

Herbaceous species responses to tree cover differ by functional group in Southeast Asian savannas



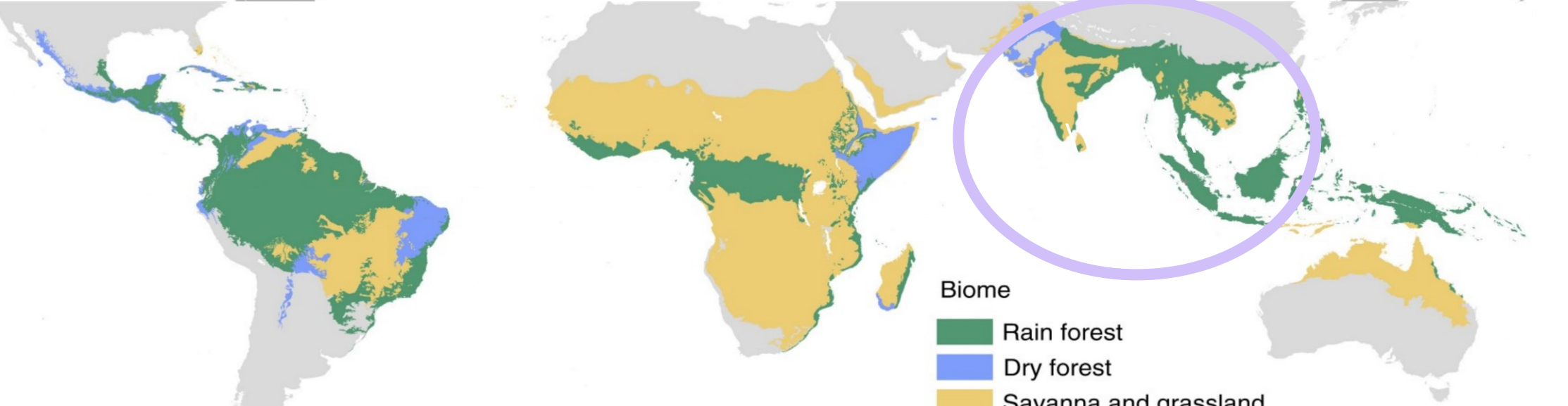
