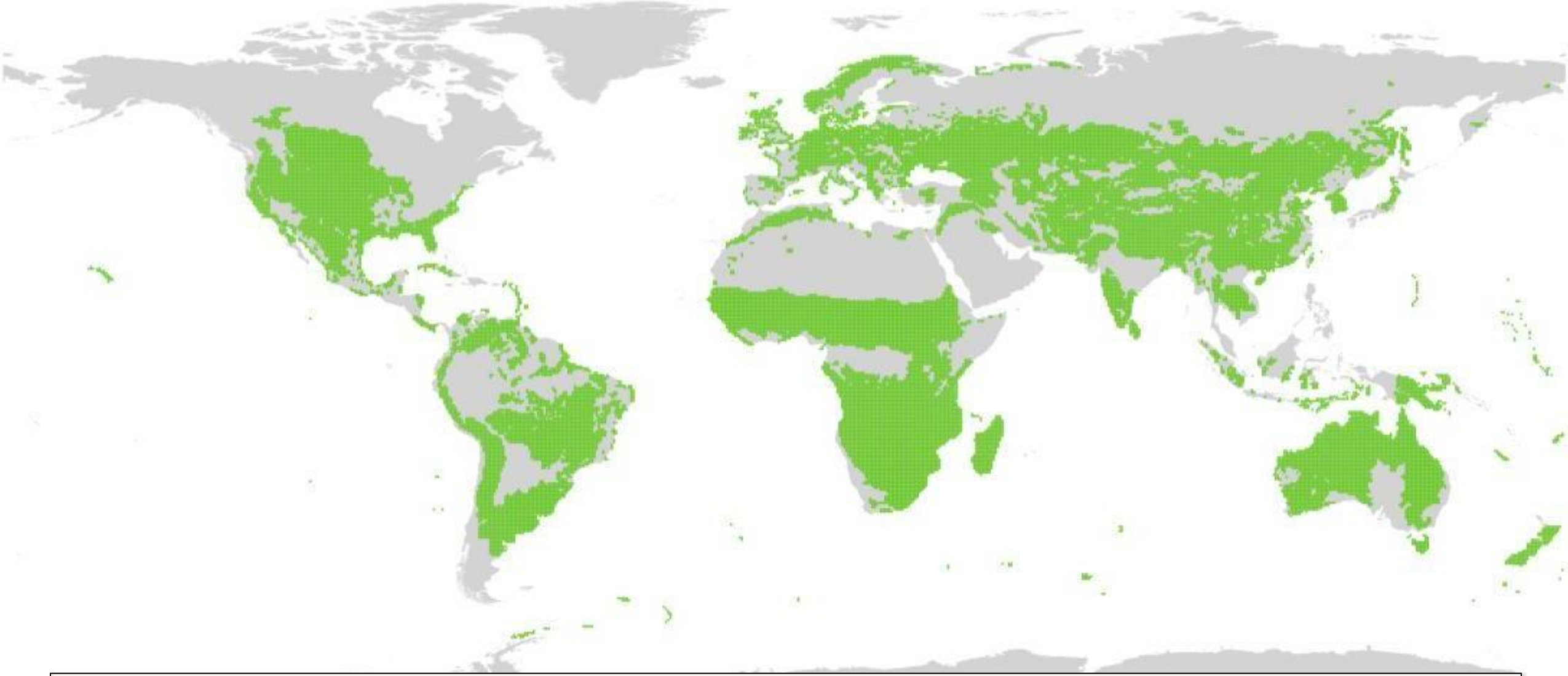
RETHINKING GRASSLANDS: A SYNTHESIS OF 252 GRASSLAND AND SAVANNA SITES INVESTIGATING GRASS AND FORB COMPOSITION AND ITS RESPONSE TO GRAZING

Rosalie S. Terry[1], Koerner, S.E[1]., & Grazing Exclosure Consortium

[1]Department of Biology, University of North Carolina Greensboro



Grasslands cover **30 - 40%** of the land on Earth!

Lehman et al (in prep)

HOW DO WE DESCRIBE AND CONDUCT RESEARCH ON SUCH A BROAD ECOSYSTEM?

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COMMON GRASSLAND GENERALIZATIONS

What's there?

What drives abundance?

What drives richness?

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Non-graminoid, vascular, herbaceous plants

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WHAT THAT LOOKS LIKE:

SO WHAT ABOUT...

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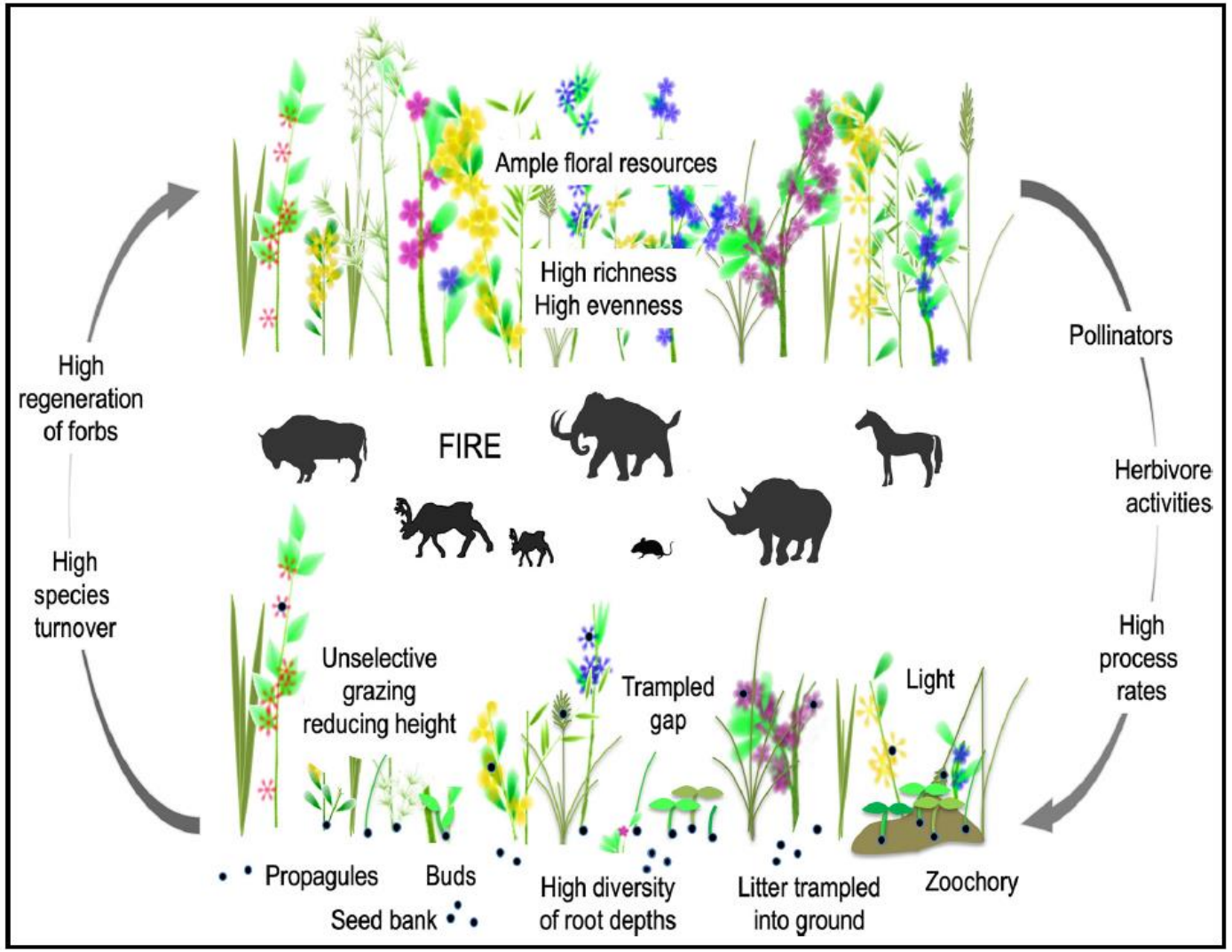
OR…

- Pleistocene era grasslands dominated by forbs – **forblands!**
- Maintained by megafauna

The paradox of forbs in grasslands and the legacy of the mammoth steppe

Kari Anne Bråthen[1*], Francisco I Pugnaire[2], and Richard D Bardgett[3]

Front Ecol Environ 2021; 19(10):584–592, doi:10.1002/fee.2405



SO WHAT DO OUR GRASSLANDS LOOK LIKE TODAY?

Lehman et al (in prep)


MAIN QUESTIONS

DO GRASSLANDS GLOBALLY HAVE GRAMINOID-DRIVEN COVER AND FORB-DRIVEN RICHNESS?

What variables explain grassland plant composition globally?

What does composition look like at the site level?

Are there still forblands?

DOES GRAZING INCREASE FORB RICHNESS AND DECREASE GRAMINOID COVER?

What variables explain differences in grassland composition response to grazing?

Do modern herbivores push grasslands towards forblands?


