

Bee-friendly livestock systems

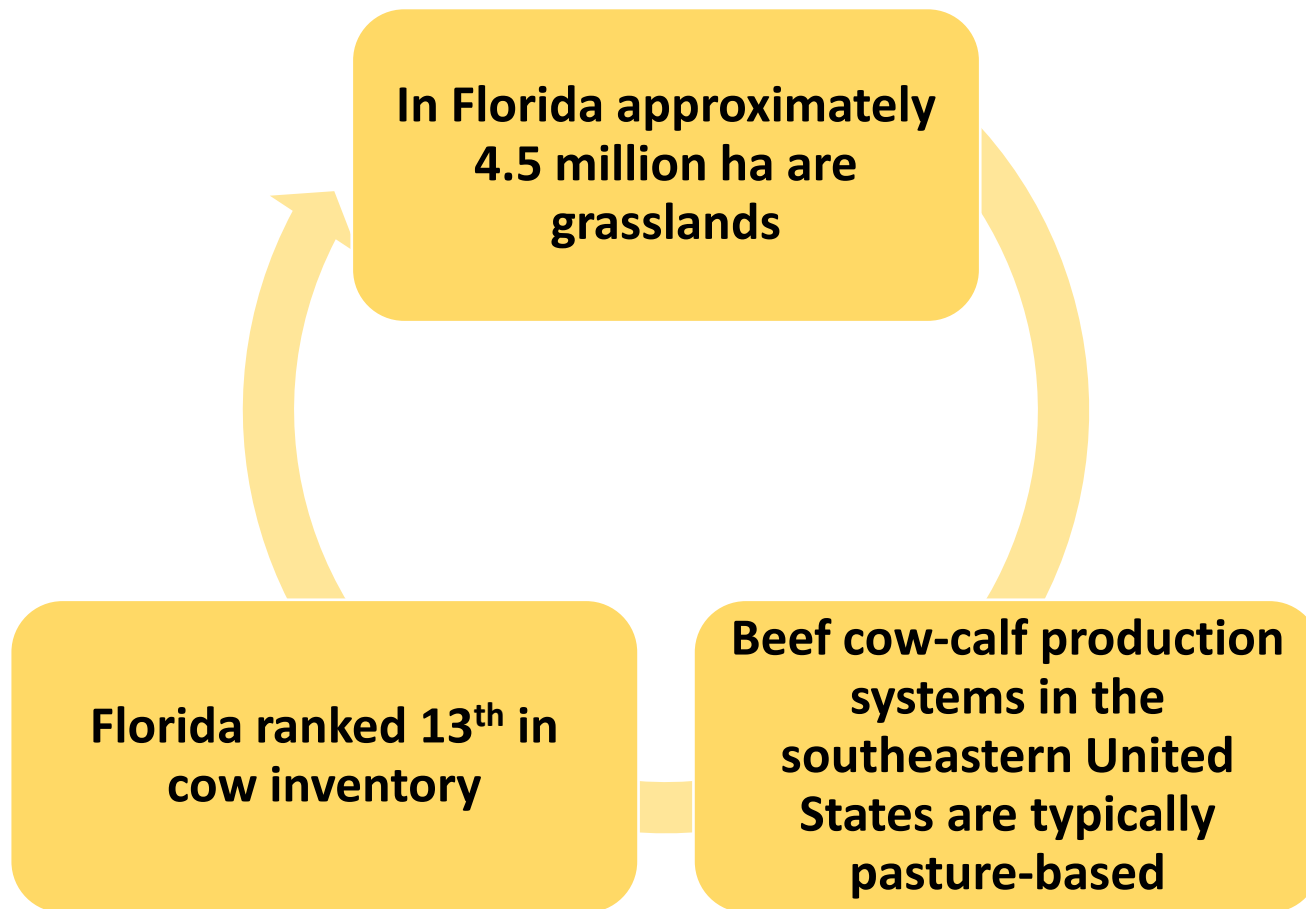


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EAAP 2024

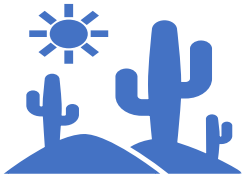
Where we are



Beef and forage systems in Florida



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)

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	1) Rye	2) Rye/Oat
10) Fallow	2) Grass	6) Grass-Legume	3) Grass	7) G-Leg-Brassica		3) Rye/Oat/Ryegrass	
8) G-Leg-Brassica	1) Grass	9) G-Leg-Brassica	4) Grass-Legume	6) Grass-Legume	II	4) Rye/Crimson	
3) Grass	7) G-Leg-Brassica	10) Fallow	2) Grass	5) Grass-Legume		5) Rye/Oat/Crimson/Ball	
5) Grass-Legume	8) G-Leg-Brassica	2) Grass	7) G-Leg-Brassica	4) Grass-Legume	I	6) Rye/Oat/Crimson/Ball/Red	
9) G-Leg-Brassica	1) Grass	6) Grass-Legume	10) Fallow	3) Grass		7) Rye/Crimson/Turnip	
						8) Rye/Ryegrass/Crimson/Ball/Turnip/Rape	
						9) Rye/Oat/Ryegrass/Crimson/Ball/red/Turnip/Rape/Kale	
						10) Fallow	

