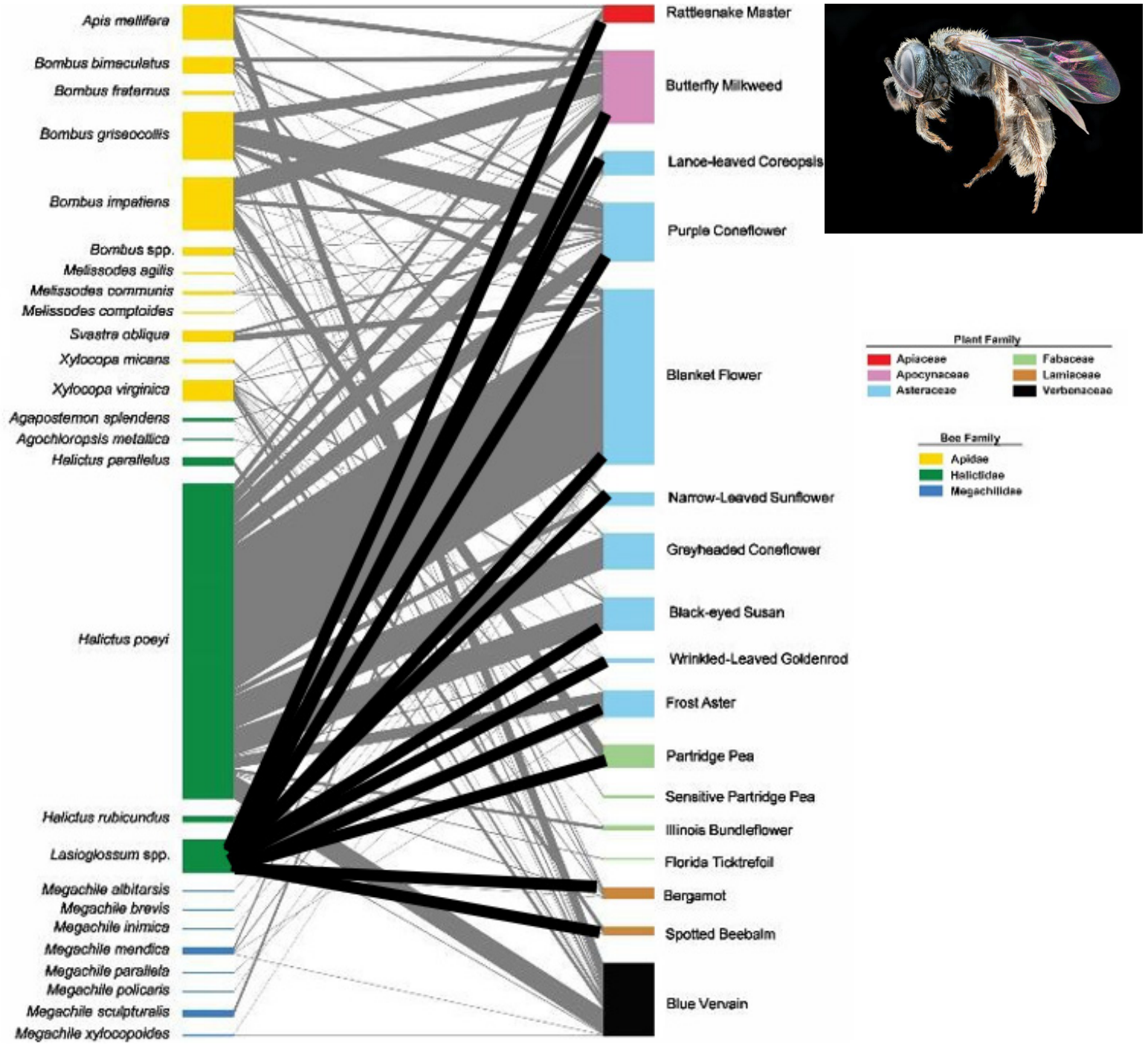
## Experimental Plantings *Bee-Wildflower Interactions*

- Each wildflower species was visited by an average of six bee species
- Each bee species/genus visited an average of four wildflower species
  - *Halictus poeyi* (14)
  - *Lasioglossum* spp.
  - *Xylocopa virginica*