METHODS

DATA

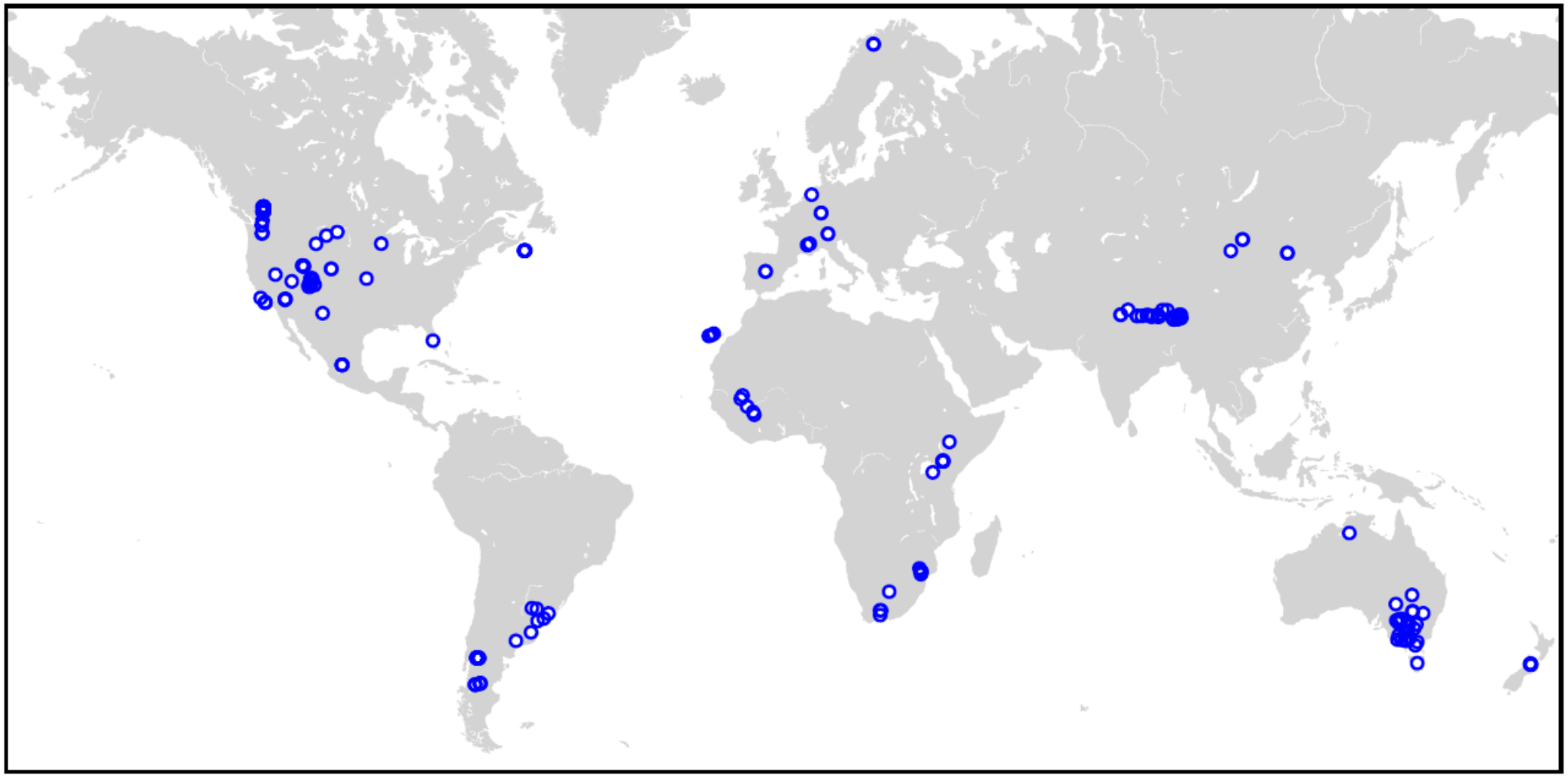
Grazing Exclosure (GEx) Data

- 252 sites
- Annual plant community composition in paired grazed and ungrazed plots at each site
- Climate data
- Herbivore data

CoRRE Trait Data

- 17 traits for 4079 plant species
- Growth form for each species found in GEx data
- Komatsu, K.J. *et al.* (2024) *Scientific Data.*

GEX SITES

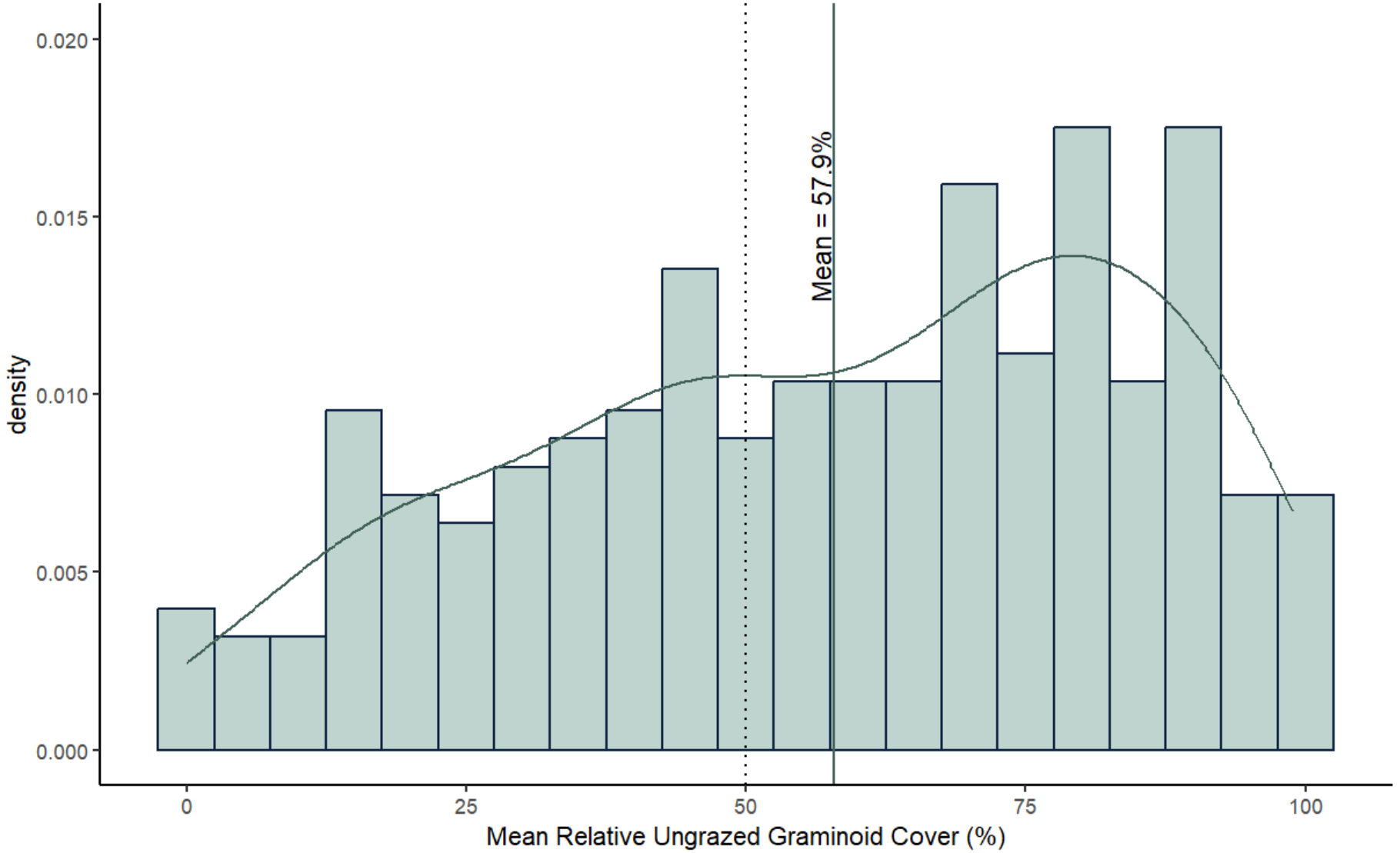



RESULTS

COMPOSITION

Do grasslands globally have graminoid-driven cover and forb-driven richness?

DO GRAMINOIDS MAKE UP MAJORITY OF COVER?



