Bee-friendly livestock systems

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Where we are

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Beef and forage systems in Florida

In Florida approximately 4.5 million ha are grasslands

Beef cow-calf production systems in the southeastern United States are typically pasture-based

Florida ranked 13th in cow inventory

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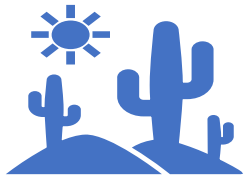
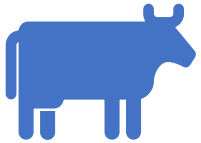
Beef and forage systems in Florida



Florida supports warm- and cool-season grasses

Bahiagrass (*Paspalum notatum*) is the most widely planted perennial grass

Nitrogen fertilizer continues to be one of the largest input in beef/forage production systems



Legumes are an important source of highly digestible protein-rich feed for livestock (Muir et al., 2011)

In Florida, rhizoma peanut (*Arachis glabrata* B.) is the most important perennial forage legume (Sollenberger et al., 2014)

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Beef and forage systems in Florida

Why pollinators?

Pollinators provide vital ecosystem services to crops and wild plants

They benefit 35% of global crop-based food production

The volume of production of pollinator-dependent crops has increased by 300% over the last five decades

The latest Buzz

Pollination services are affected by ecosystem changes that could affect distribution, abundance, and effectiveness in pollination (Millenium Ecosystem Assessment, 2005)

Reasons for bee decline include:

- **Land-use change**
- **Habitat fragmentation**
- **Agriculture intensification**
- **Exposure to pesticides**
- **Decreased diversity**
- **Spread of pathogens**

Cool season forage mixtures

4) Grass-Legume	9) G-Leg-Brassica	5) Grass-Legume	1) Grass	8) G-Leg-Brassica	III
10) Fallow	2) Grass	6) Grass-Legume	3) Grass	7) G-Leg-Brassica	
8) G-Leg-Brassica	1) Grass	9) G-Leg-Brassica	4) Grass-Legume	6) Grass-Legume	II
3) Grass	7) G-Leg-Brassica	10) Fallow	2) Grass	5) Grass-Legume	
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9) G-Leg-Brassica	1) Grass	6) Grass-Legume	10) Fallow	3) Grass	

1)Rye
2)Rye/Oat
3)Rye/Oat/Ryegrass
4)Rye/Crimson
5)Rye/Oat/Crimson/Ball
6)Rye/Oat/Crimson/Ball/Red
7)Rye/Crimson/Turnip
8)Rye/Ryegrass/Crimson/Ball/Turnip/Rape
9)Rye/Oat/Ryegrass/Crimson/Ball/red/Turnip/Rape/Kale
10)Fallow

Methods

Bee Species

Species	Fallow	Grass	Grass Legume	Grass Legume Brassica	Grand Total
Augochlora aurata	2	27	44	32	**105**
Augochloropsis metallica	-	4	5	-	**9**
Bombus impatiens	2	-	8	7	**17**
Osmia subfasciata	-	-	1	-	**1**
Halictus poeyi	-	4	1	4	**9**
Lasioglossum callidum	-	3	2	1	**6**
Lasioglossum floridanum	1	1	1	1	**4**
Lasioglossum longifrons	-	-	1	-	**1**
Lasioglossum mitchelli	-	-	1	1	**2**
Lasioglossum pectorale	-	2	2	-	**4**
Lasioglossum pilosum	4	4	-	-	**8**
Lasioglossum reticulatum	-	1	-	-	**1**
Lasioglossum tegulare Group	6	5	11	2	**24**
Lasioglossum trigeminum	-	1	2	1	**4**
Megachile albitarsius	-	-	1	-	**1**
Triepeolus donatus	1	1	-	1	**3**
Total Abundance	16	53	80	50	**199**
Bee Richness	6	11	13	9	**16**