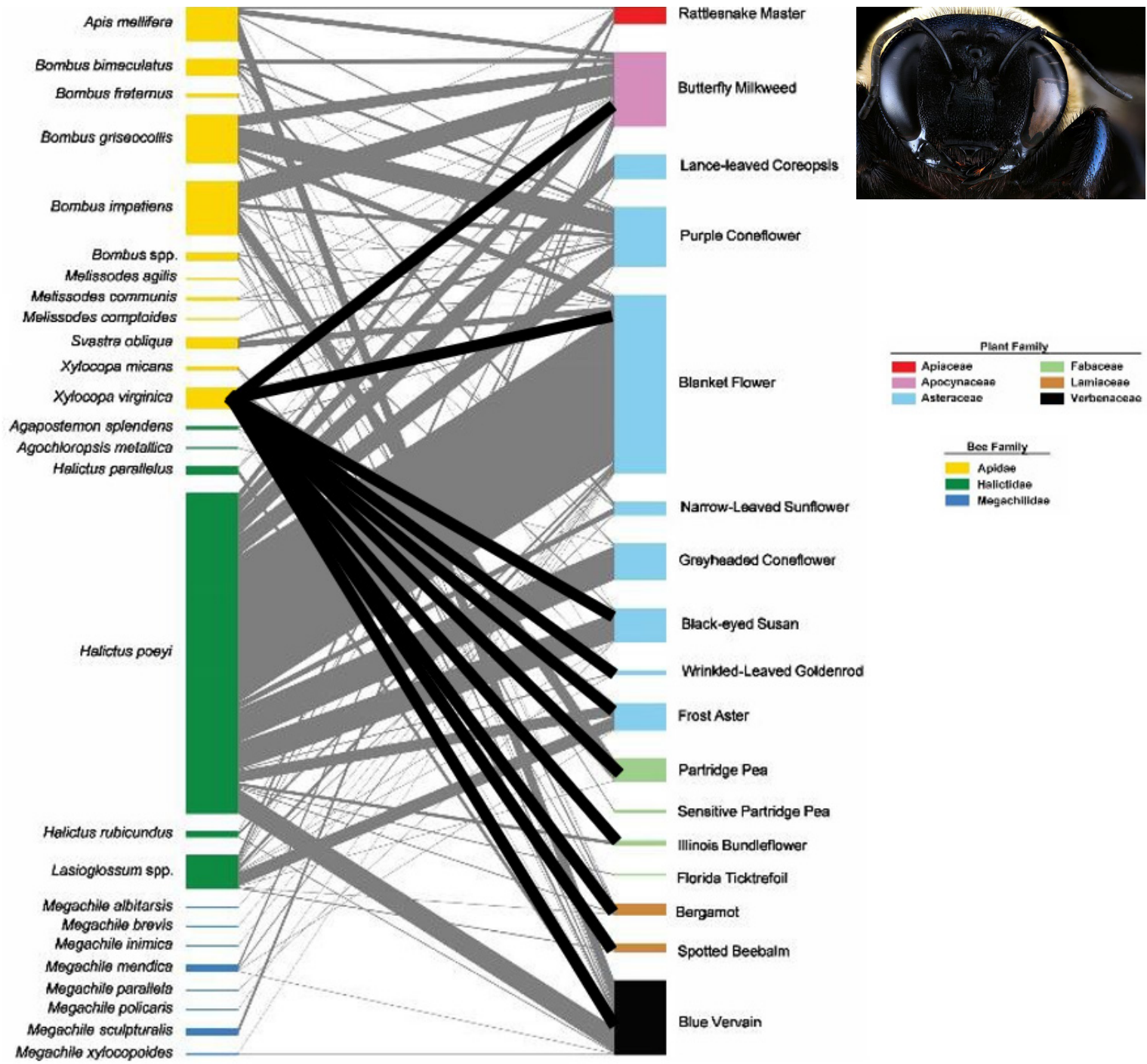
## Experimental Plantings *Bee-Wildflower Interactions*

- Each wildflower species was visited by an average of six bee species
- Each bee species/genus visited an average of four wildflower species
  - *Halictus poeyi*
  - *Lasioglossum* spp. (12)
  - *Xylocopa virginica*