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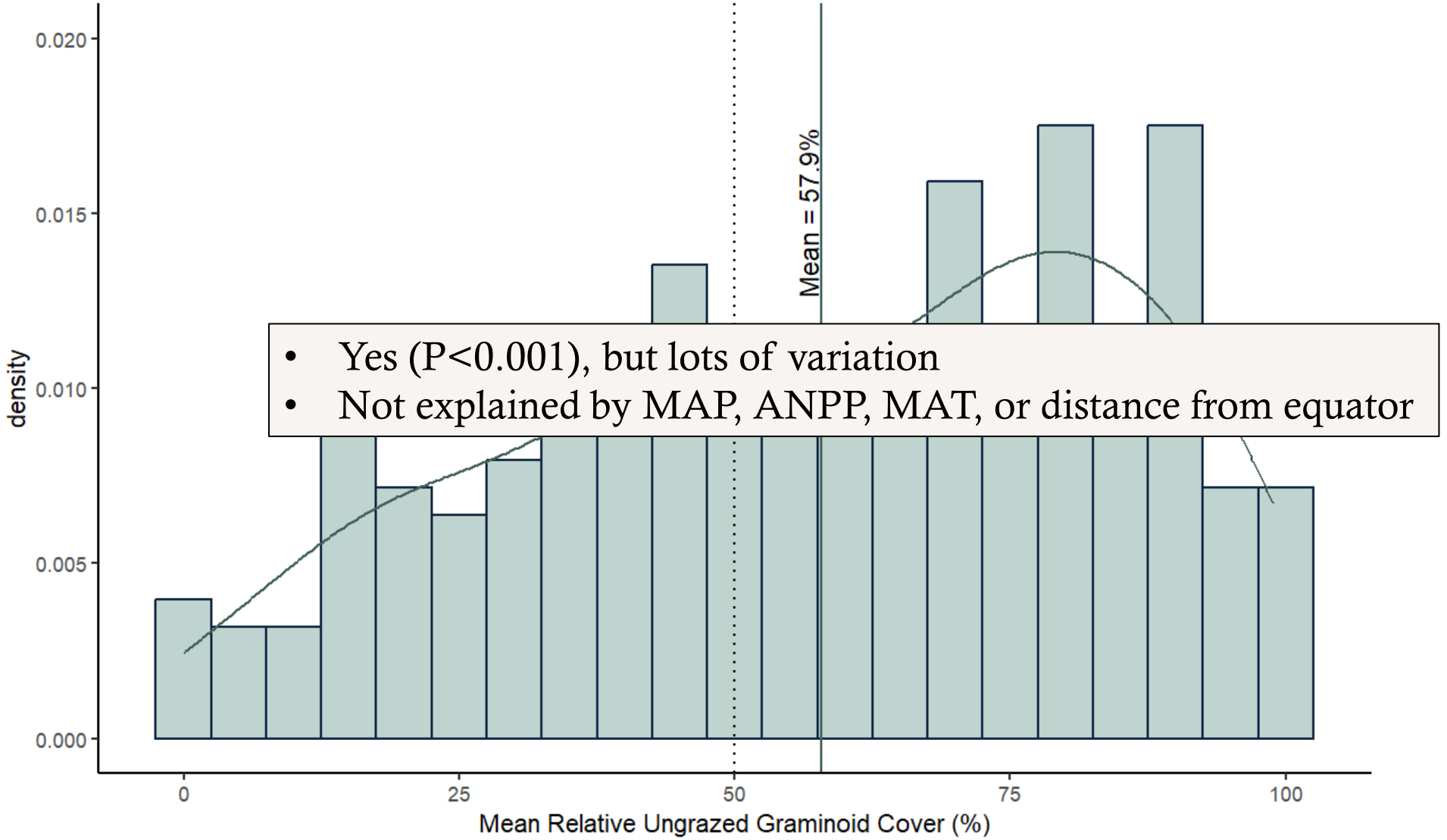
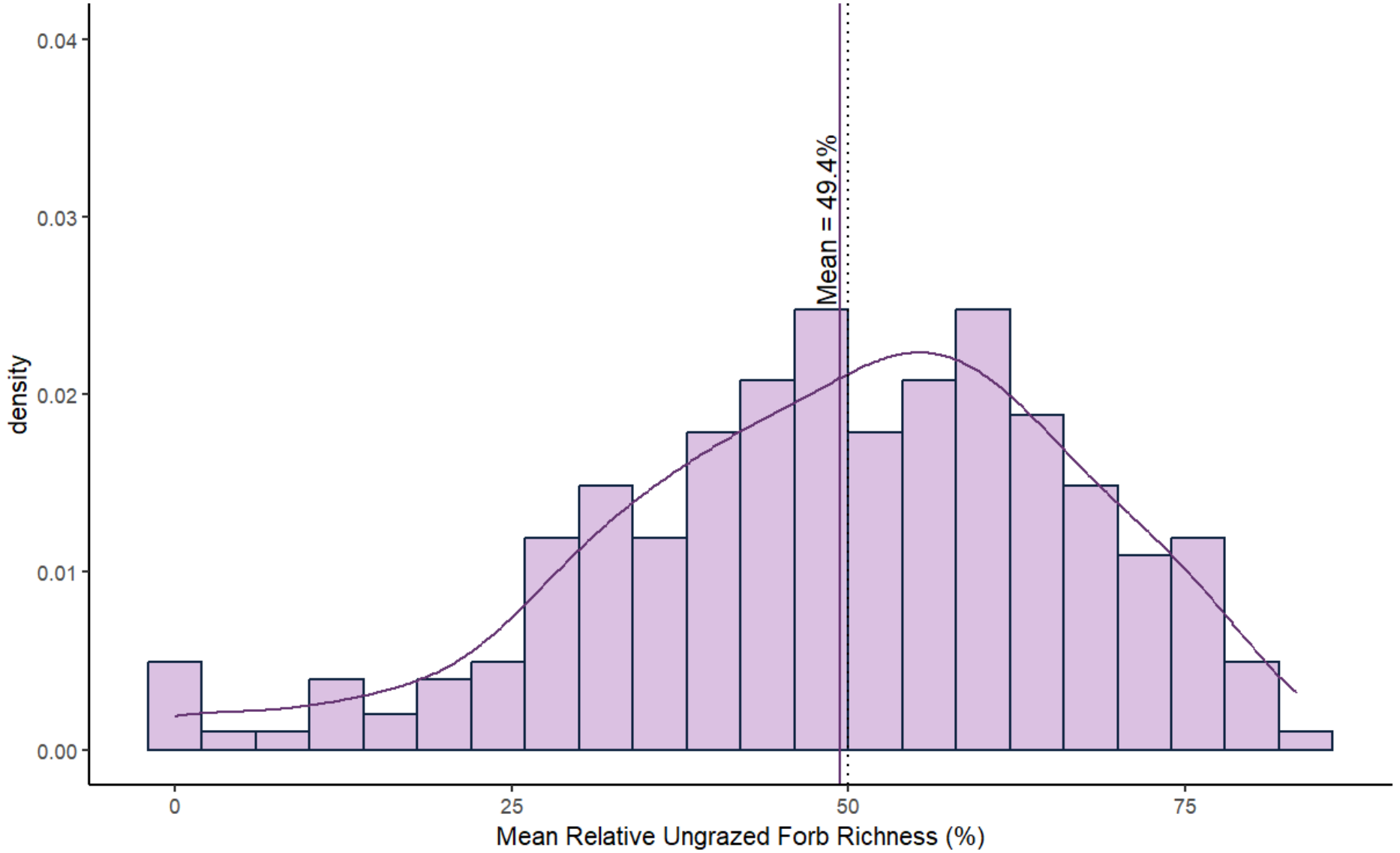


- Yes (P<0.001), but lots of variation
- Not explained by MAP, ANPP, MAT, or distance from equator

DO FORBS MAKE UP MAJORITY OF RICHNESS?