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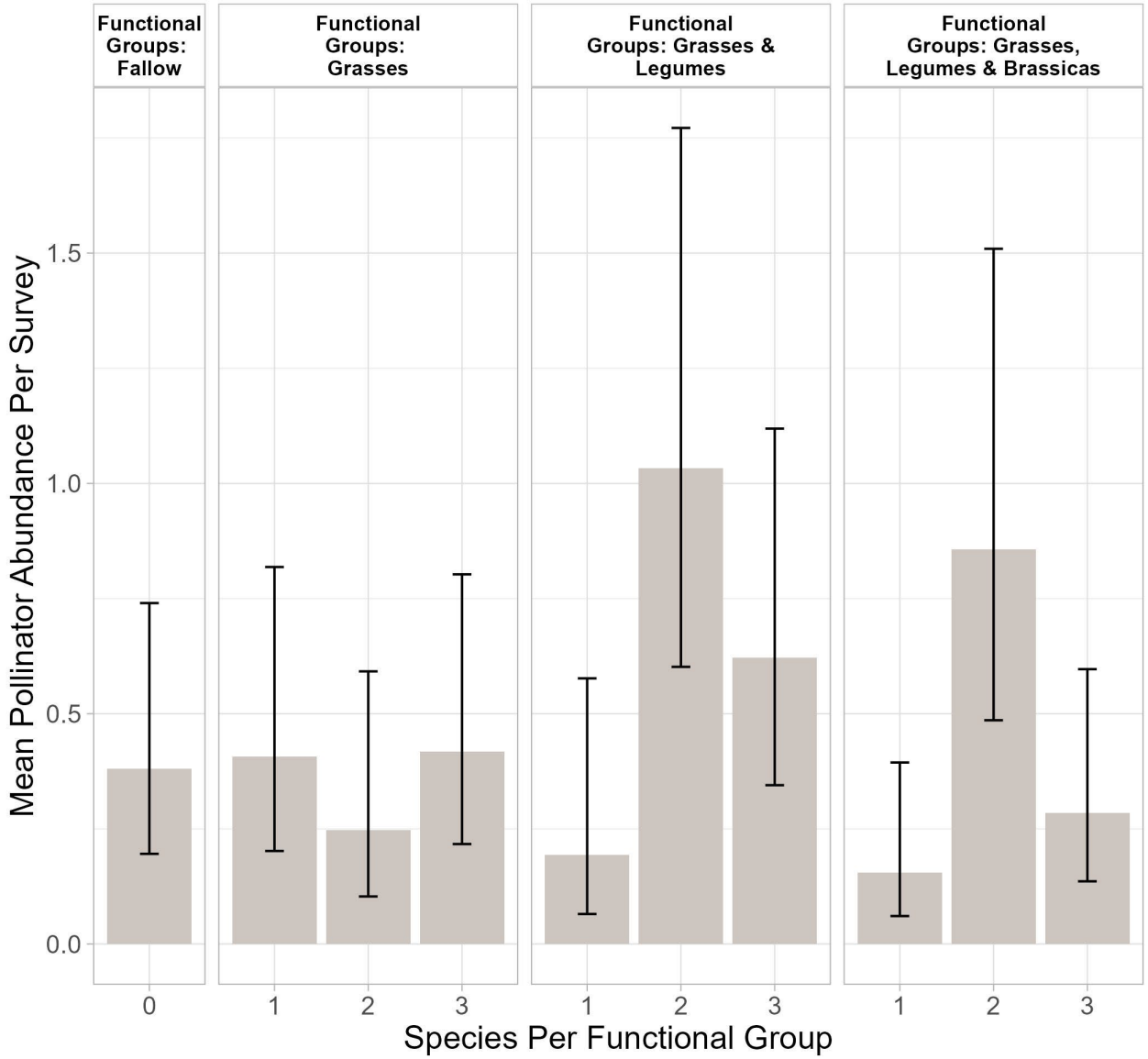
Bee abundance emergence traps