## Experimental Plantings *Bee-Wildflower Interactions*

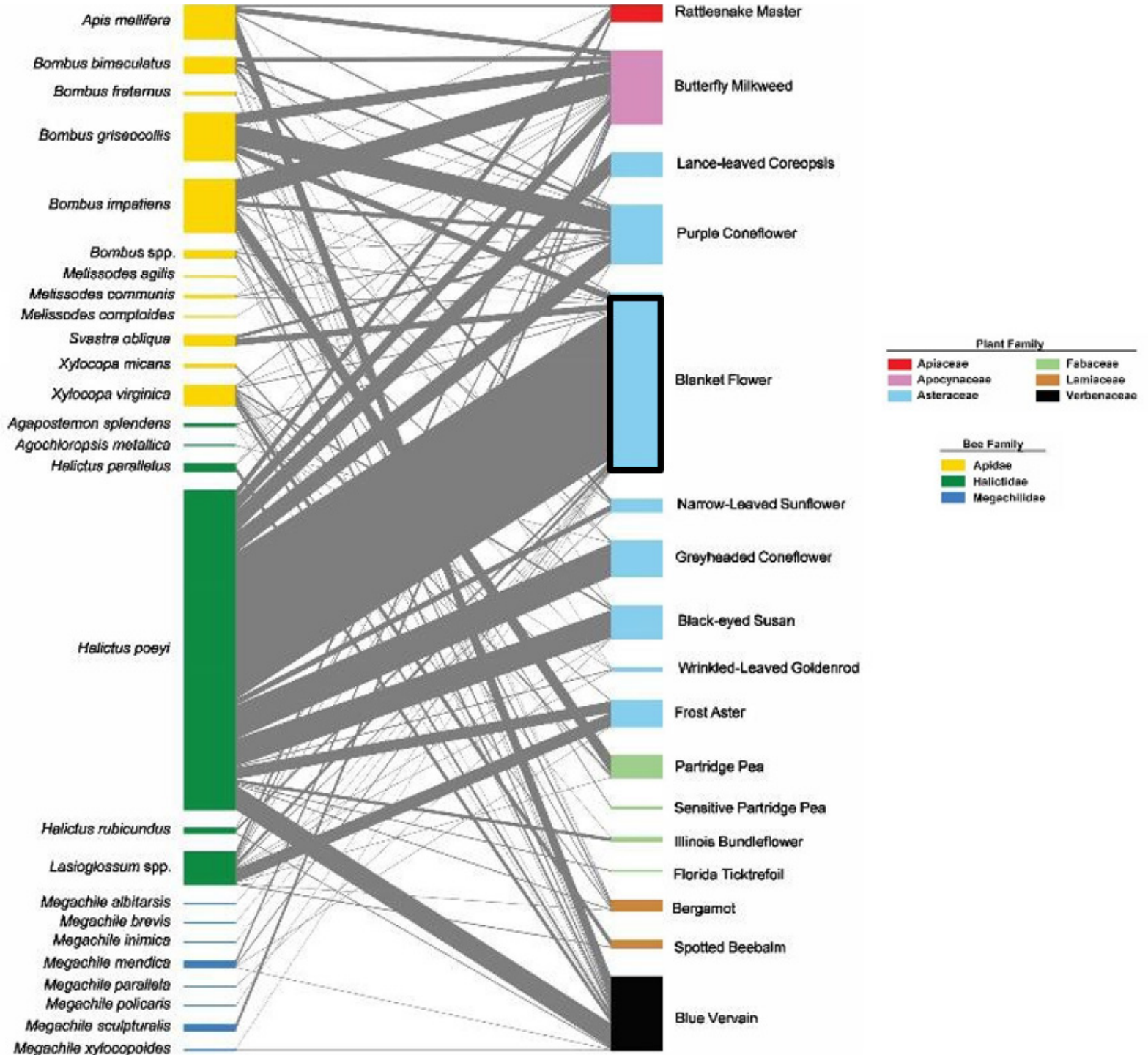
- Each wildflower species was visited by an average of six bee species
- Each bee species/genus visited an average of four wildflower species
  - *Halictus poeyi*
  - *Lasioglossum* spp.
  - *Xylocopa virginica* (10)