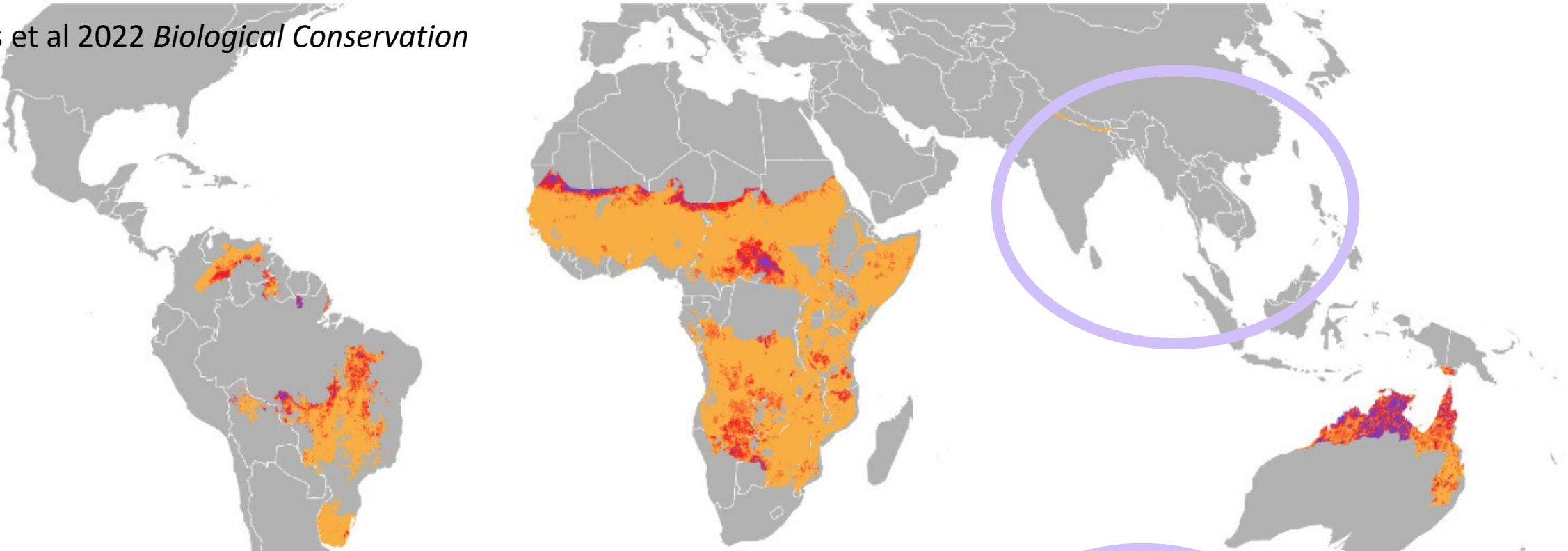
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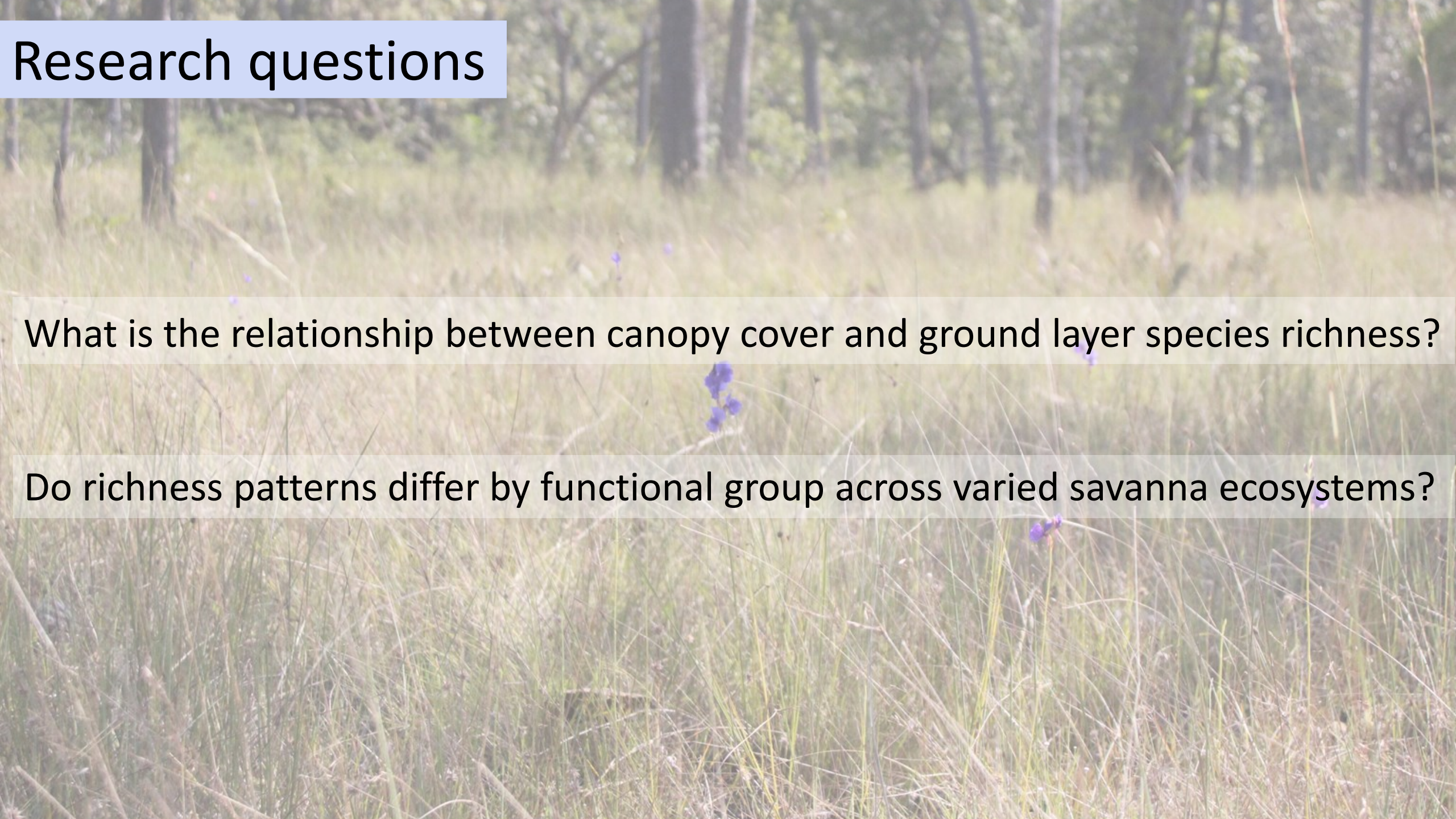