Treatment effect, $P < 0.02$

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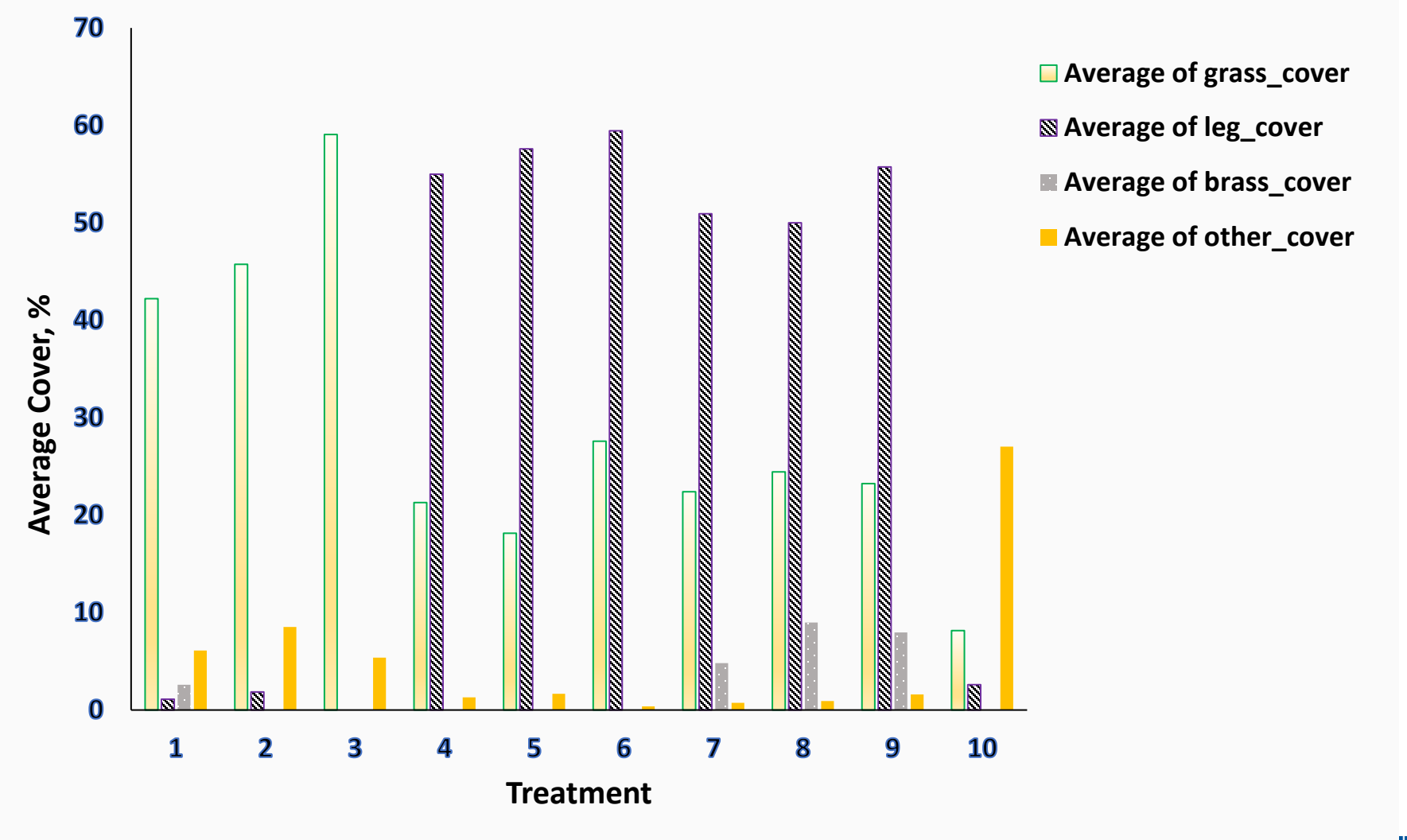
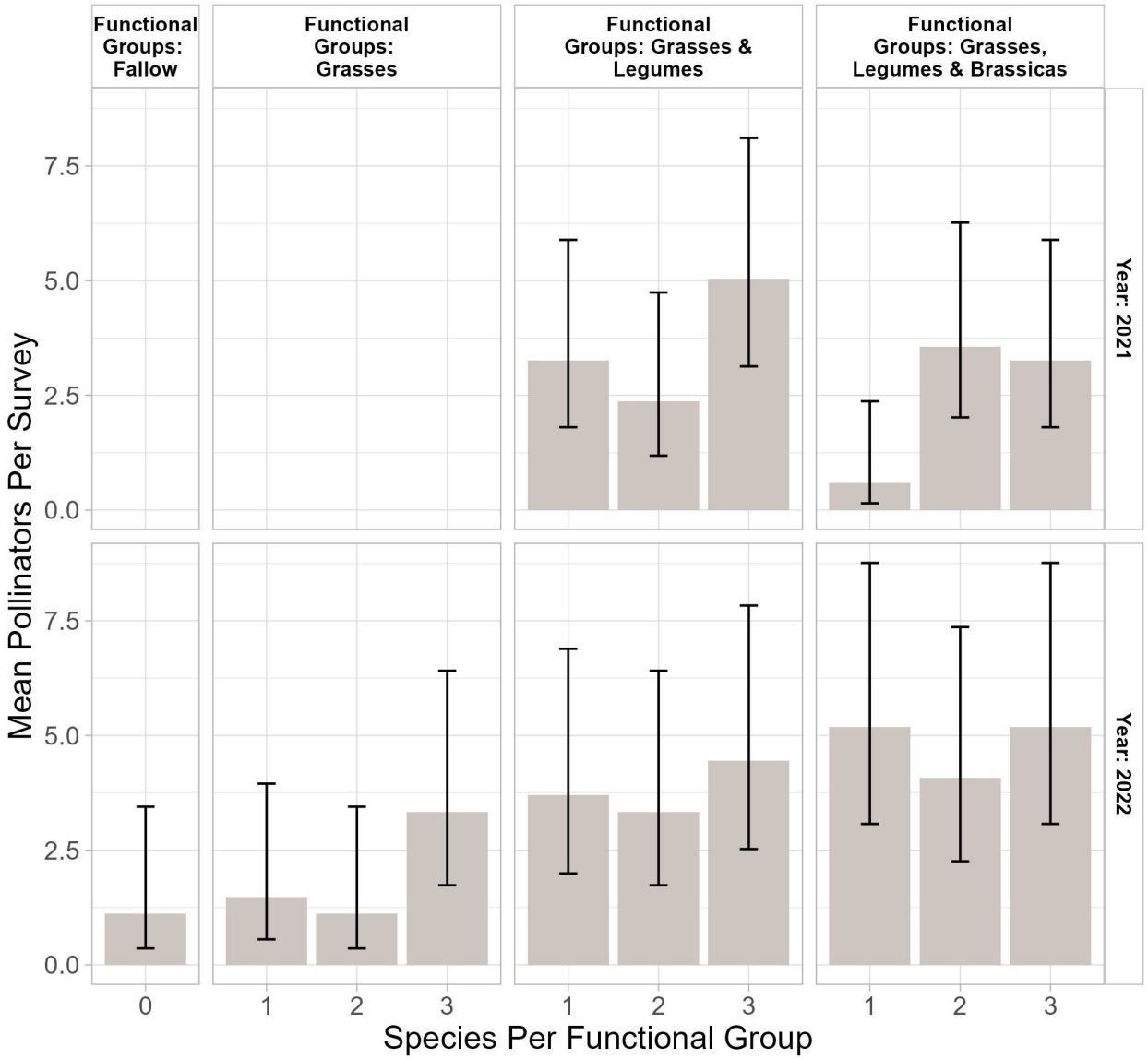
Average cover