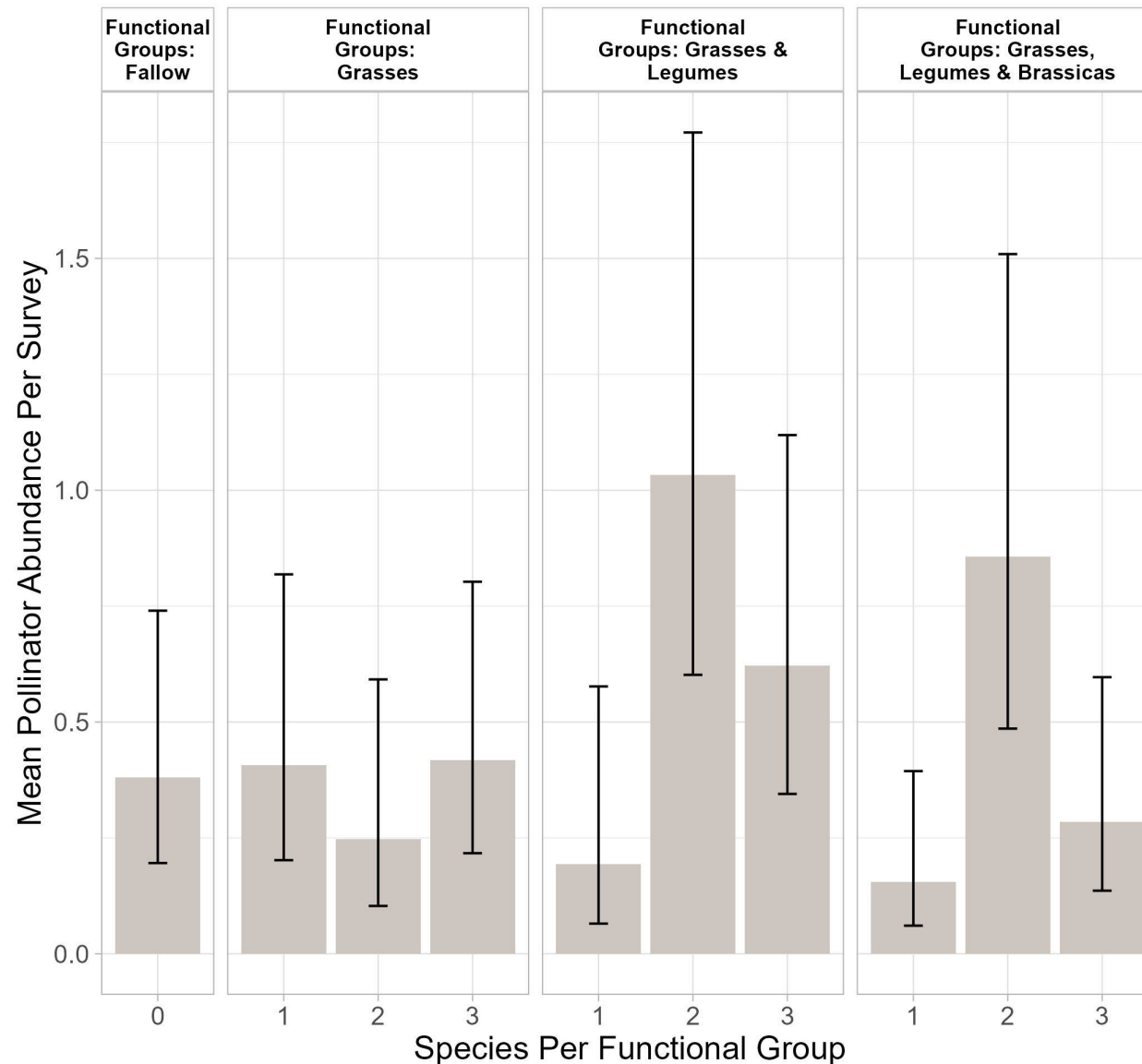
Methods



Bee Species

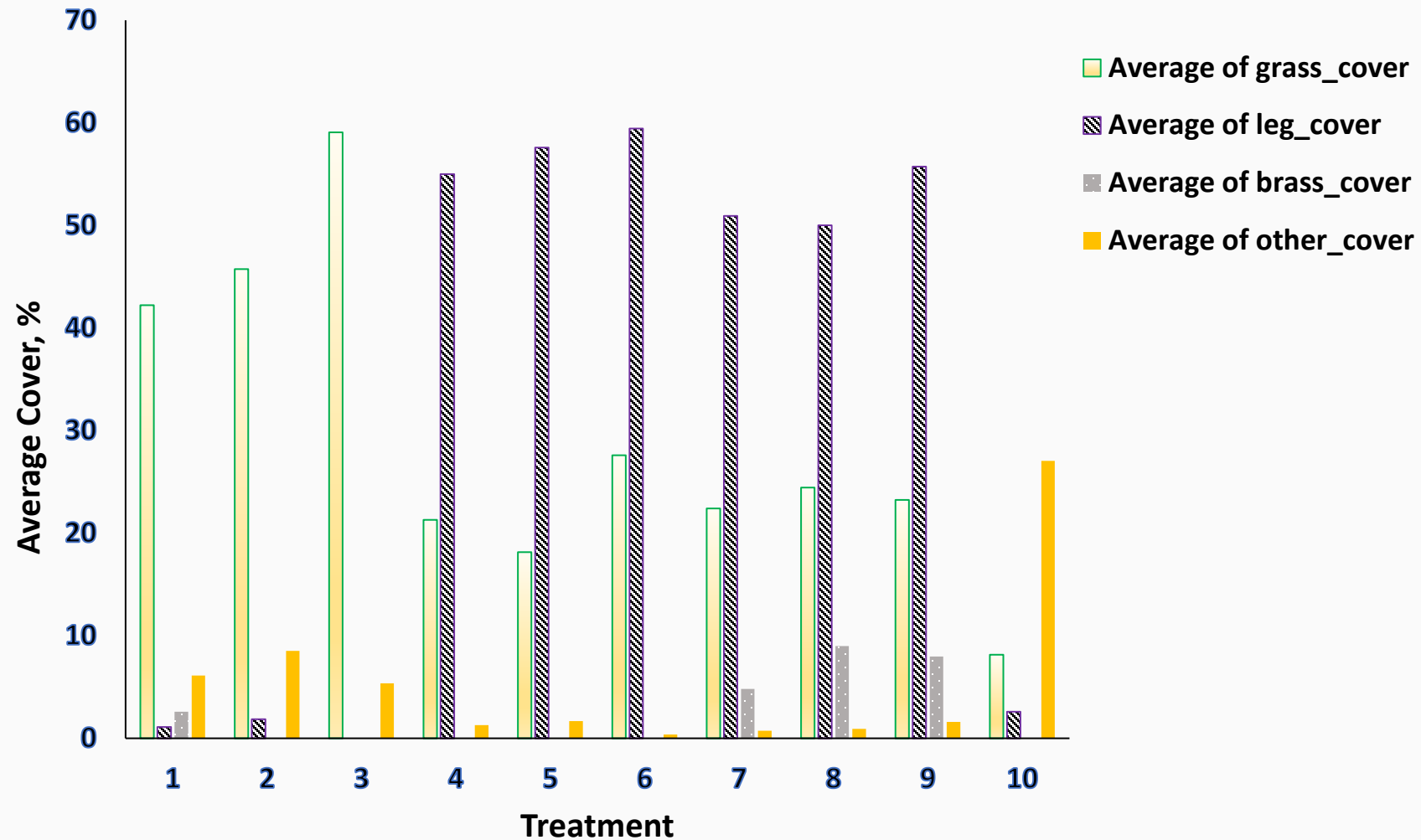
Species	Fallow	Grass	Grass Legume	Grass Legume Brassica	Grand Total
<i>Augochlora aurata</i>	2	27	44	32	105
<i>Augochloropsis metallica</i>	-	4	5	-	9
<i>Bombus impatiens</i>	2	-	8	7	17
<i>Osmia subfasciata</i>	-	-	1	-	1
<i>Halictus poeyi</i>	-	4	1	4	9
<i>Lasioglossum callidum</i>	-	3	2	1	6
<i>Lasioglossum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