# Experimental Plantings

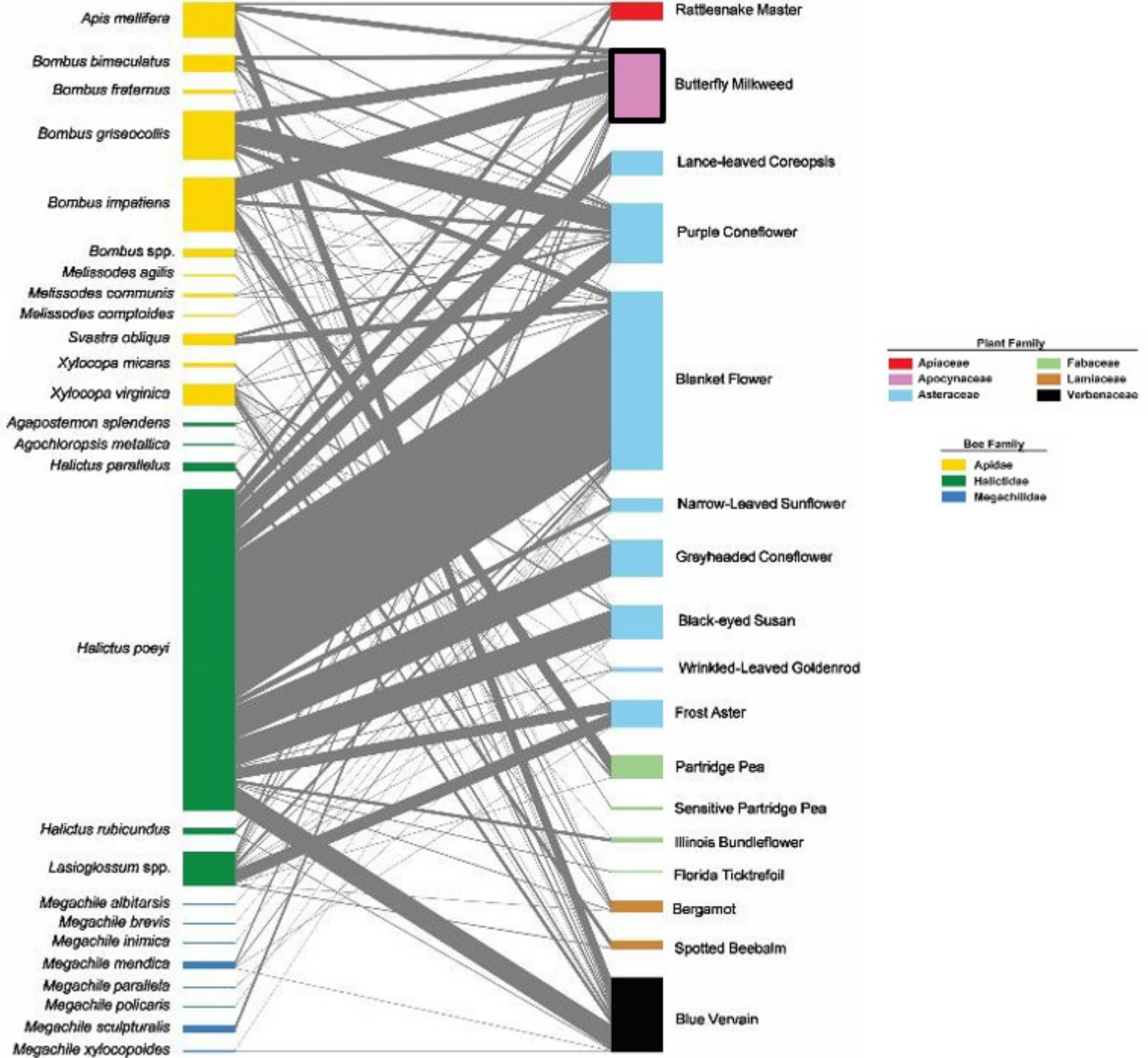
## Bee-Wildflower Interactions

- Blanket Flower attracted the greatest **abundance** of bees followed by...



# Experimental Plantings Bee-Wildflower Interactions

- Blanket Flower attracted the greatest **abundance** of bees followed by...
  - Butterfly Milkweed



# Experimental Plantings

## *Bee-Wildflower Interactions*

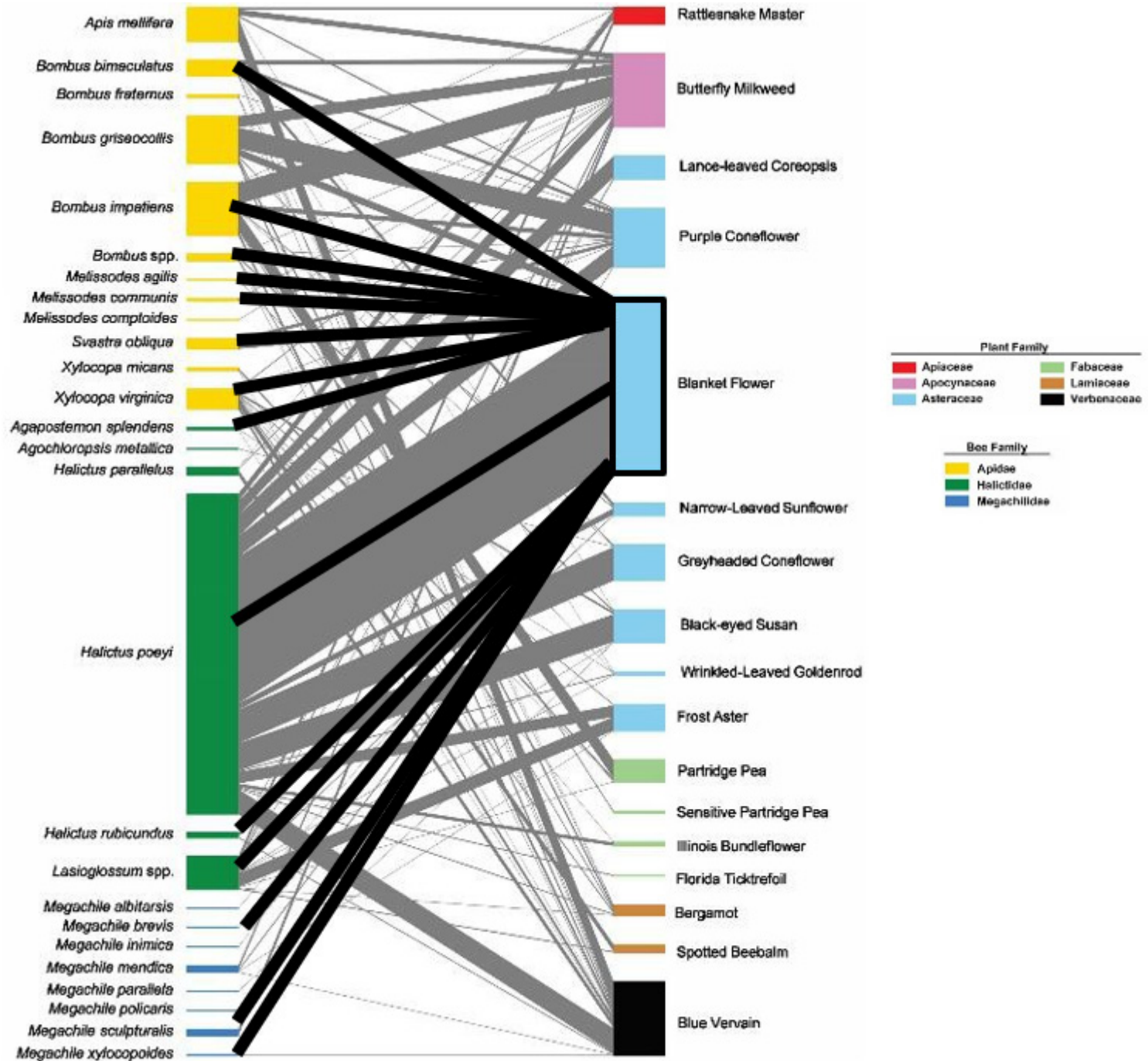
- Blanket Flower attracted the greatest **abundance** of bees followed by...
  - Butterfly Milkweed
  - Blue Vervain