Bee species visual survey



Treatment effect, *P* = 0.01

Treatment × year, *P* = 0.03

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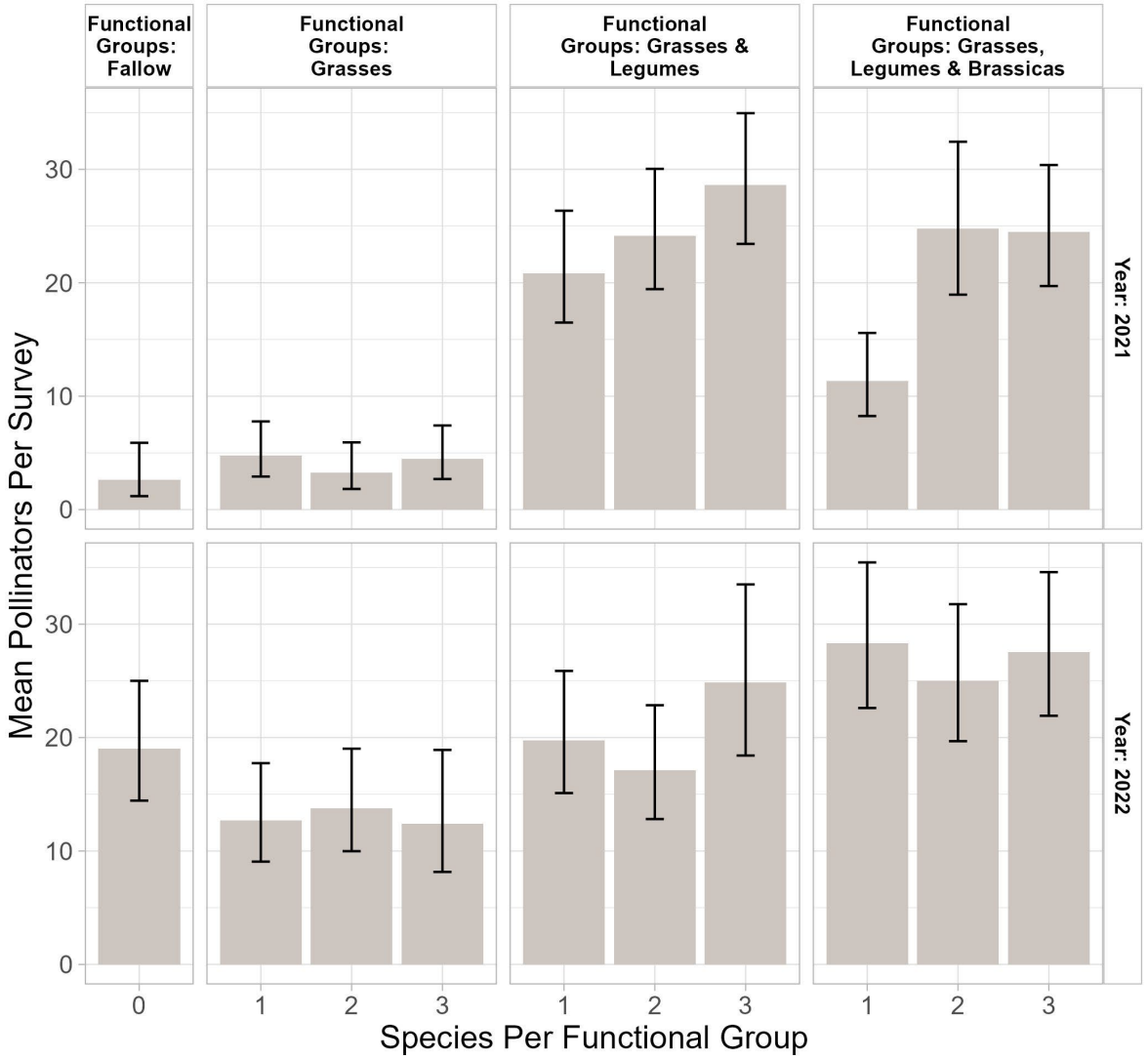
All species observed



Treatment effect, *P* < 0.001

Treatment × year, *P* < 0.001

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Grazing system

Treatments

System	Warm-season	Cool-season
Grass+N	Fertilized bahiagrass = 100 lb N/A	Cool-season grass + 100 lb N/A
Grass+ clovers	Unfertilized bahiagrass pastures	Cool season grass-legume mixture + 30 lb N/A
Grass + CL+RP	Bahiagrass-Rhizoma peanut mixture	Cool season grass-legume mixture + 30 lb N/A

Methods

- Bee collection traps placed every 28 d
- Quadrats to measure flower abundance and richness
- Specimens collected are identified to species level