Bee abundance emergence traps

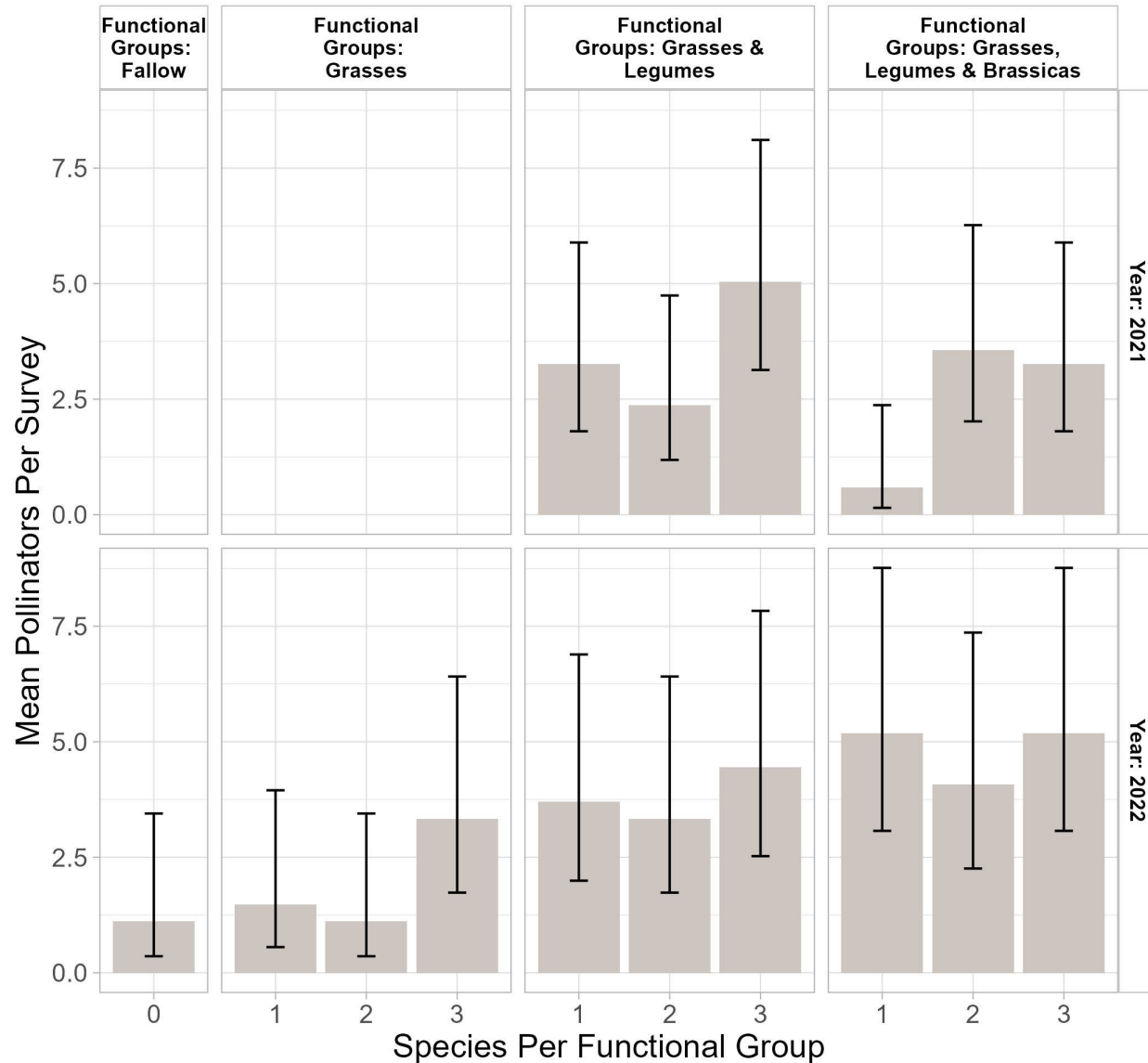


Treatment effect, $P < 0.02$

Average cover

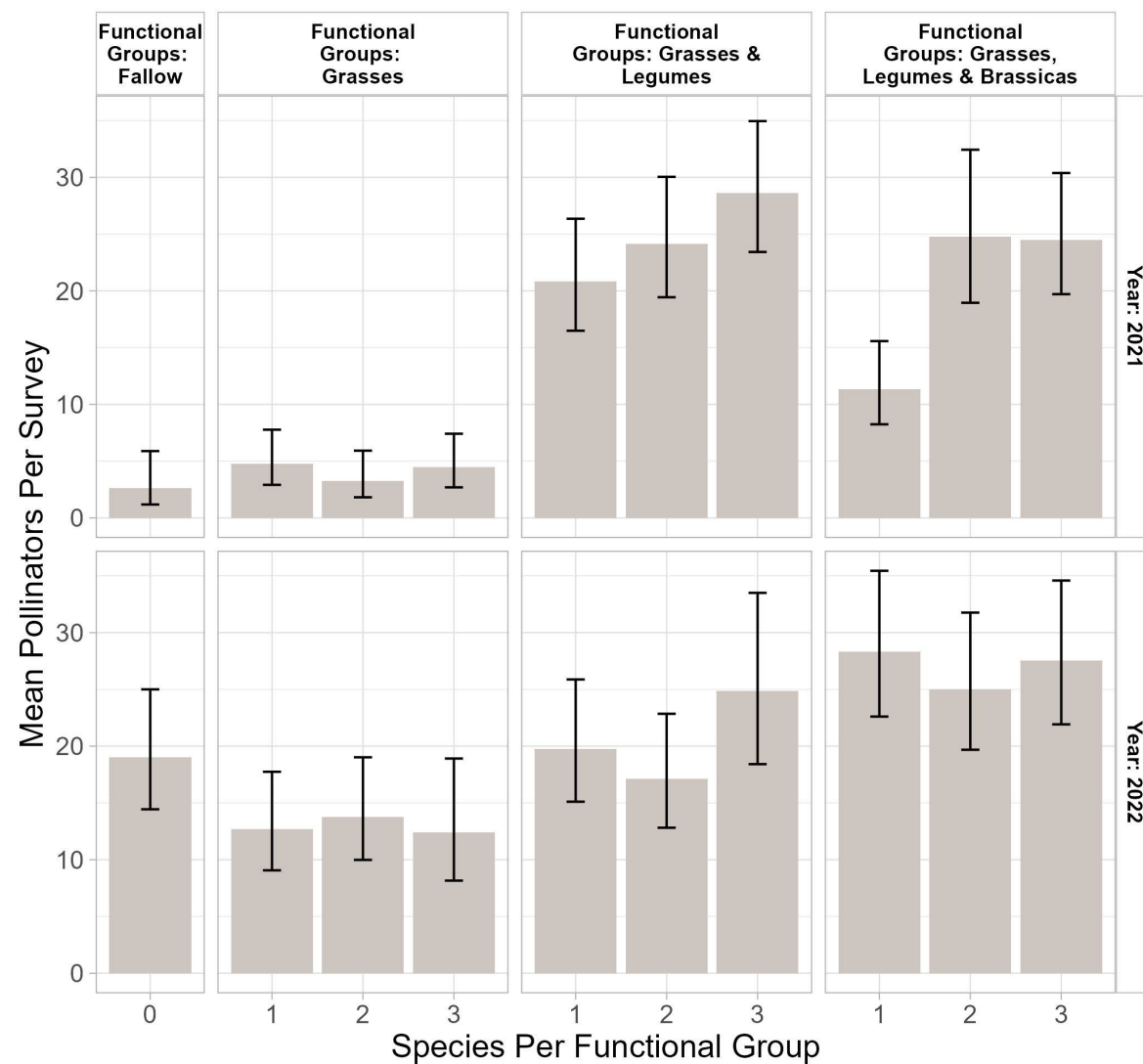


Bee species visual survey



Treatment effect, $P = 0.01$
Treatment $\times$ year,
 $P = 0.03$

All species observed