# Experimental Plantings

## *Bee-Wildflower Interactions*

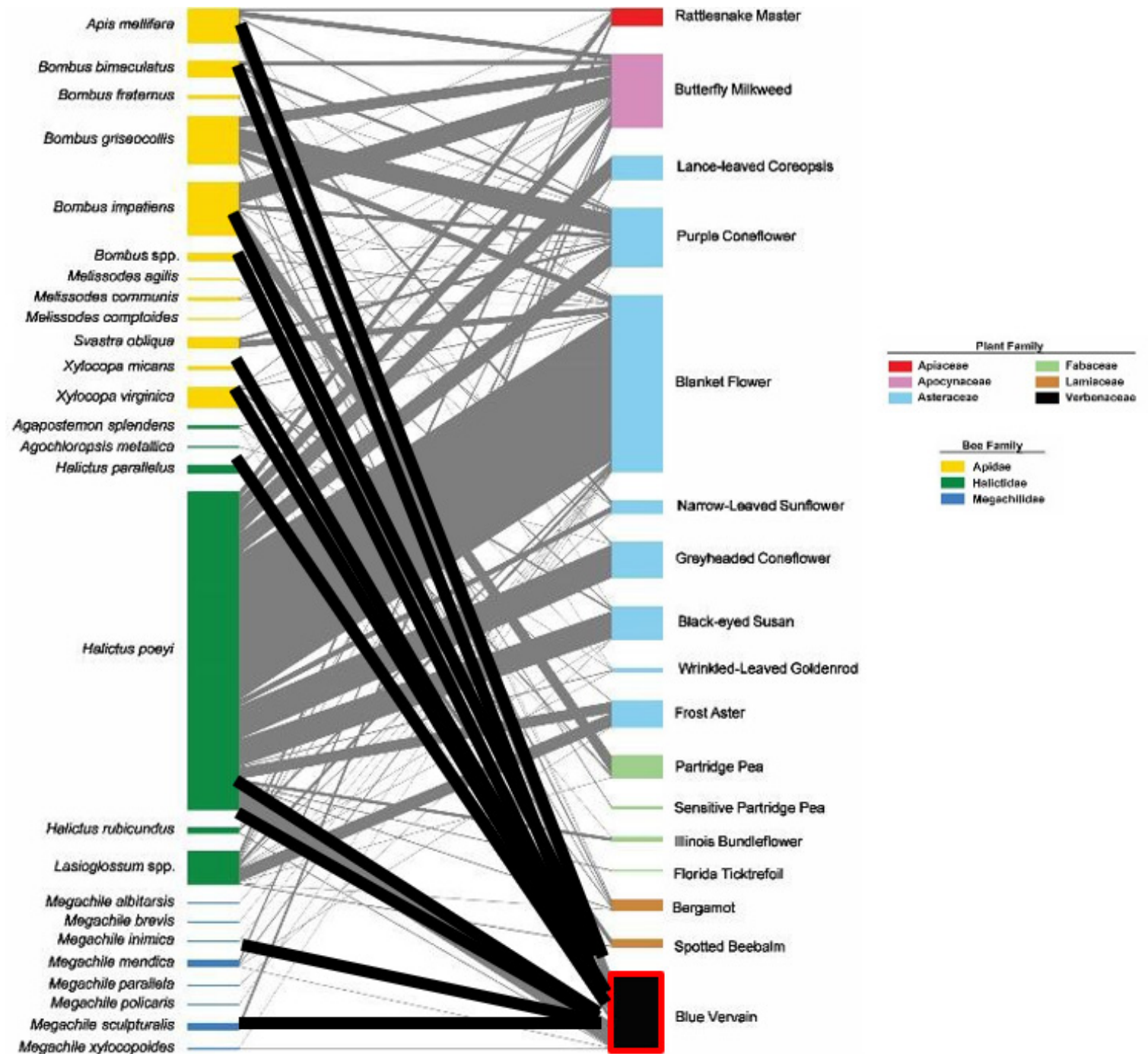
- Blanket Flower attracted the greatest **diversity** of bees followed by...