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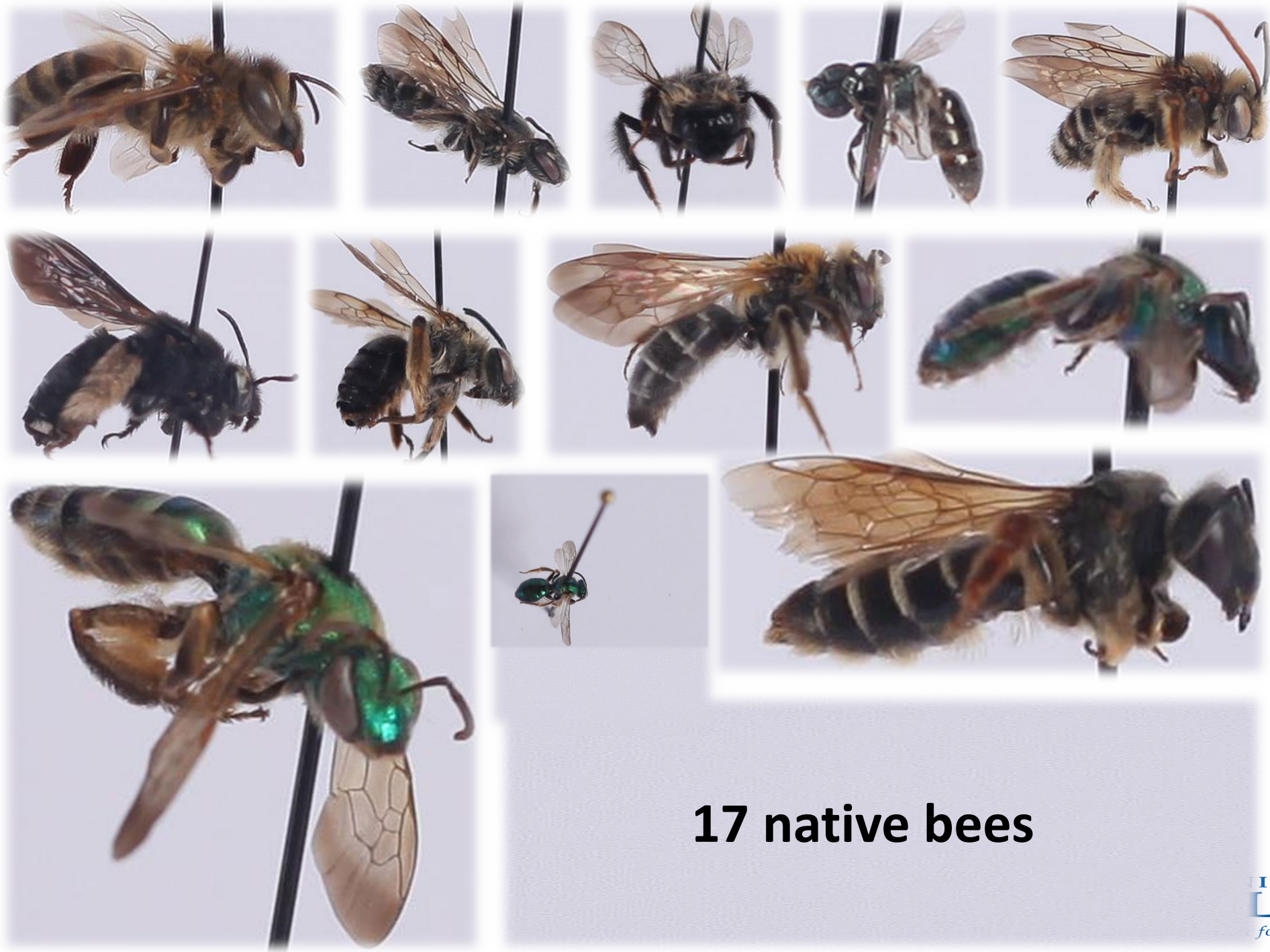