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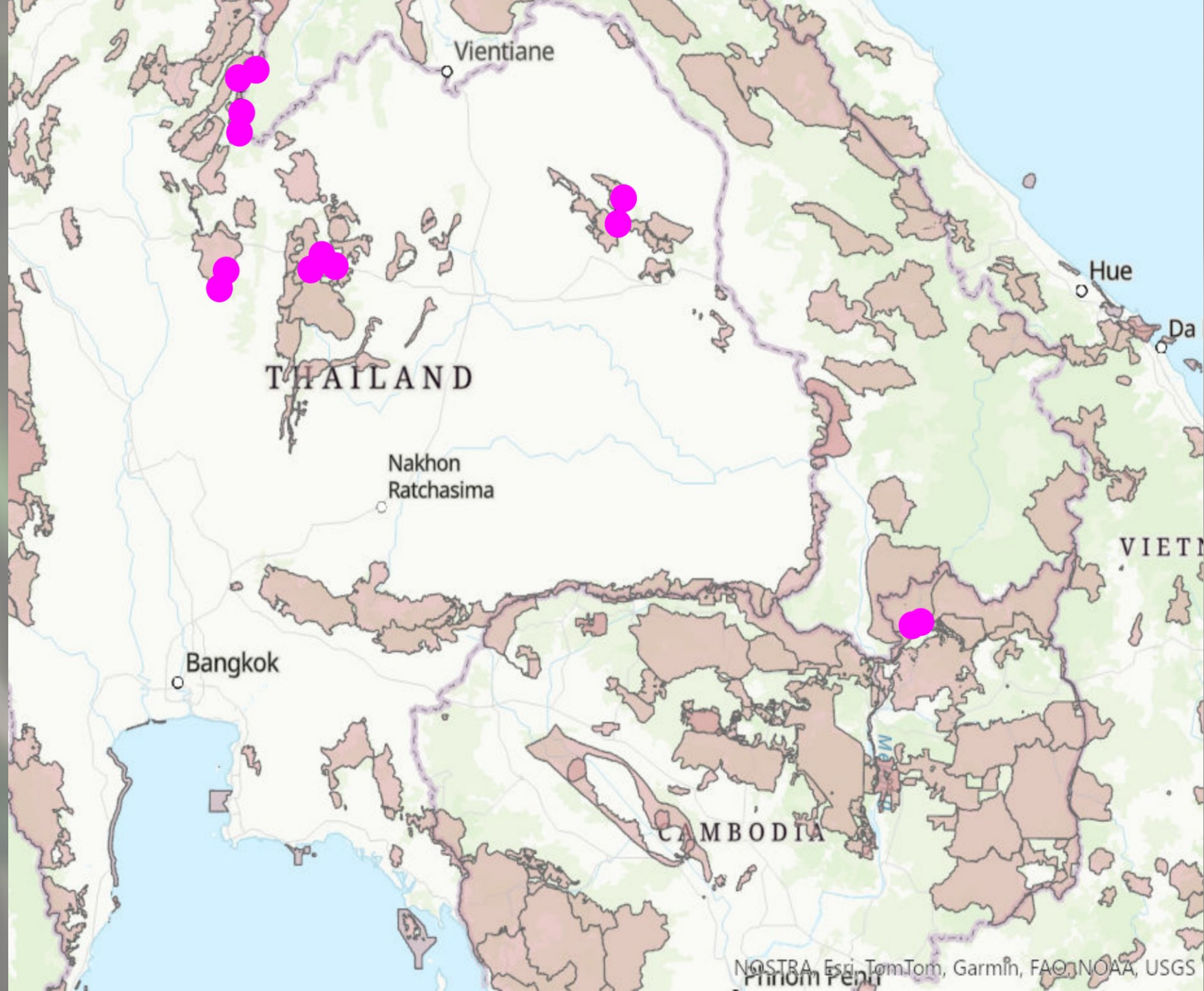
Research questions