# Experimental Plantings

## *Bee-Wildflower Interactions*

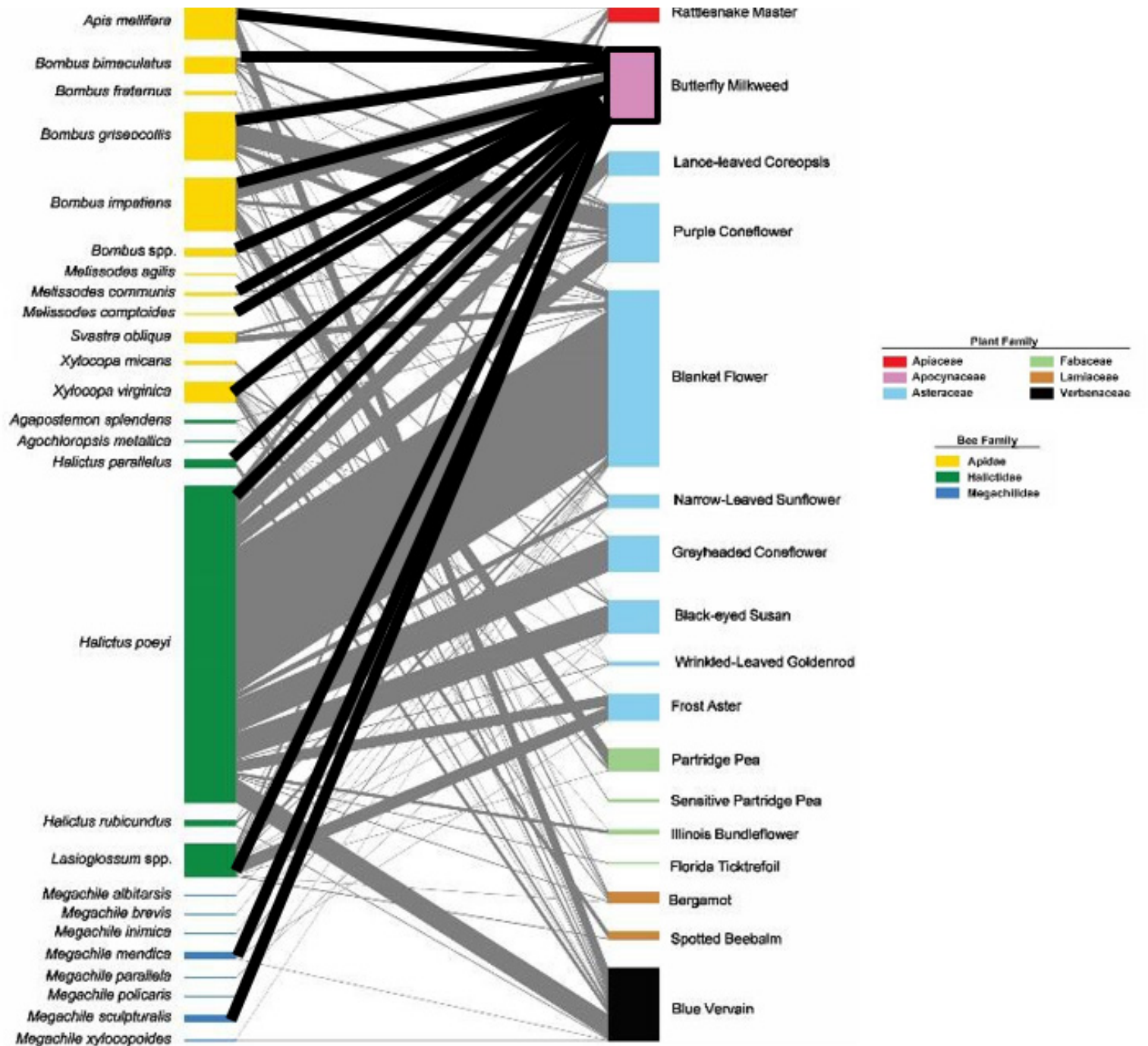
- Blanket Flower attracted the greatest **diversity** of bees followed by...
  - Blue Vervain



# Experimental Plantings

## *Bee-Wildflower Interactions*

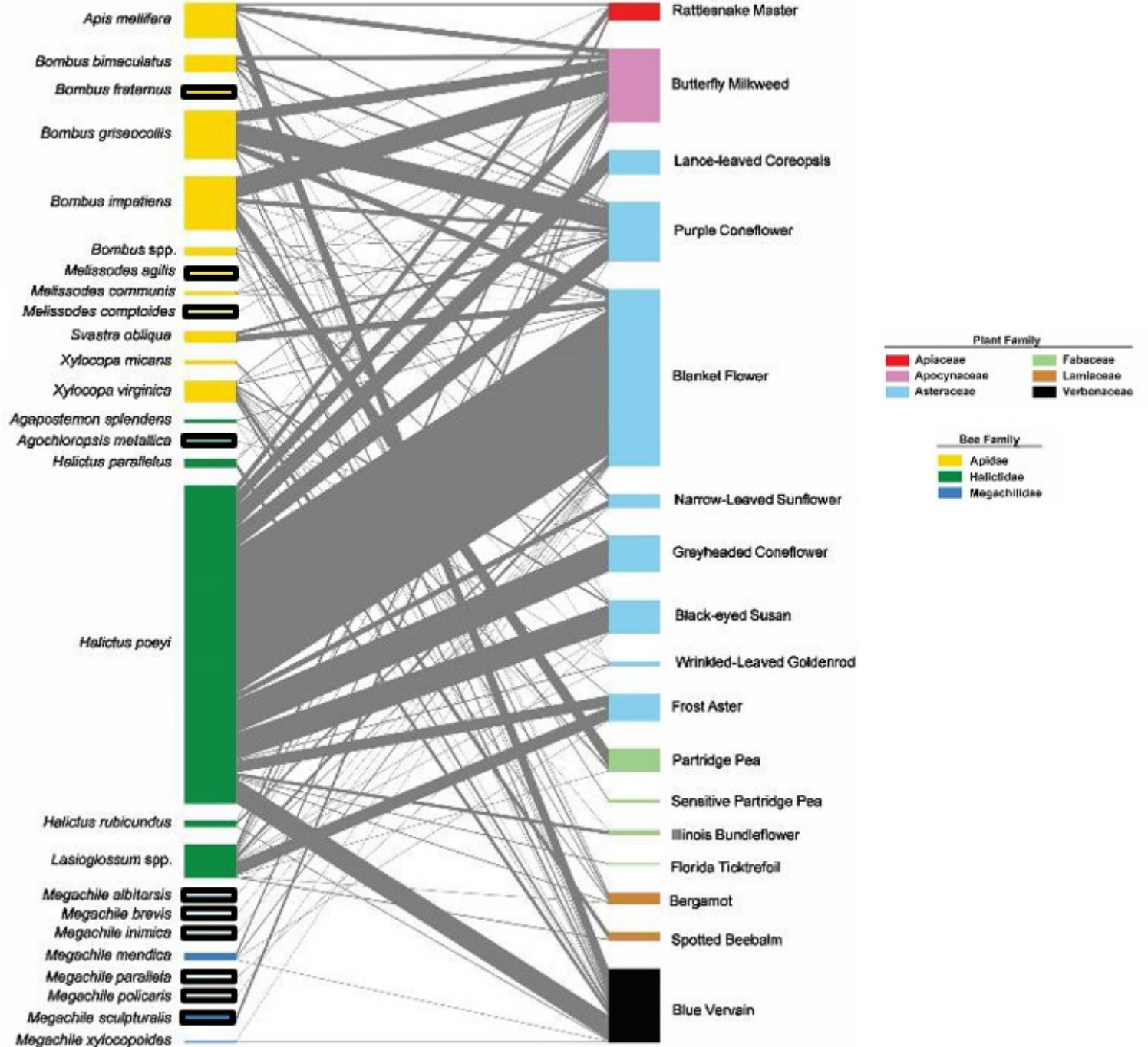
- Blanket Flower attracted the greatest **diversity** of bees followed by...
  - Blue Vervain
  - Butterfly Milkweed