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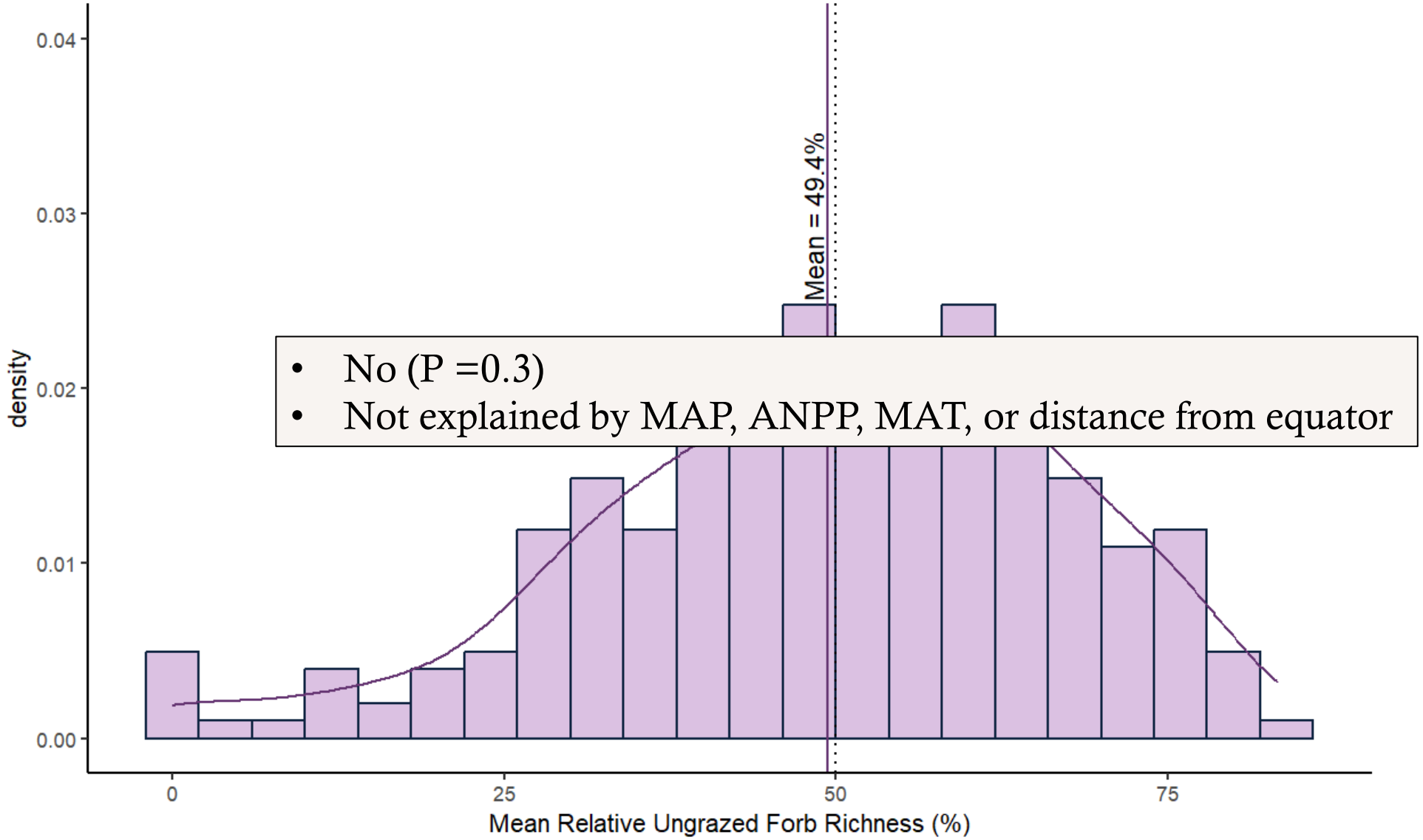
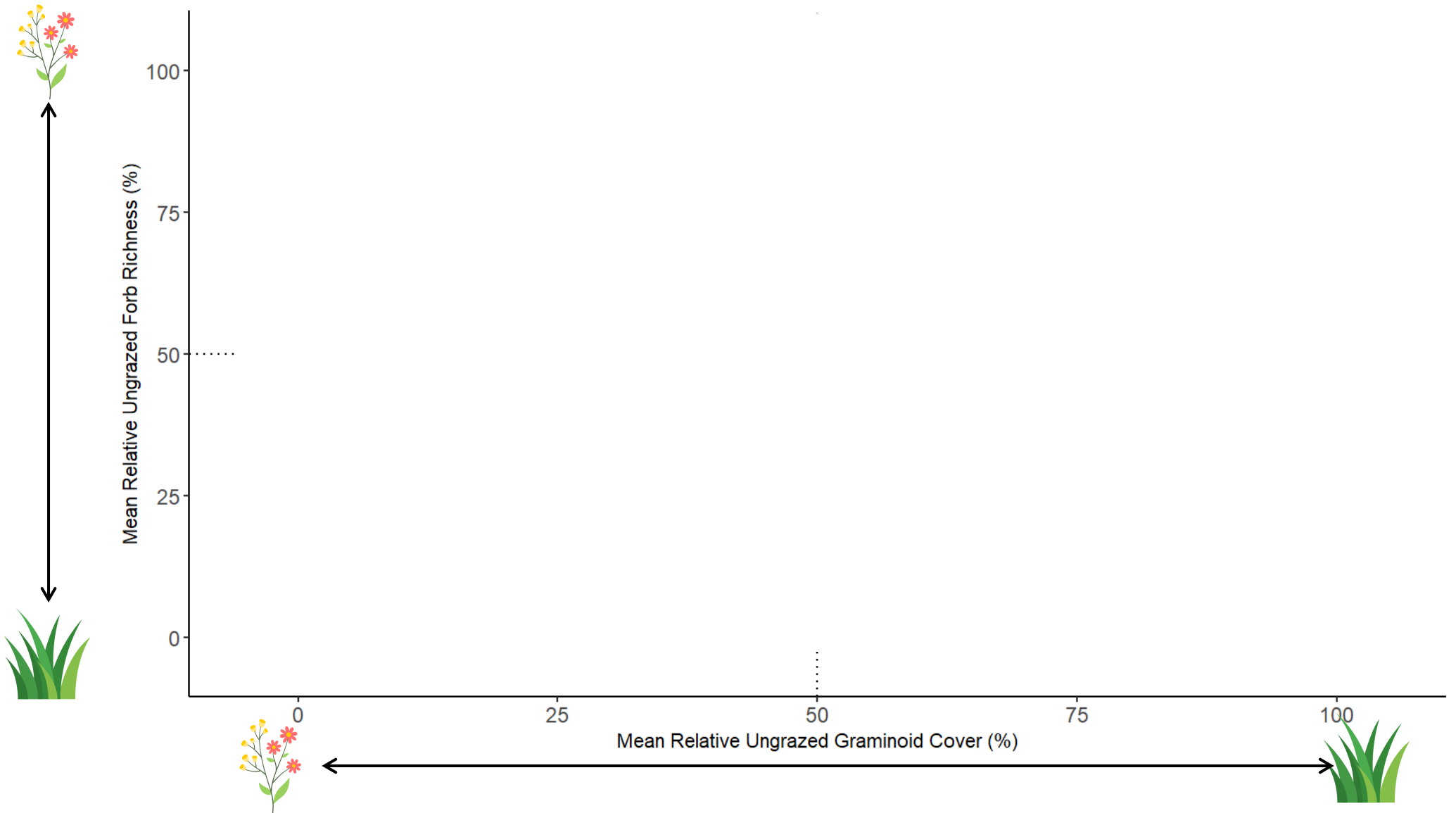


- No (P =0.3)
- Not explained by MAP, ANPP, MAT, or distance from equator

WHAT DOES SITE COMPOSITION LOOK LIKE?



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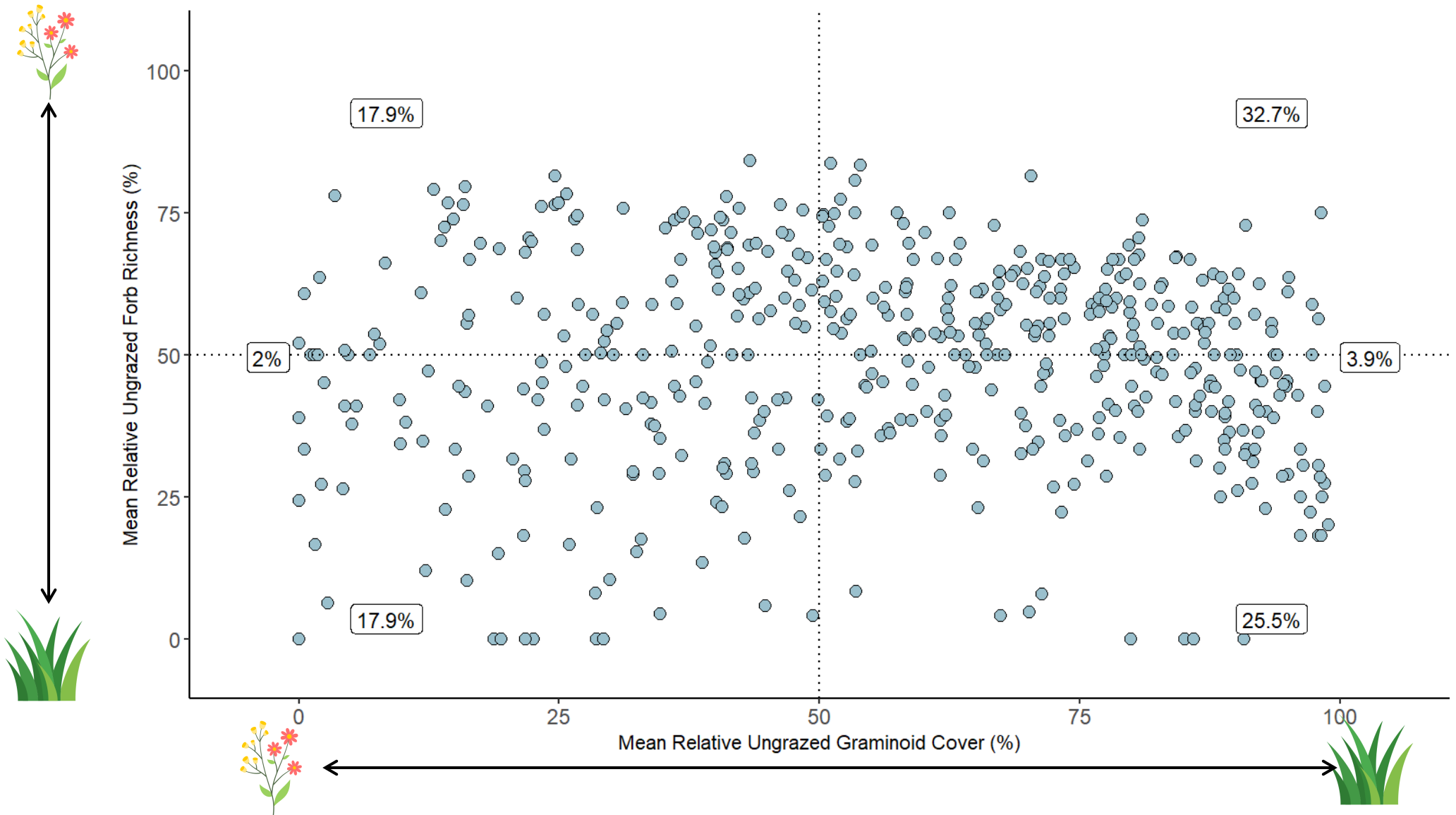