Treatment effect, $P < 0.001$

Treatment $\times$ year, $P < 0.001$

Grazing system



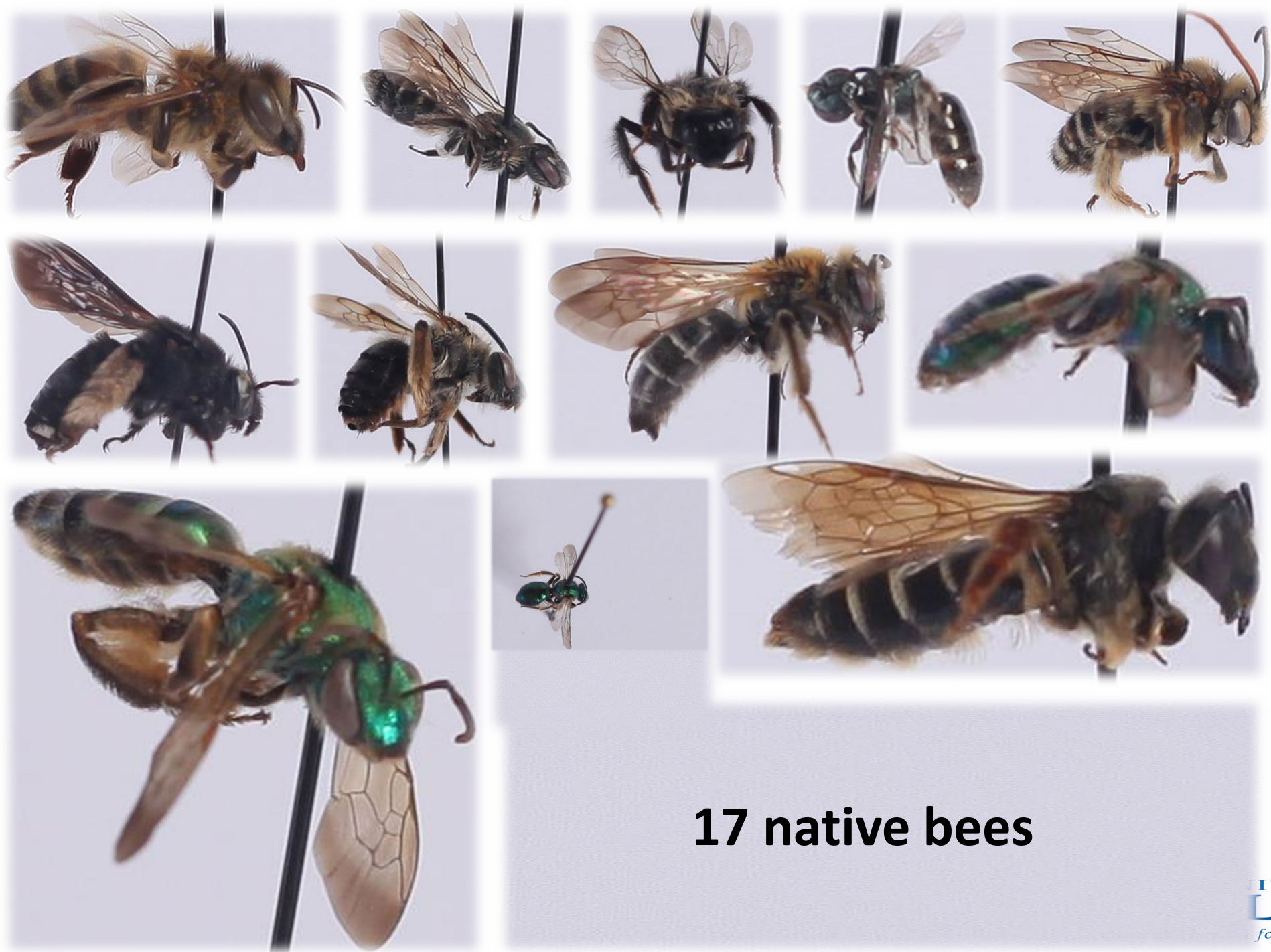
Treatments

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

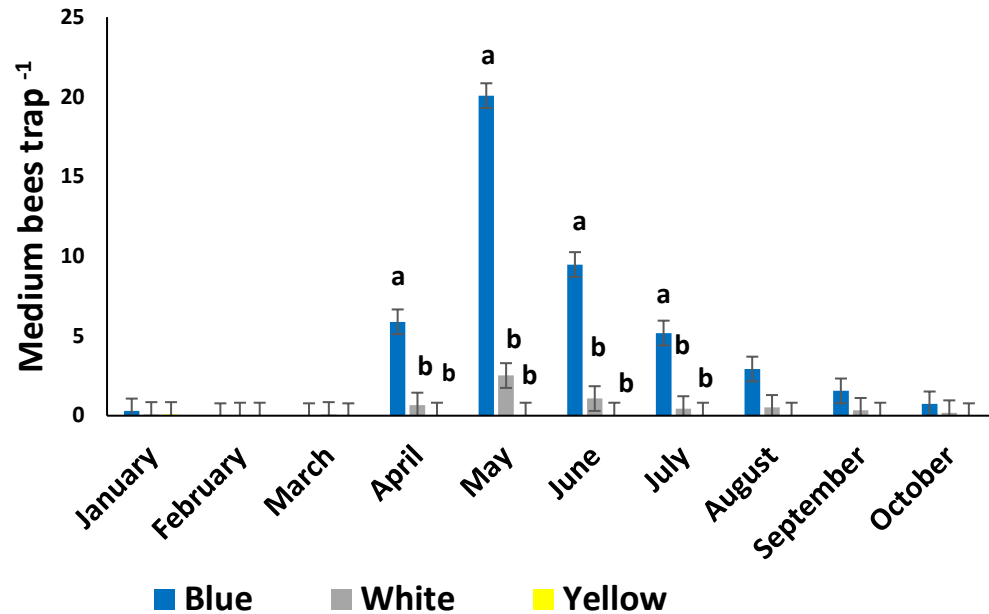
- Bee collection traps placed every 28 d
- Quadrats to measure flower abundance and richness