The background image shows a savanna landscape. In the foreground, there is a dense field of tall, thin grasses, some of which are yellowish-brown, suggesting a dry season. A few small, purple flowers are scattered among the grass. In the background, there is a line of trees with green foliage, partially obscured by the grass. The overall scene is a natural, open environment.

What is the relationship between canopy cover and ground layer species richness?

Do richness patterns differ by functional group across varied savanna ecosystems?

Location





Shorea



Dipterocarpus

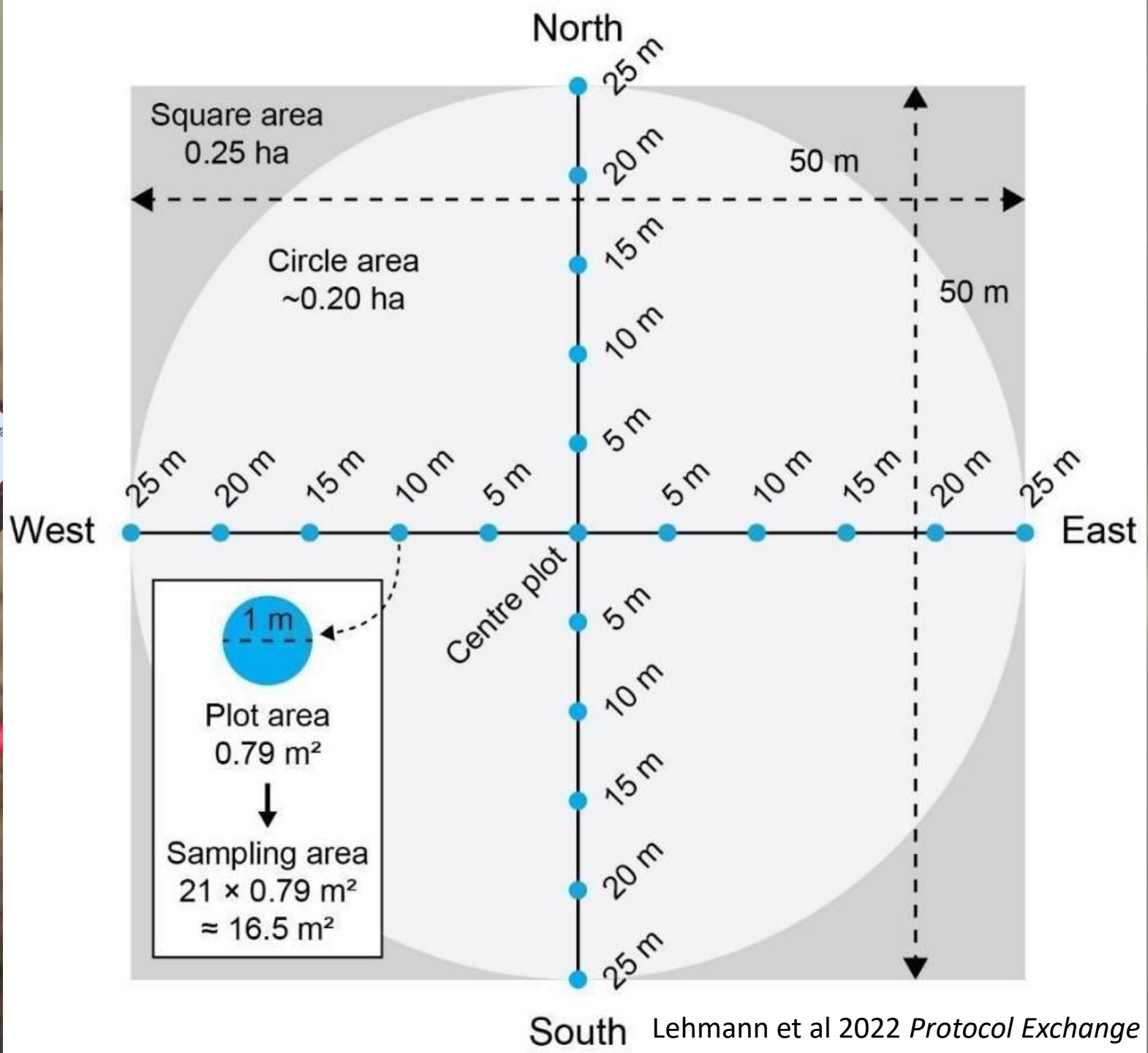


Pterocarpus



Pinus

Methods



Sampling

Savanna Type	<i>Dipterocarpus</i>	<i>Pinus</i>	<i>Shorea</i>	<i>Pterocarpus</i>
# Plots	210	210	483	147
# Sites	10	10	23	7
% Total	20	20	46	14
Canopy cover range (%)	12-85	1.6-91	0-99	4.2-23
Country	Cambodia	Thailand	Thailand	Thailand