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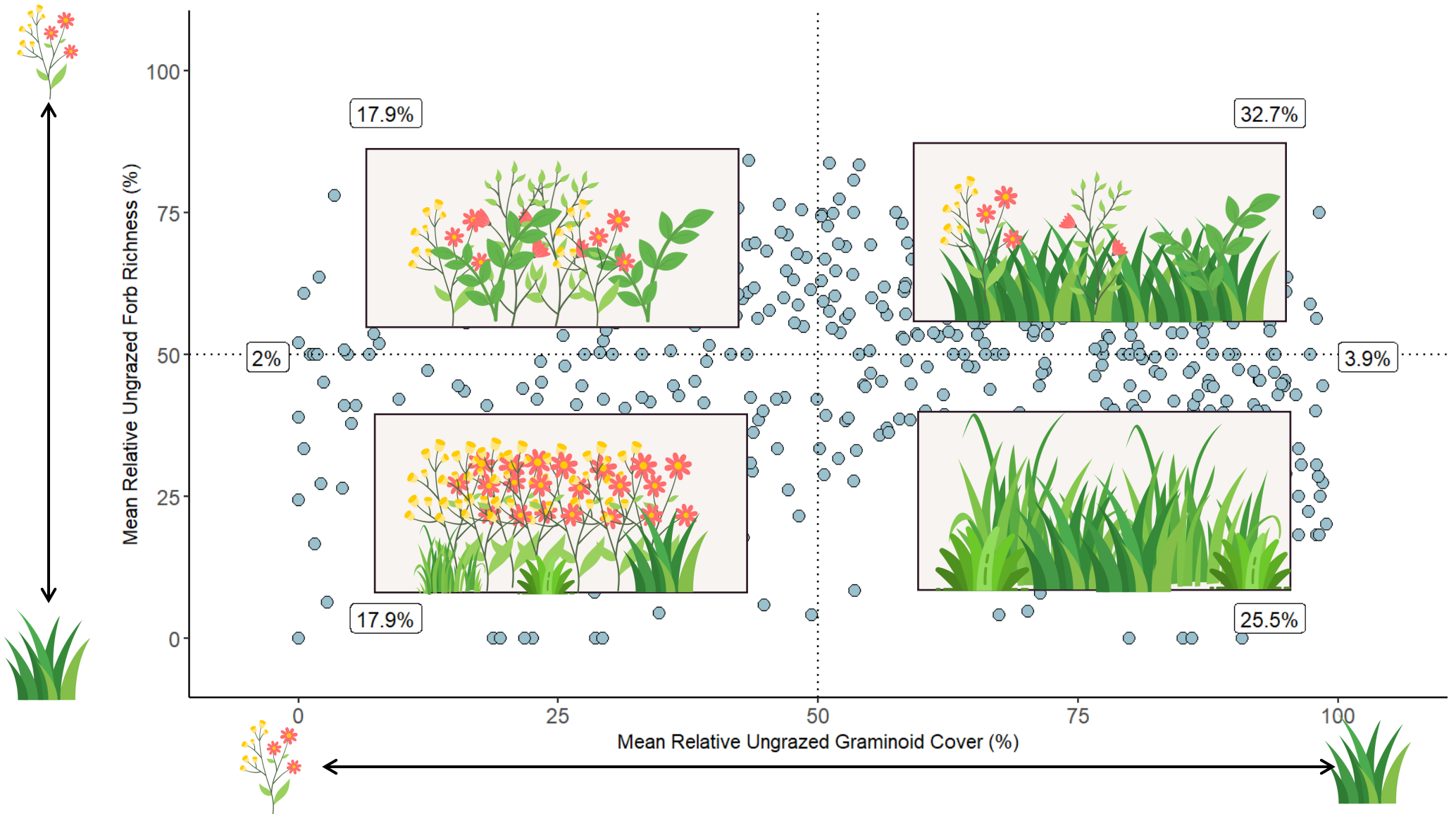

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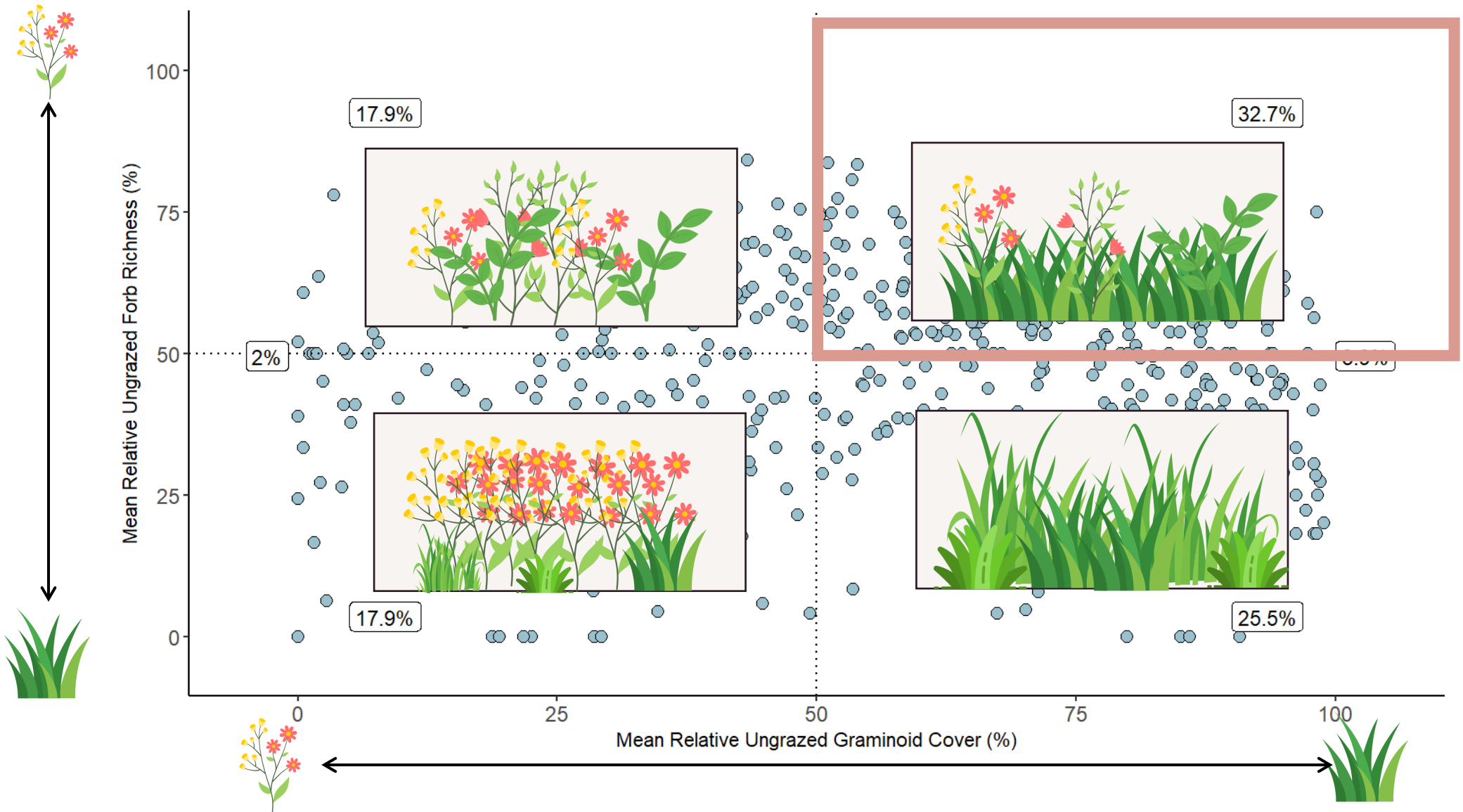