# Experimental Plantings

## *Bee-Wildflower Interactions*

- Uncommon or rare bees
  - *Bombus fraternus*
- 9 bee species visited a single plant!



# Presentation Roadmap



# Current Recommendations

- Early Blooming
- Mid Blooming
- Late Blooming

Common Name	For Bee Abundance	For Bee Diversity	For Uncommon	For Honey Bees	My Selections
Lance-Leaved Coreopsis ✓	*				
Blanket flower ✓	*				
Foxglove Beardtongue ✓					
Black-Eyed Susan ✓	*				
Butterfly Milkweed	*				
Plains Coreopsis					
Purple Coneflower	*				
Bergamot					
Mountain Mint					
Gray-Headed Coneflower	*				
Goat's-Rue					
Blue Vervain	*				
Partridge Pea +	*				
Spotted Beebalm +					
Narrowleaf Sunflower +	*				
Goldenrod +	*				
Frost Aster +	*				

# Current Recommendations

-  Early Blooming
-  Mid Blooming
-  Late Blooming

Common Name	For Bee Abundance	For Bee Diversity	For Uncommon	For Honey Bees	My Selections
Lance-Leaved Coreopsis ✓	*	*			
Blanket flower ✓	*	*			
Foxglove Beardtongue ✓					
Black-Eyed Susan ✓	*	*			
Butterfly Milkweed	*	*			
Plains Coreopsis					
Purple Coneflower	*	*			
Bergamot					
Mountain Mint					
Gray-Headed Coneflower	*	*			
Goat's-Rue					
Blue Vervain	*	*			
Partridge Pea +	*	*			
Spotted Beebalm +					
Narrowleaf Sunflower +	*	*			
Goldenrod +	*	*			
Frost Aster +	*				

# Current Recommendations

- Early Blooming
- Mid Blooming
- Late Blooming

Common Name	For Bee Abundance	For Bee Diversity	For Uncommon	For Honey Bees	My Selections
Lance-Leaved Coreopsis ✓	*	*			
Blanket flower ✓	*	*	*		
Foxglove Beardtongue ✓					
Black-Eyed Susan ✓	*	*	*		
Butterfly Milkweed	*	*	*		
Plains Coreopsis					
Purple Coneflower	*	*			
Bergamot					
Mountain Mint					
Gray-Headed Coneflower	*	*	*		
Goat's-Rue			*		
Blue Vervain	*	*	*		
Partridge Pea +	*	*			
Spotted Beebalm +					
Narrowleaf Sunflower +	*	*			
Goldenrod +	*	*	*		
Frost Aster +	*		*		

# Current Recommendations

- ✓ Early Blooming
- Mid Blooming
- + Late Blooming

Common Name	For Bee Abundance	For Bee Diversity	For Uncommon	For Honey Bees	My Selections
Lance-Leaved Coreopsis ✓	*	*			
Blanket flower ✓	*	*	*		
Foxglove Beardtongue ✓					
Black-Eyed Susan ✓	*	*	*		
Butterfly Milkweed	*	*	*	*	
Plains Coreopsis					
Purple Coneflower	*	*			
Bergamot					
Mountain Mint					
Gray-Headed Coneflower	*	*	*		
Goat's-Rue			*		
Blue Vervain	*	*	*	*	
Partridge Pea +	*	*			
Spotted Beebalm +					
Narrowleaf Sunflower +	*	*			
Goldenrod +	*	*	*		
Frost Aster +	*		*		