Results

C4 grass



C3 grass



Sedge



Monocot



Dicot



Dipterocarpus

40

14

28

26

142

Pinus

26

6

13

14

32

Shorea

49

12

24

33

177

Pterocarpus

28

5

11

6

48

Analyses

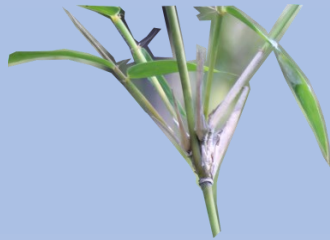
Generalized linear mixed models to predict the effect of increasing canopy cover on:

- Total species richness

- C4 grass



- C3 grass



- Sedge



- Non-graminoid monocot



- Herbaceous dicot



Analyses

Savanna type and canopy cover

Savanna type + canopy cover + (1|Site)

- Total species richness – incl. unidentified grasses

- C4 grass



- Sedge



- Non-graminoid monocot



Just savanna type

Savanna type + (1|Site)

- C3 grass



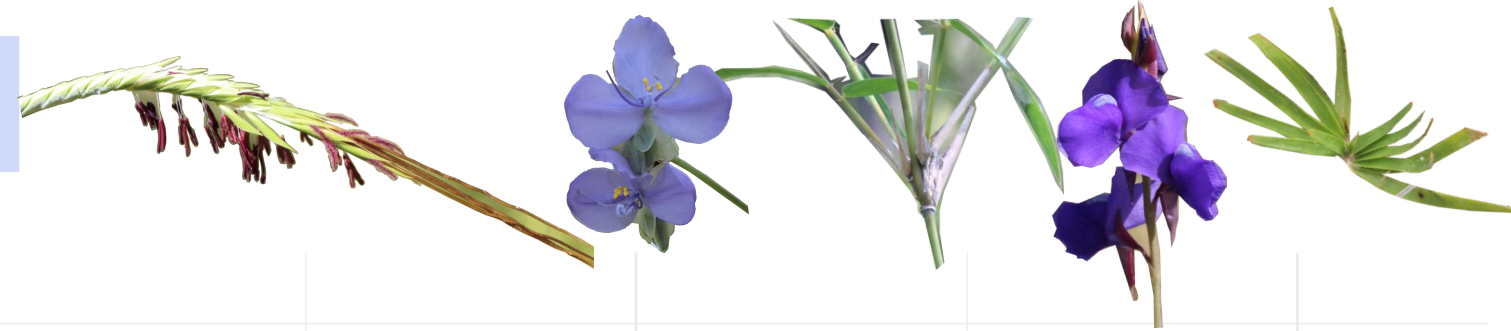
- All forbs



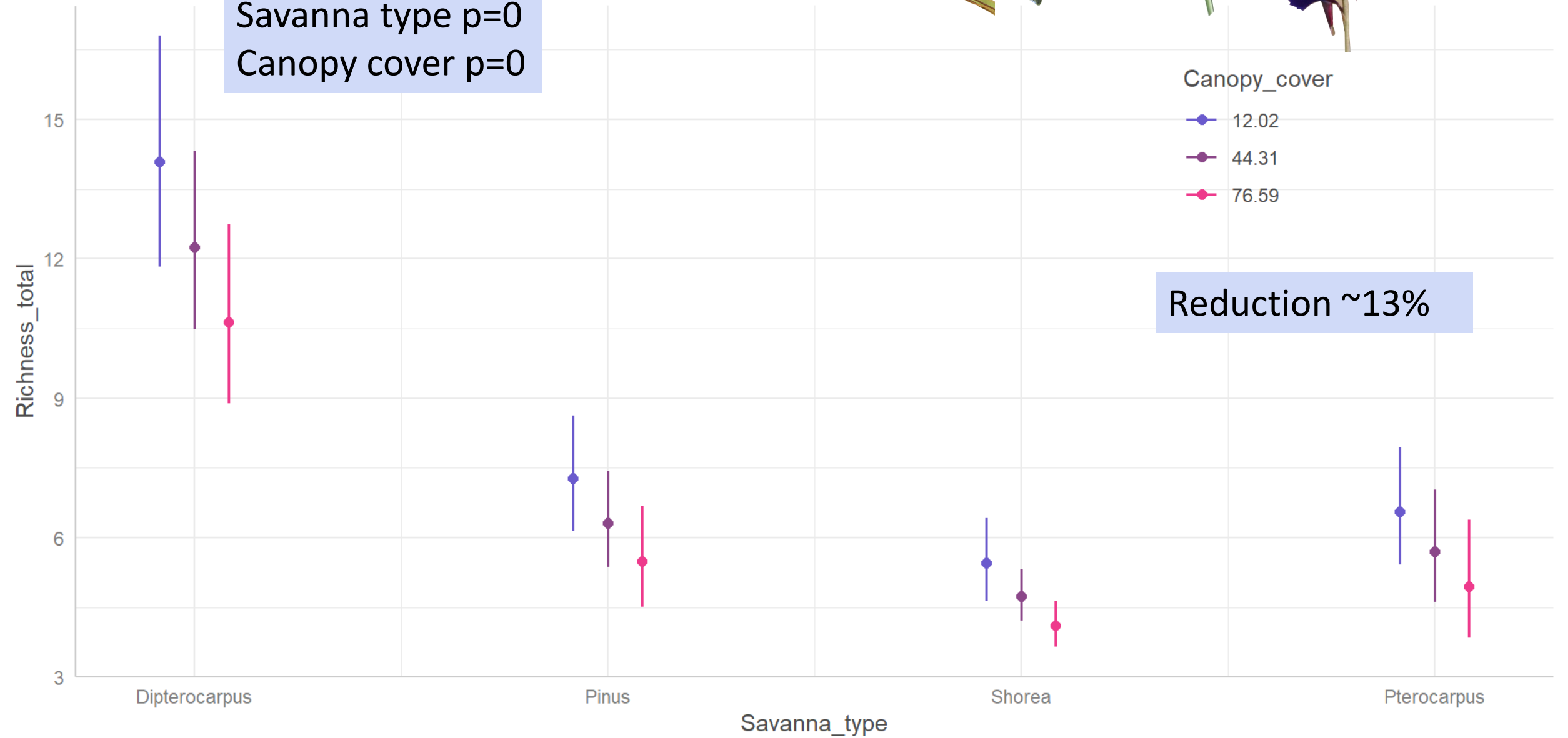
- Herbaceous dicot



Results – total richness

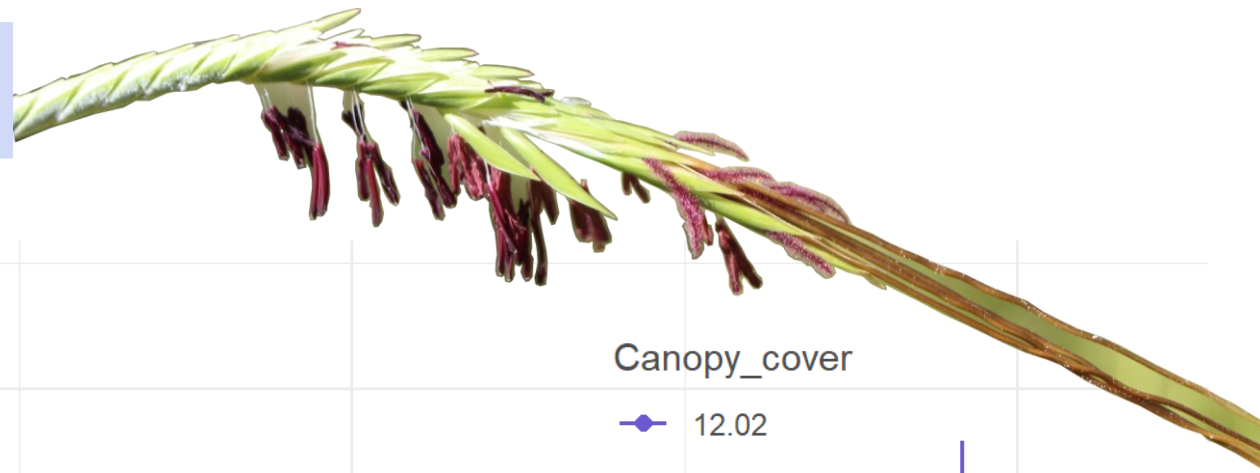


Savanna type p=0
Canopy cover p=0

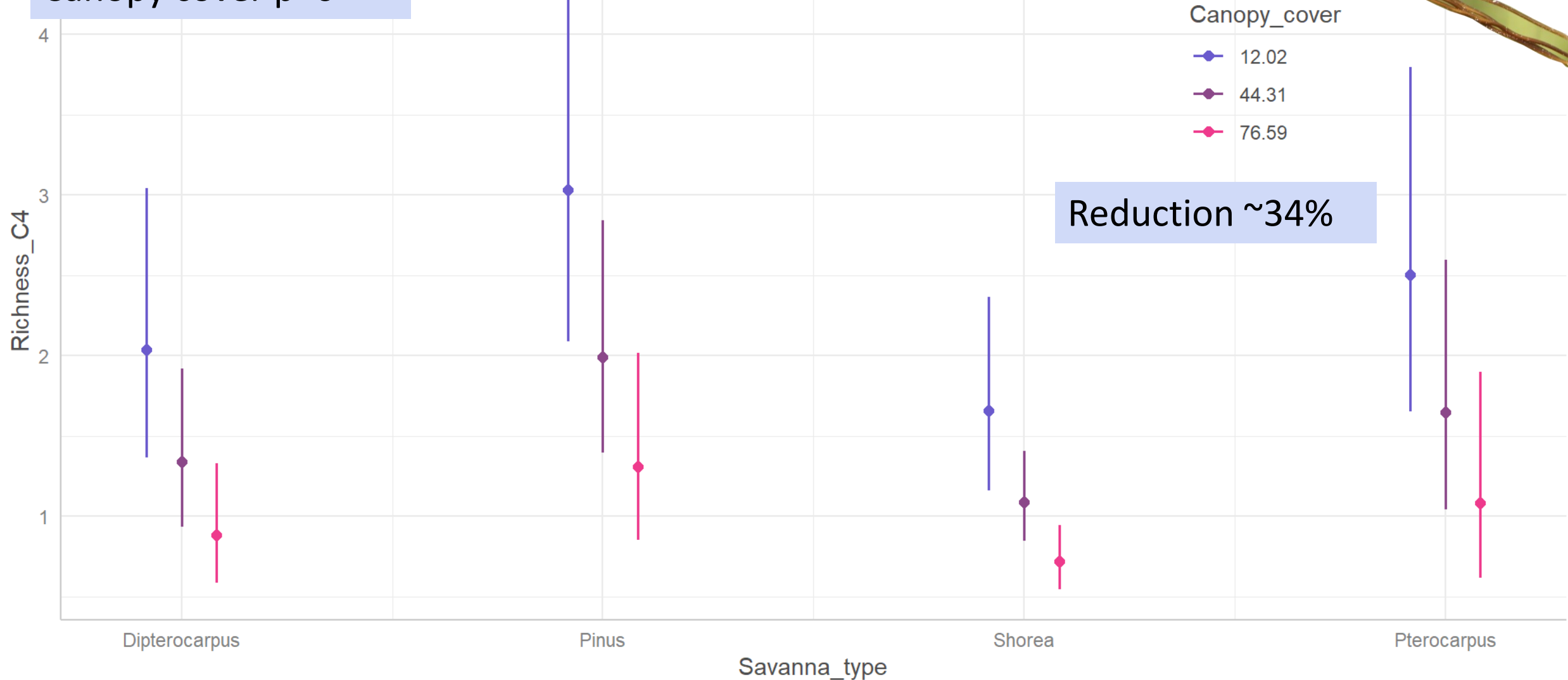


Reduction ~13%

Results – C4 grass richness

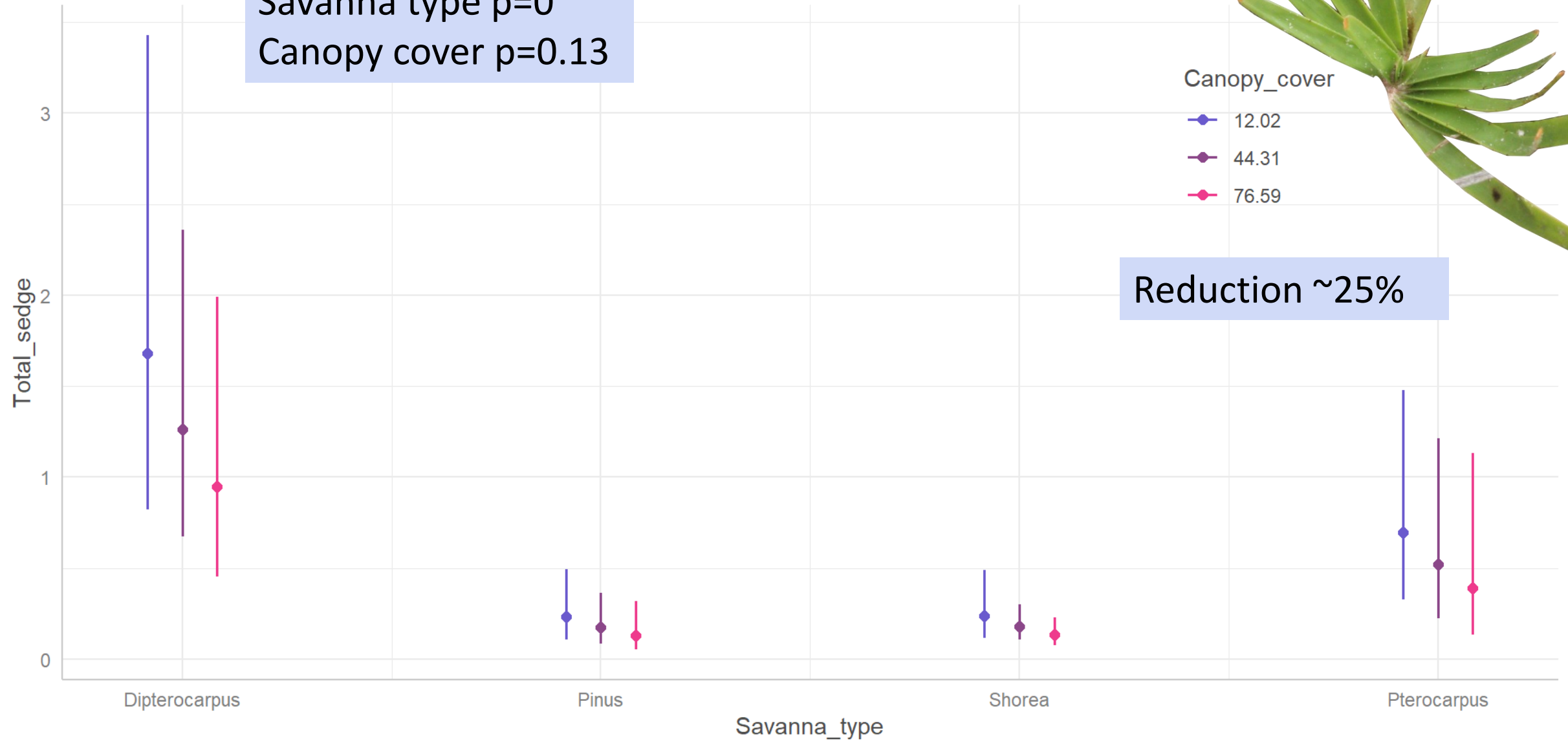


Savanna type p=0.06