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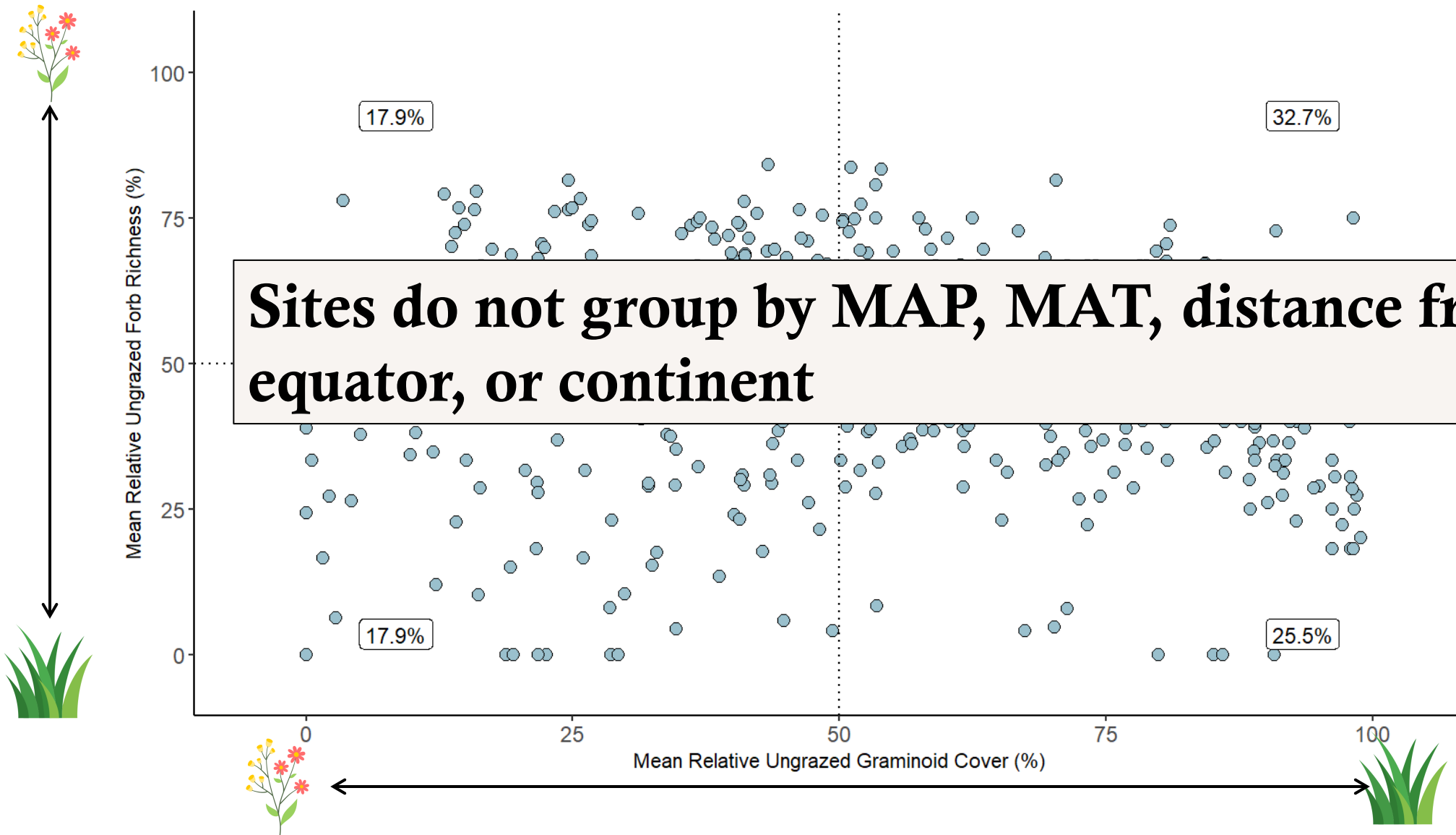
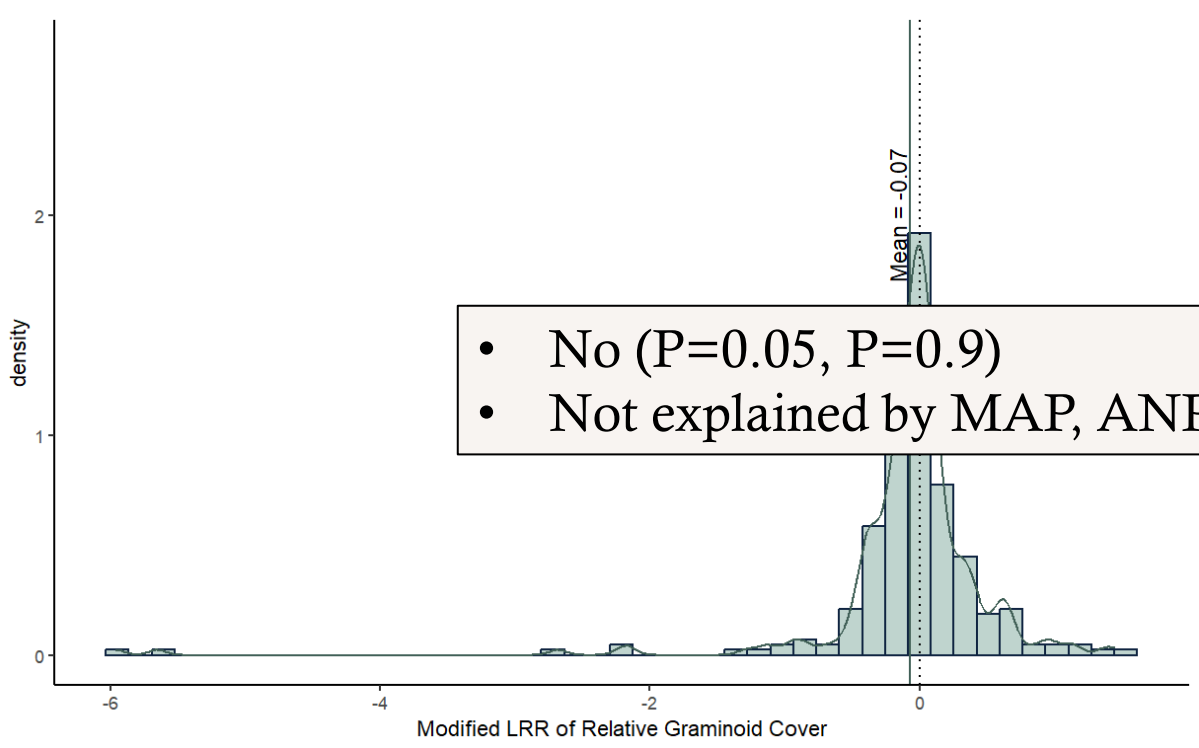


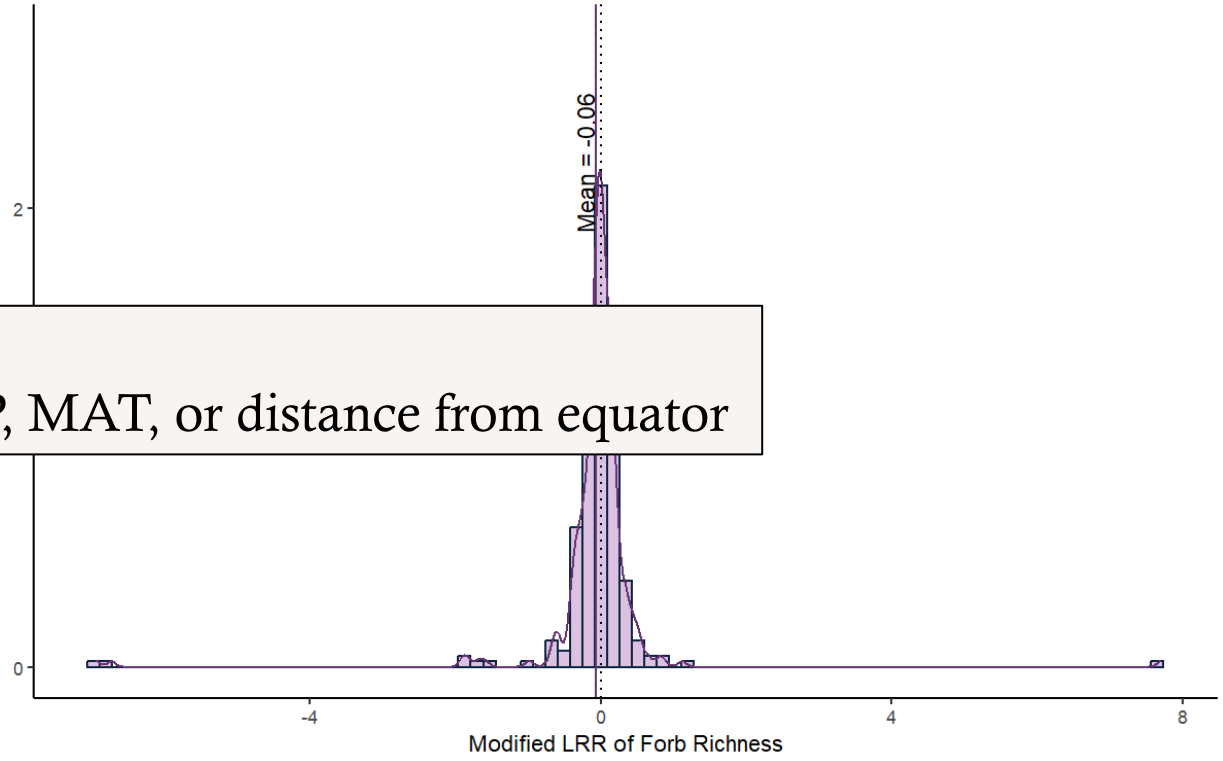
Sites do not group by MAP, MAT, distance from equator, or continent

GRAZING RESPONSE

Does grazing increase forb richness and decrease graminoid cover?