- Specimens collected are identified to species level



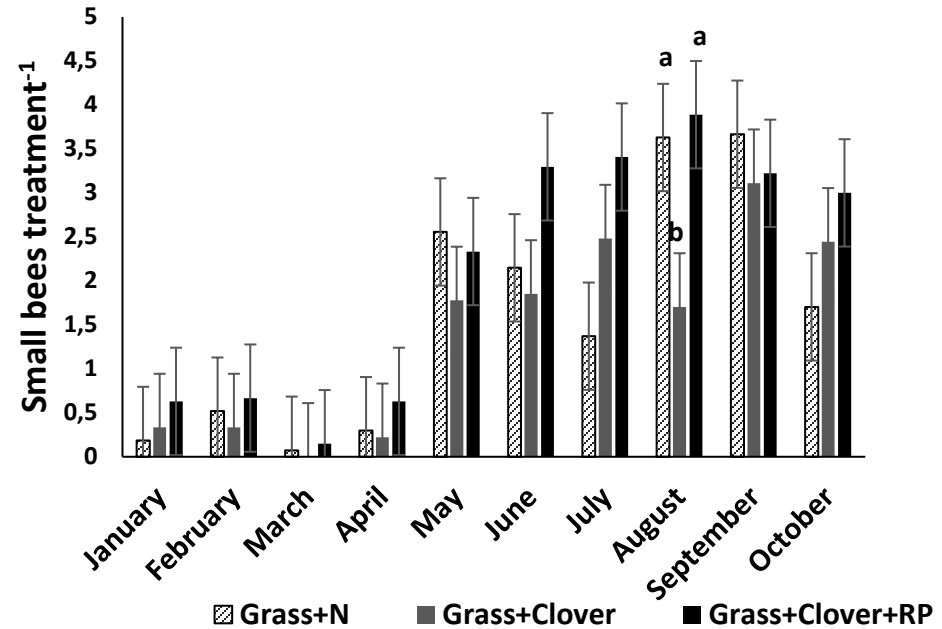


17 native bees

Medium and small bees



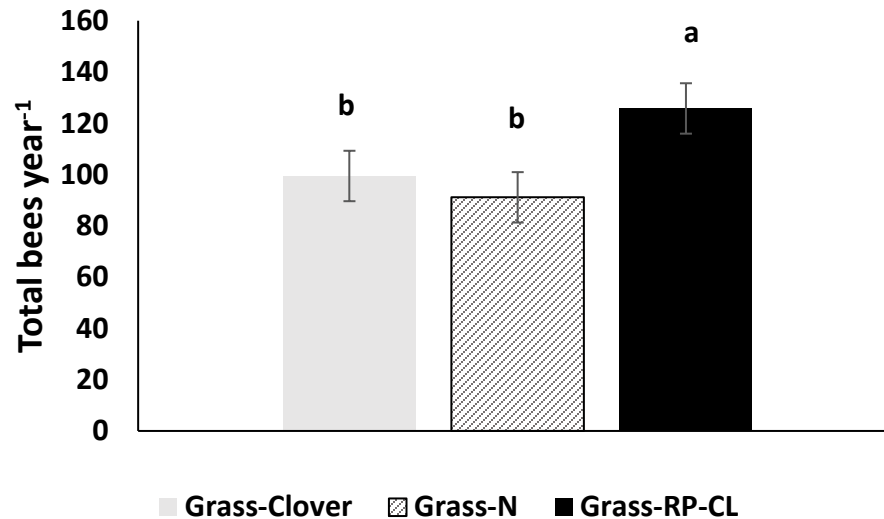
Trap color × evaluation, $P < 0.001$
^{a,b} Within month, means differ, $P < 0.05$