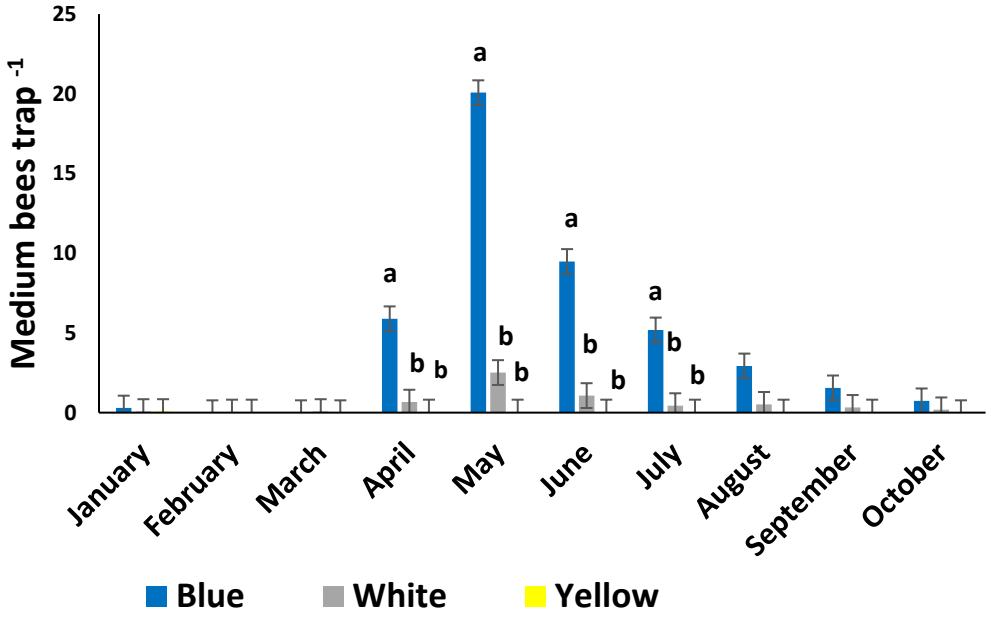
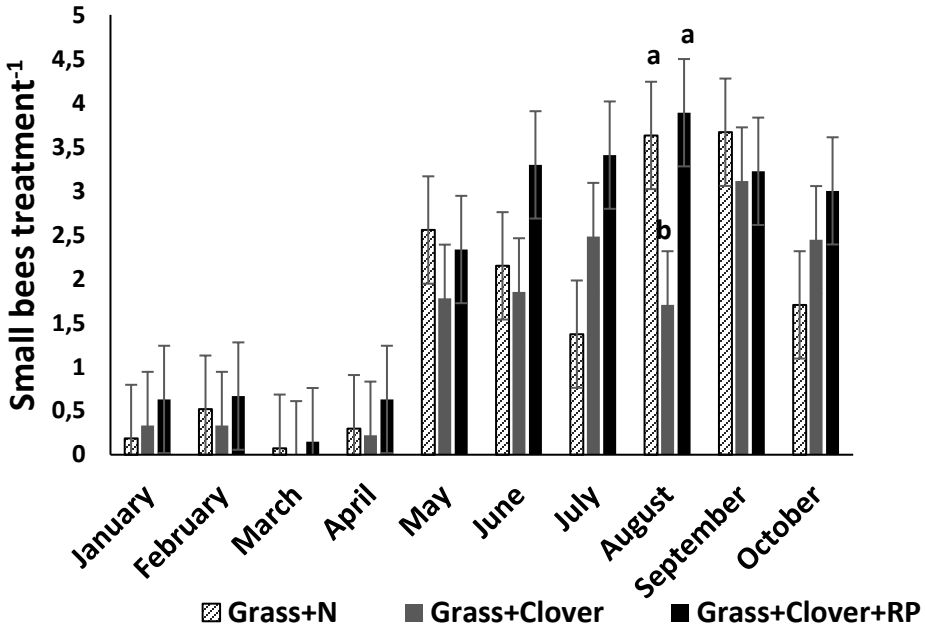