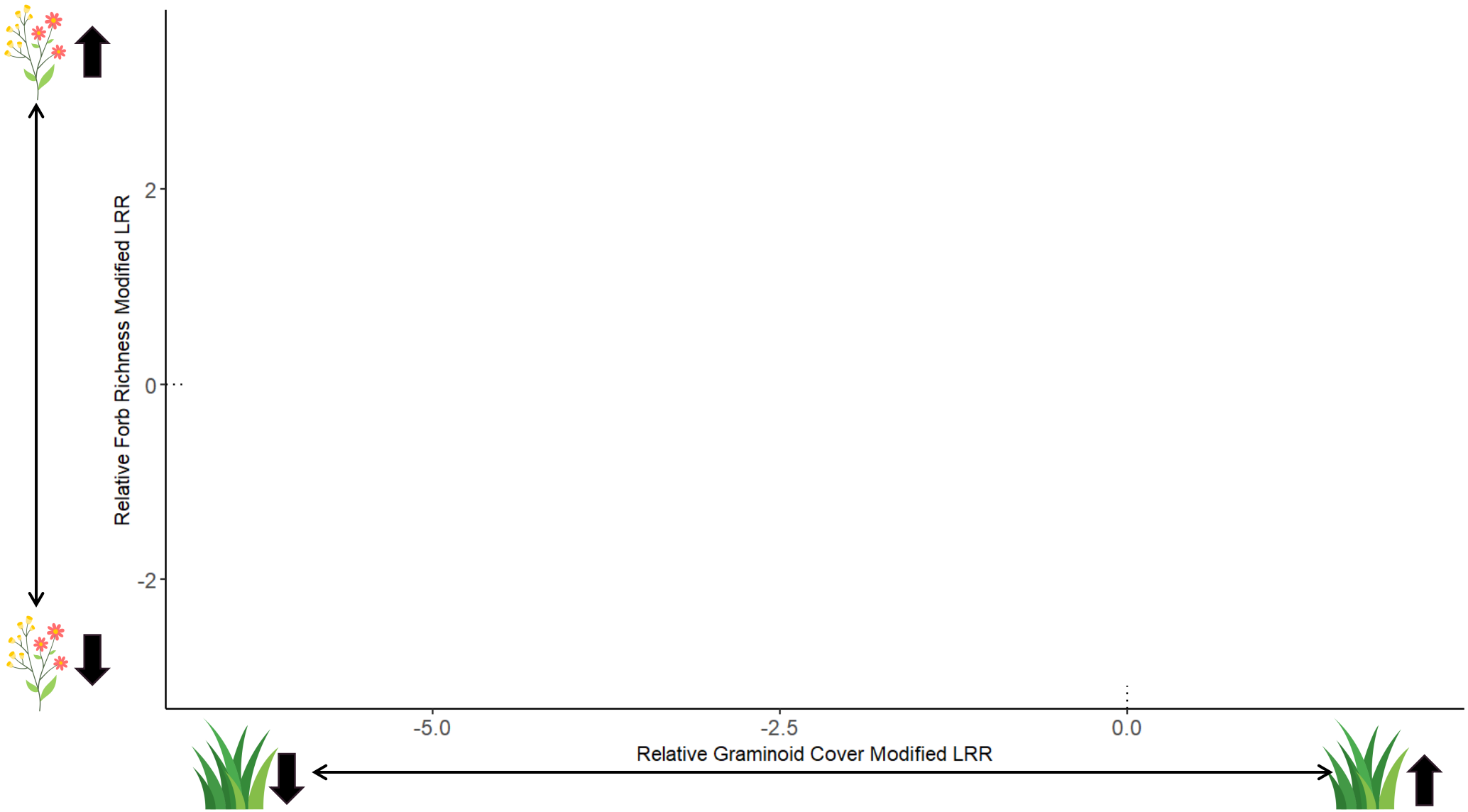
DOES GRAZING REDUCE GRAMINOID COVER AND INCREASE FORB RICHNESS GLOBALLY?





- No (P=0.05, P=0.9)
- Not explained by MAP, ANPP, MAT, or distance from equator

WHAT DOES SITE RESPONSE LOOK LIKE?



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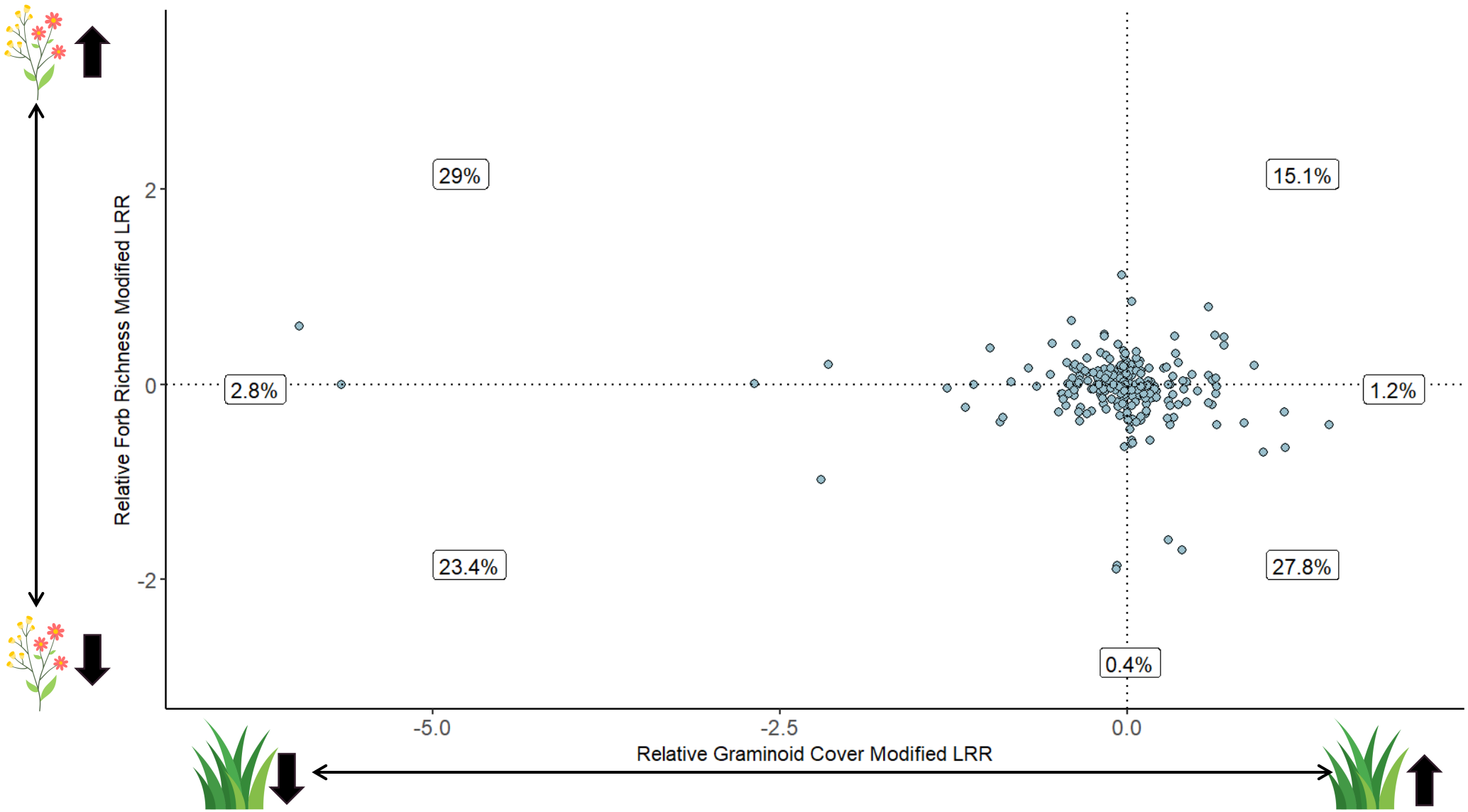

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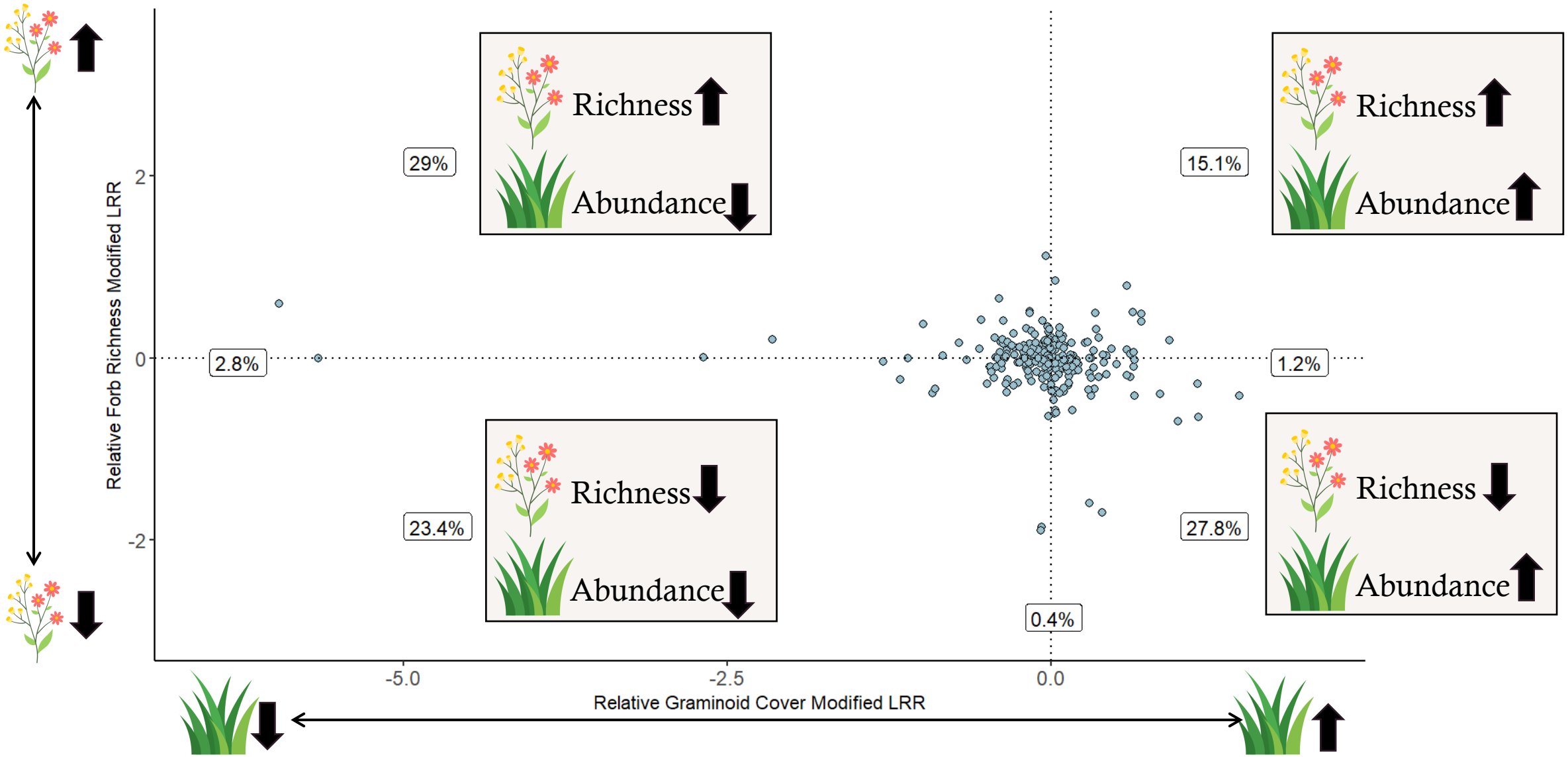