Treatment × Evaluation, $P < 0.001$
^{a,b,c} Within treatment, $P < 0.05$

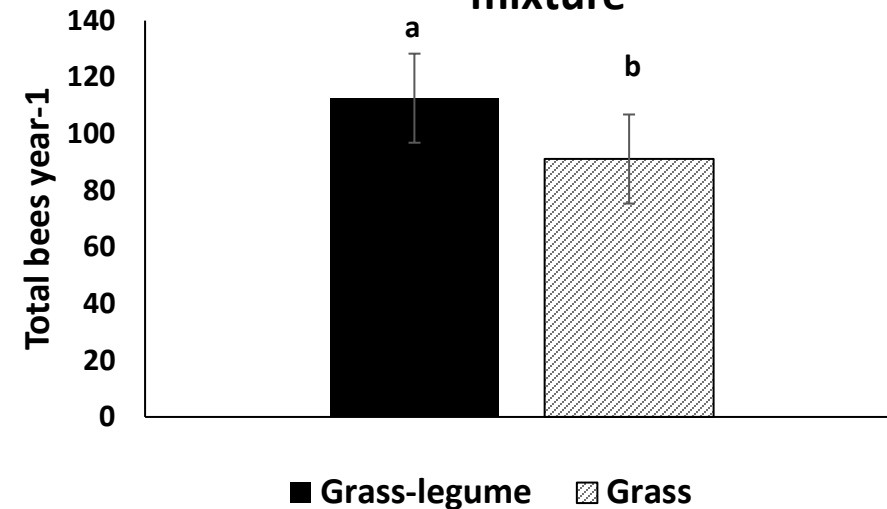
Bee Abundance

Abundance of bees by treatment



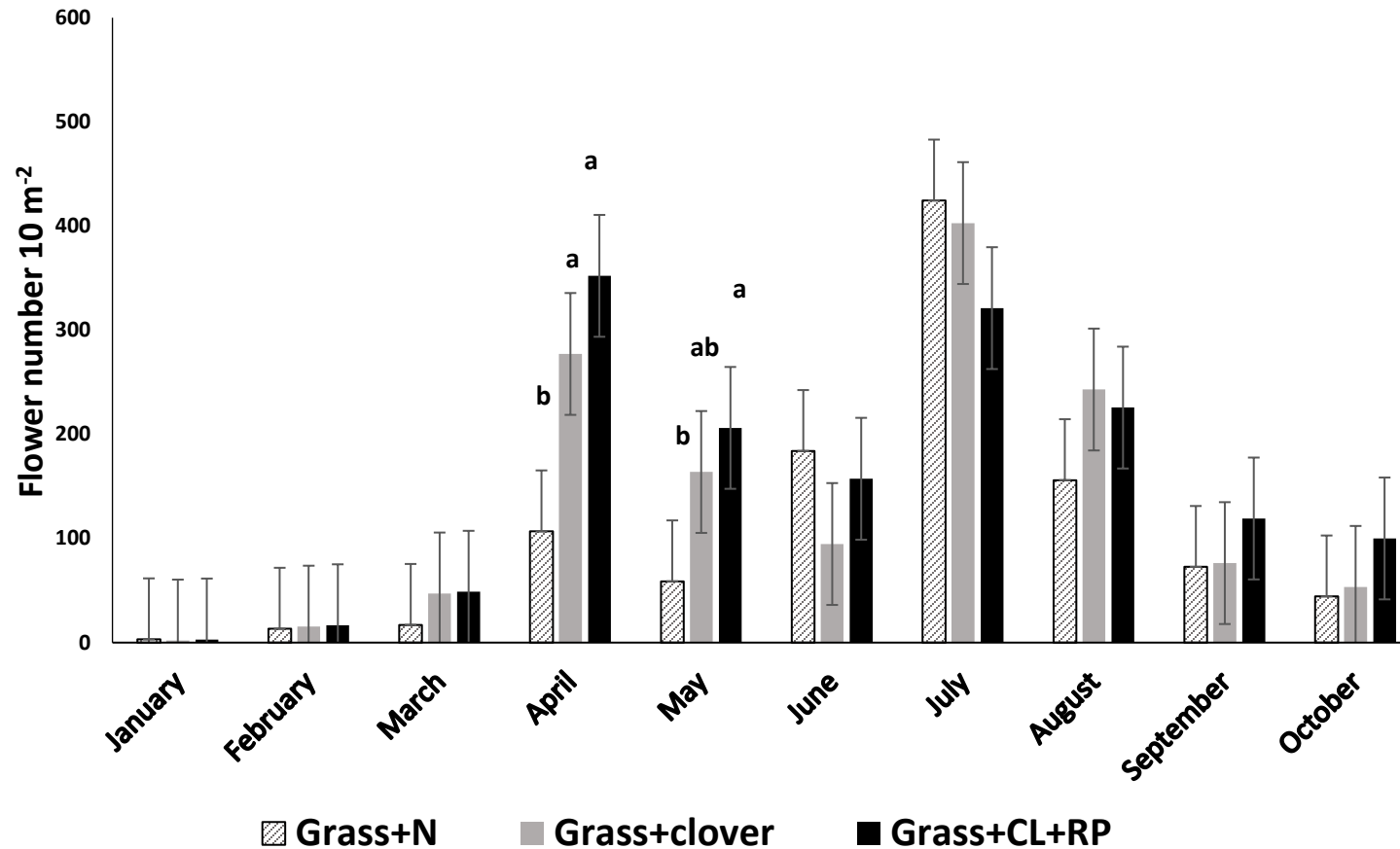
Treatment effect, $P = 0.003$
a,b Means differ, $P < 0.05$