Canopy cover p=0



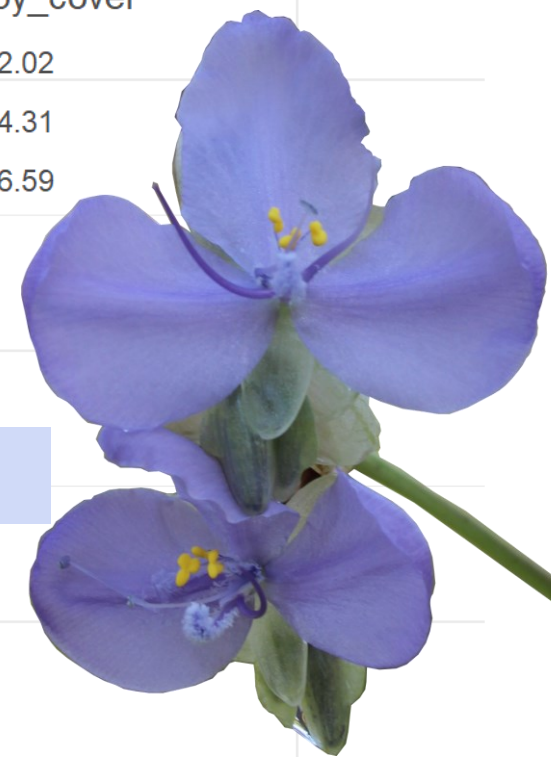
Results – sedge richness

Savanna type p=0
Canopy cover p=0.13



Results – non-grass monocot richness

Savanna type p=0
Canopy cover p=0.01



Interpretation

- C4 grass decline is expected under shadier conditions
- As C3 grasses are adapted to shade, it isn't surprising that canopy cover is not a relevant factor
- Would we see divergent patterns between C3 and C4 sedges?
- Monocots are often sensitive to shade especially geophytes which are common in fireprone ecosystems.
- Savanna type explains dicot richness but doesn't disaggregate factors ie nutrient differences.

Conclusion

- Species richness declined under increasing canopy cover across savanna ecosystems in C4 grasses, sedges, and non-graminoid monocot herbs
- Monocots and dicots displayed differing responses to increasing canopy cover
- Monocots experienced the largest declines
- Future studies should avoid categorising herbaceous plants together to better predict ecosystem-level patterns
- We need to consider forbs in savannas!