17 native bees

Medium and small bees





Trap color × evaluation, *P* < 0.001

[a,b] Within month, means differ, *P* < 0.05

Treatment × Evaluation, *P* < 0.001

[a,b,c] Within treatment, *P* < 0.05

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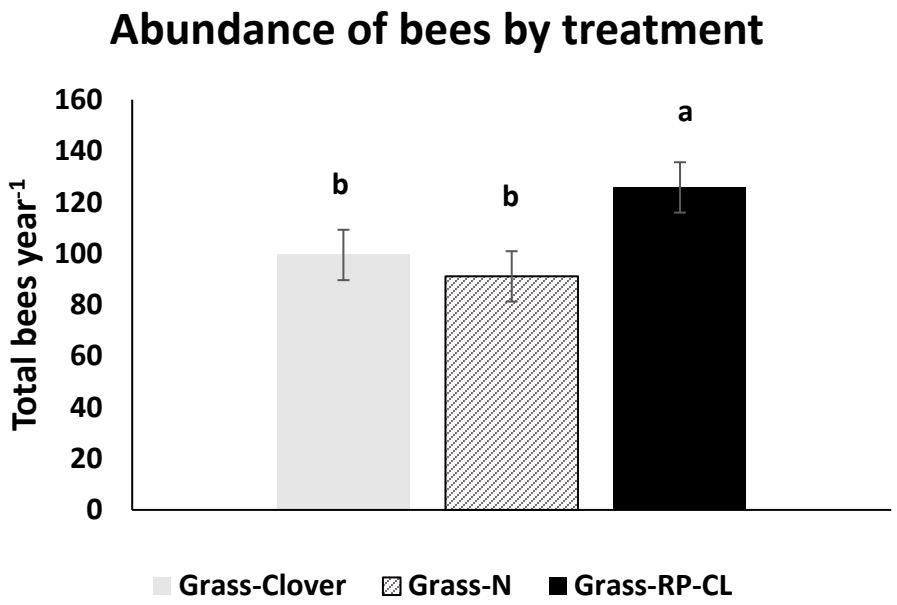
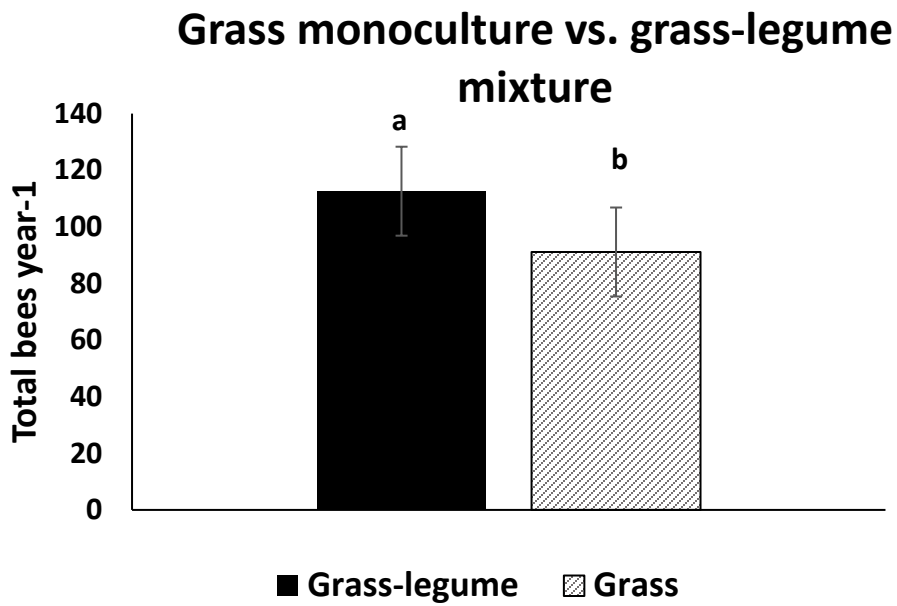
Bee Abundance





Treatment effect, *P* = 0.003

[a,b] Means differ, *P* < 0.05

Contrast, *P* = 0.01

[a,b] Means differ, *P* < 0.05

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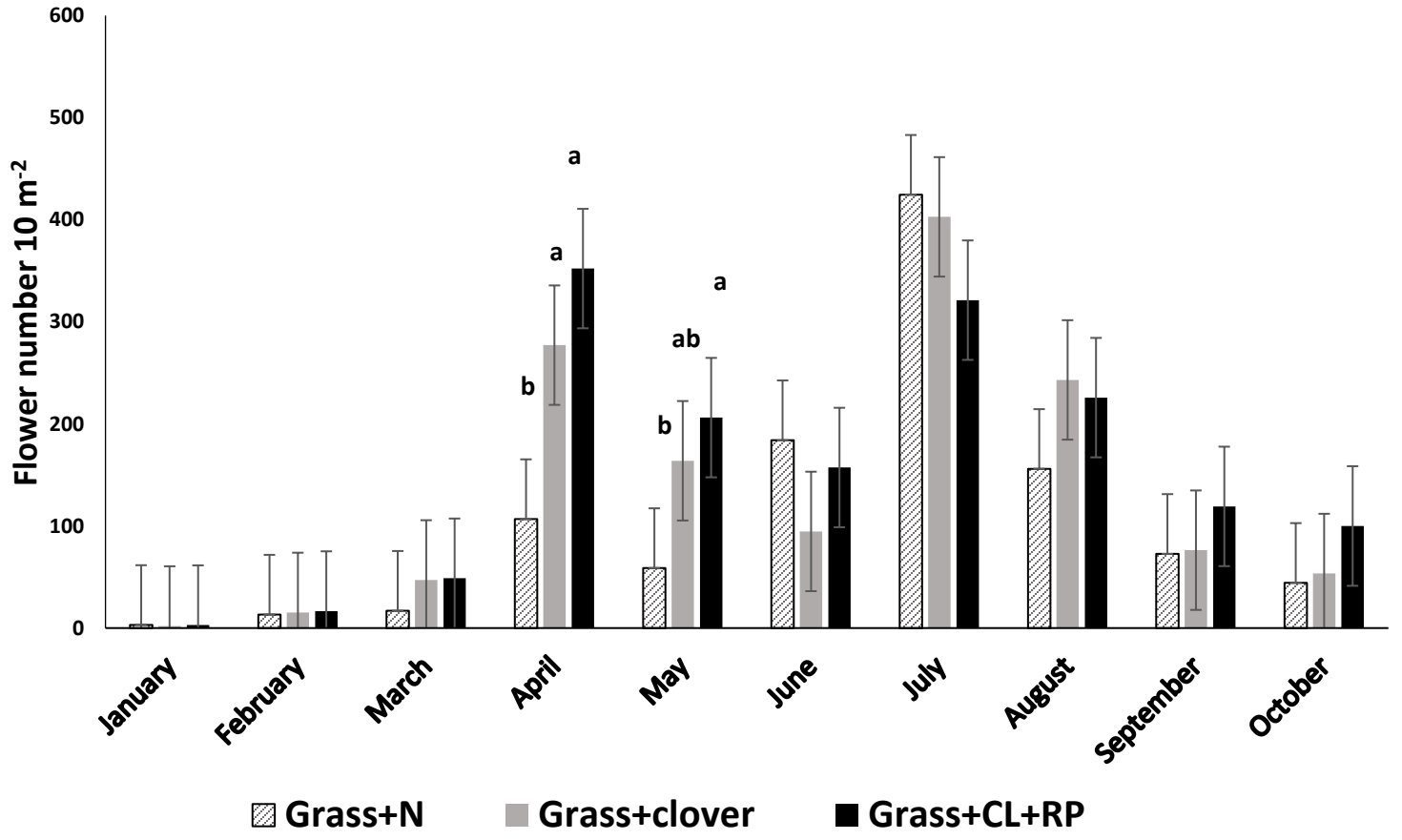
Flower survey