Grass monoculture vs. grass-legume mixture



Contrast, $P = 0.01$
a,b Means differ, $P < 0.05$

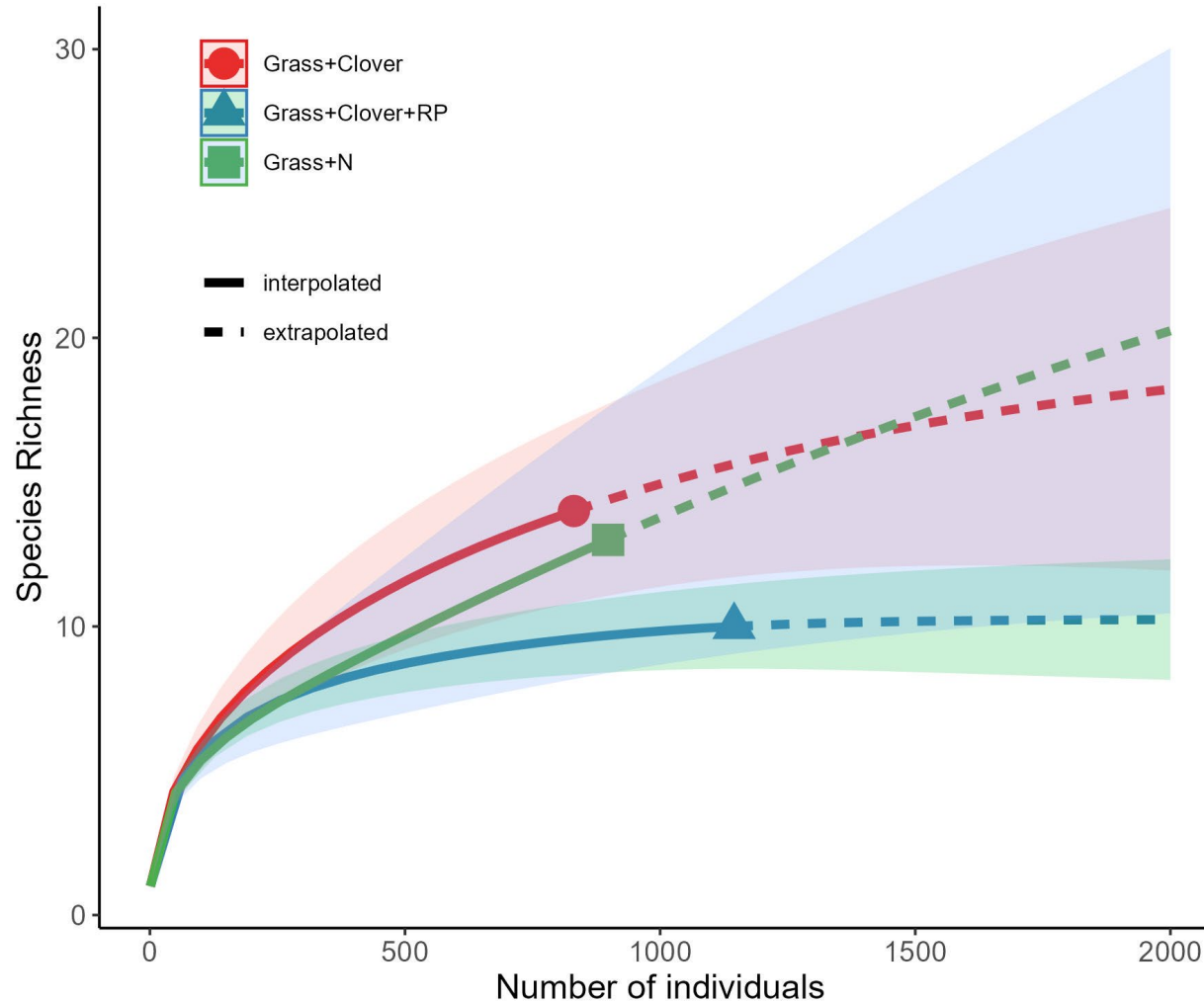
Flower survey



Treatment effect, $P < 0.001$

^{a,b} Means differ, $P < 0.05$

Accumulation curve



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