# Current Recommendations

- Early Blooming
- Mid Blooming
- Late Blooming

Common Name	For Bee Abundance	For Bee Diversity	For Uncommon	For Honey Bees	My Selections
Lance-Leaved Coreopsis ✓	*	*			*
Blanket flower ✓	*	*	*		*
Foxglove Beardtongue ✓					*
Black-Eyed Susan ✓	*	*	*		
Butterfly Milkweed	*	*	*	*	*
Plains Coreopsis					
Purple Coneflower	*	*			*
Bergamot					
Mountain Mint					
Gray-Headed Coneflower	*	*	*		
Goat's-Rue			*		
Blue Vervain	*	*	*	*	*
Partridge Pea +	*	*			*
Spotted Beebalm +					*
Narrowleaf Sunflower +	*	*			*
Goldenrod +	*	*	*		
Frost Aster +	*		*		

# Current Recommendations

- Are these recommendations applicable to the greater southeastern United States?

- YES!

 Early Blooming  
 Mid Blooming  
 Late Blooming

Common Name	For Bee Abundance	For Bee Diversity	For Uncommon	For Honey Bees	My Selections
Lance-Leaved Coreopsis ✓	*	*			*
Blanket flower ✓	*	*	*		*
Foxglove Beardtongue ✓					*
Black-Eyed Susan ✓	*	*	*		
Butterfly Milkweed	*	*	*	*	*
Plains Coreopsis					
Purple Coneflower	*	*			*
Bergamot					
Mountain Mint					
Gray-Headed Coneflower	*	*	*		
Goat's-Rue			*		
Blue Vervain	*	*	*	*	*
Partridge Pea +	*	*			*
Spotted Beebalm +					*
Narrowleaf Sunflower +	*	*			*
Goldenrod +	*	*	*		
Frost Aster +	*		*		

Common Name	Growth Habit	For Bee Abundance	For Bee Diversity	For Uncommon Bees	For Honey Bees	My Selections	Price per lb
Lance-Leaved Coreopsis ✓	Perennial	*	*			*	\$
Blanket flower ✓	Annual	*	*	*		*	\$
Foxglove Beardtongue ✓	Perennial					*	\$\$
Black-Eyed Susan ✓	Annual	*	*	*			\$
Butterfly Milkweed	Perennial	*	*	*	*	*	\$\$\$
Plains Coreopsis	Annual						\$
Purple Coneflower	Perennial	*	*			*	\$
Bergamot	Perennial						\$\$
Mountain Mint	Perennial						\$\$
Gray-Headed Coneflower	Perennial	*	*	*			\$
Goat's-Rue	Perennial			*			\$\$
Blue Vervain	Perennial	*	*	*	*	*	\$
Partridge Pea +	Annual	*	*			*	\$
Spotted Beebalm +	Perennial					*	\$\$\$
Narrowleaf Sunflower +	Perennial	*	*			*	\$\$
Goldenrod +	Annual	*	*	*			\$\$
Frost Aster +	Perennial	*		*			\$\$\$

- Early Blooming
- Mid Blooming
- Late Blooming

# Presentation Roadmap



## Future Directions

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- How well do the wildflower species grow in a seed mixture?
- What are the best management practices for establishing and maintaining a wildflower plot?
- What is practical for landowners?



# Acknowledgments

**AU-BEES**  
AT AUBURN UNIVERSITY.



My E-Portfolio



**Dissertation Supervisors**  
Dr. Geoffrey Williams & Dr. Joshua Campbell

# References

- **Cane, J. H., and Tepedino, V. J. 2001.** Causes and extent of declines among native north American invertebrate pollinators: Detection, evidence, and consequences. *Conservation Ecology*, 5(1).
- **Garbuzov, M., and Ratnieks, F. L. W. 2014.** Quantifying variation among garden plants in attractiveness to bees and other flower-visiting insects. *Functional Ecology*, 28(2), 364–374.
- **Gegeer, R. J., and Thomson, J. D. 2004.** Does the flower constancy of bumble bees reflect foraging economics? *Ethology*, 110(10), 793–805.
- **Koh, I., Lonsdorf, E. V., Williams, N. M., Brittain, C., Isaacs, R., Gibbs, J., and Ricketts, T. H. 2016.** Modeling the status, trends, and impacts of wild bee abundance in the United States. *Proceedings of the National Academy of Sciences*, 113(1), 140–145.
- **Pellmyr, O. 2002.** Pollination by animals. *Plant–animal interactions*. Herrera CM and Pellmyr O, 157–184.
- **Rowe, L., Gibson, D., Bahlai, C. A., Gibbs, J., Landis, D. A., and Isaacs, R. 2020.** Flower traits associated with the visitation patterns of bees. *Oecologia*, 193(2), 511–522.
- **Vanbergen, A. J., and Initiative, the I. P. 2013.** Threats to an ecosystem service: Pressures on pollinators. *Frontiers in Ecology and the Environment*, 11(5), 251–259.