Treatment effect, *P* < 0.001

[a,b] Means differ, *P* < 0.05

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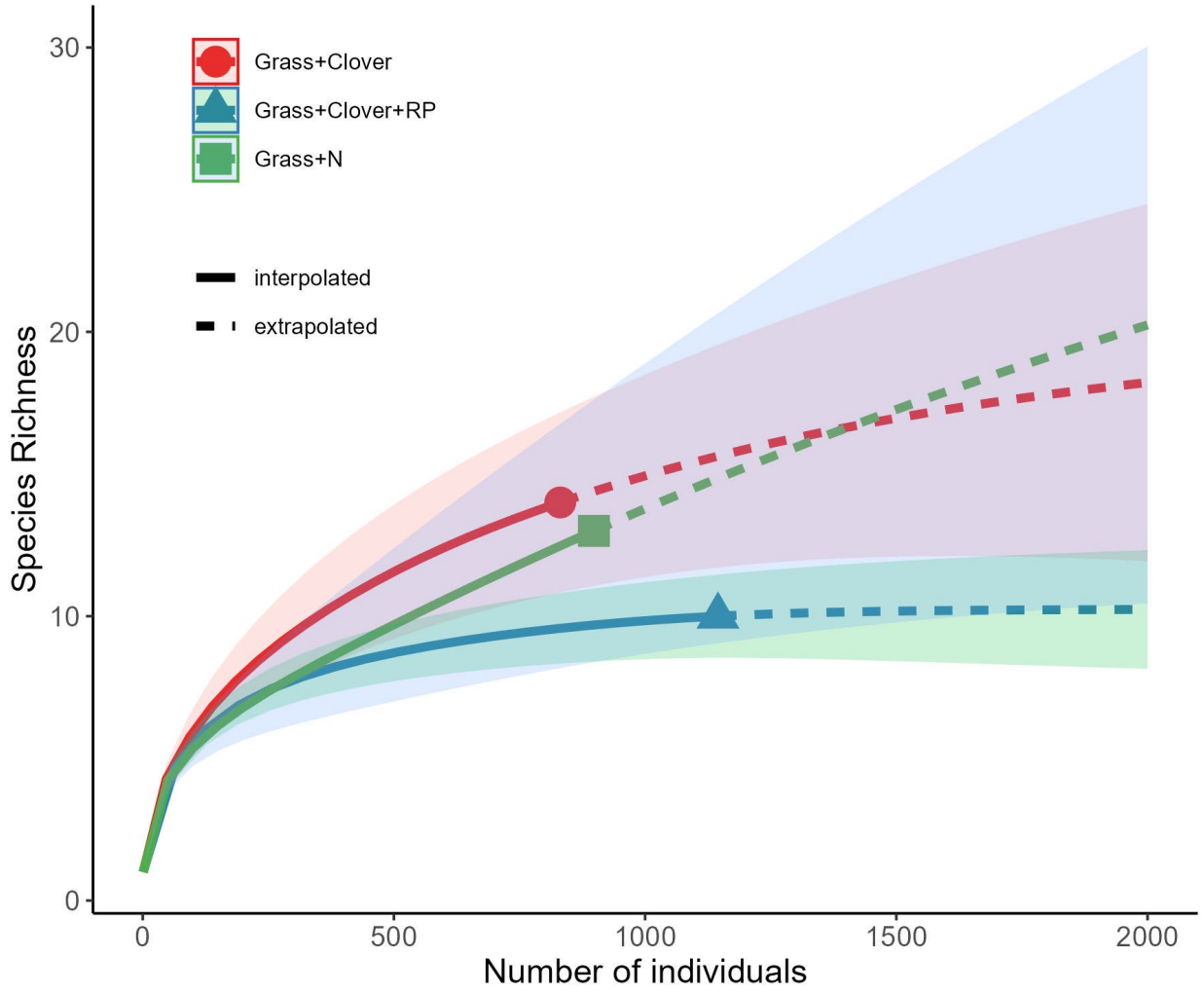
Accumulation curve



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Take home message

The introduction of legumes in the forage systems enhanced pollinator habitat leading to a greater presence of bees

Grassland vegetation structure and functioning affect bee population

Enhancing pollinator habitat, also improves other ecosystem services from grasslands

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