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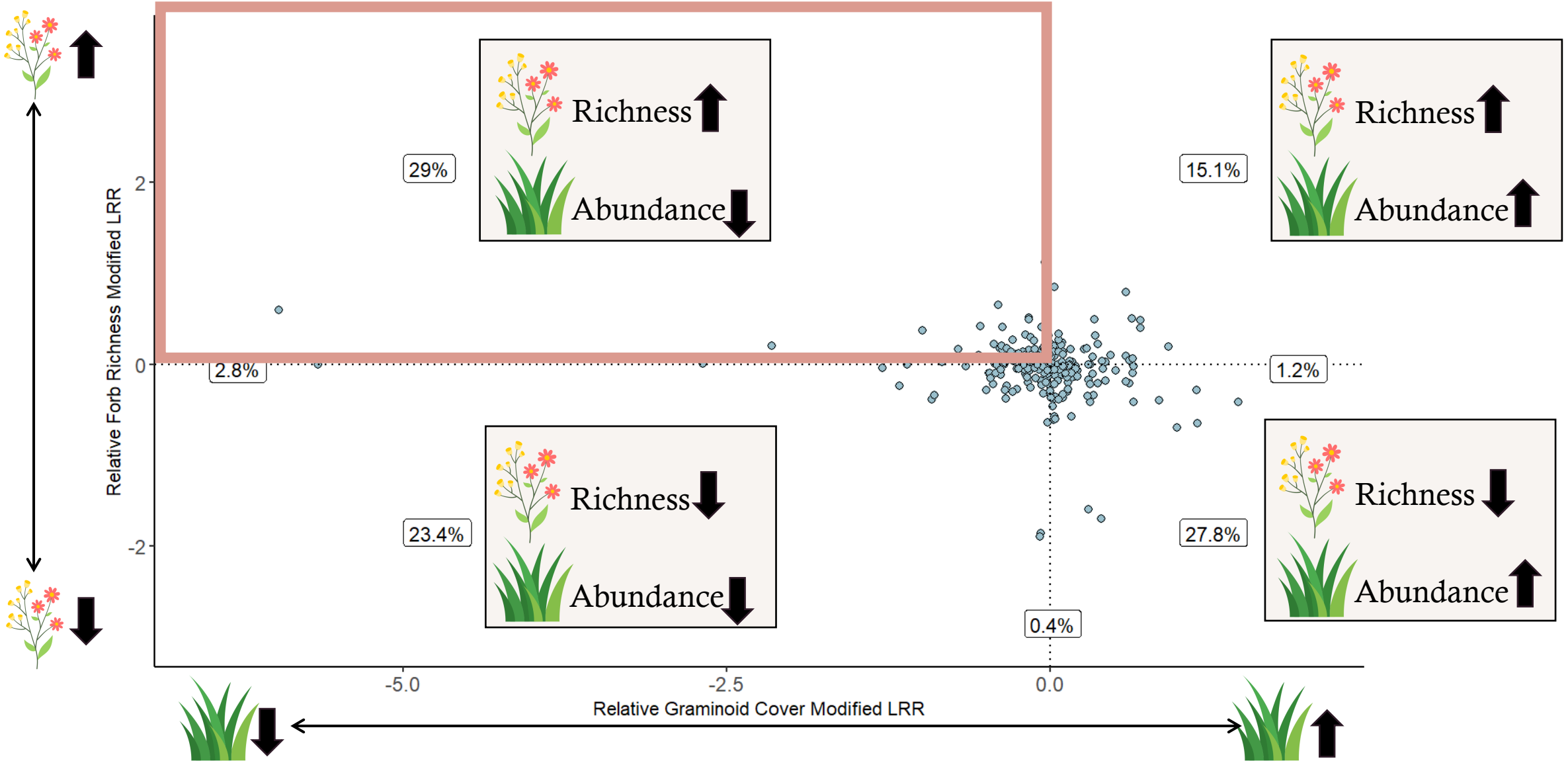

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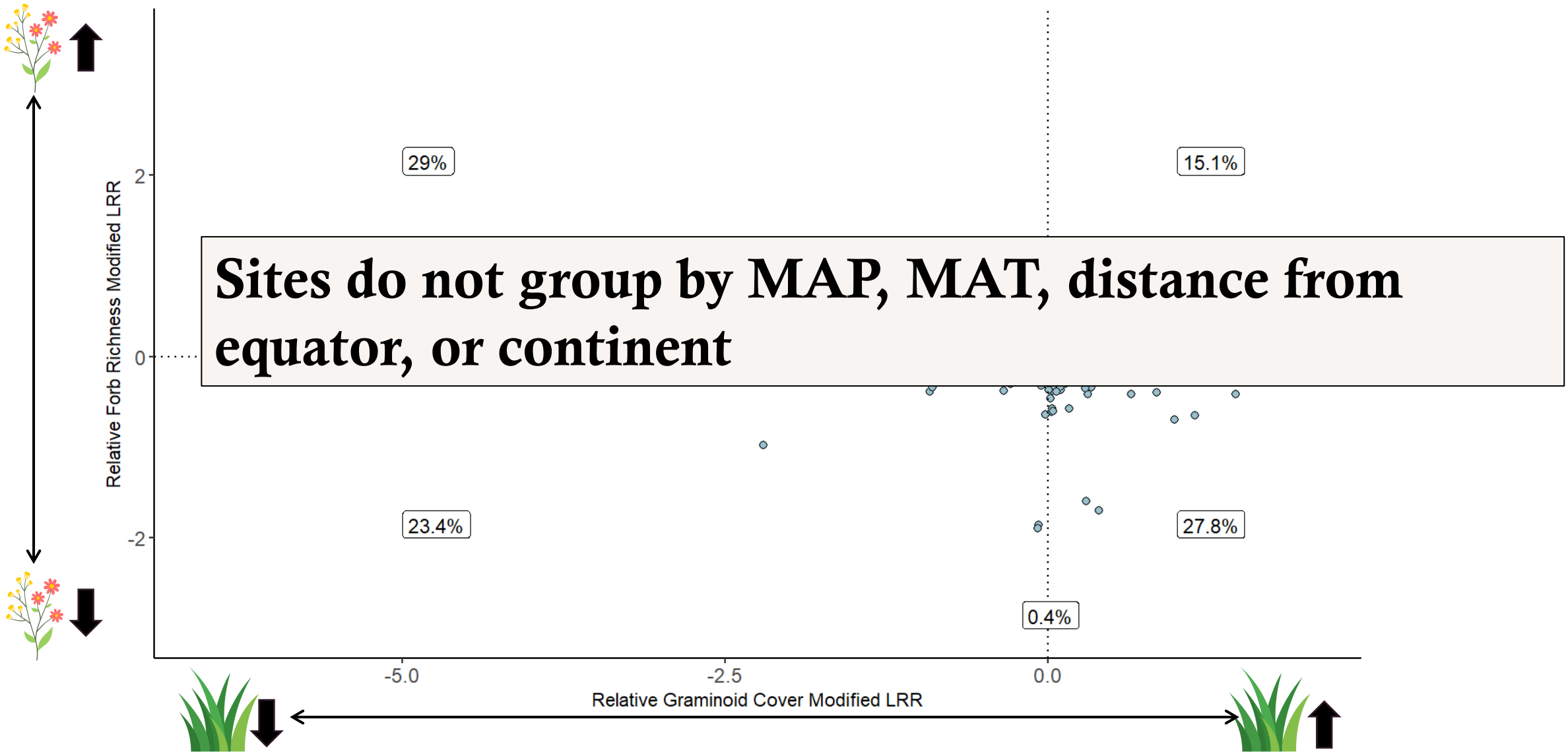

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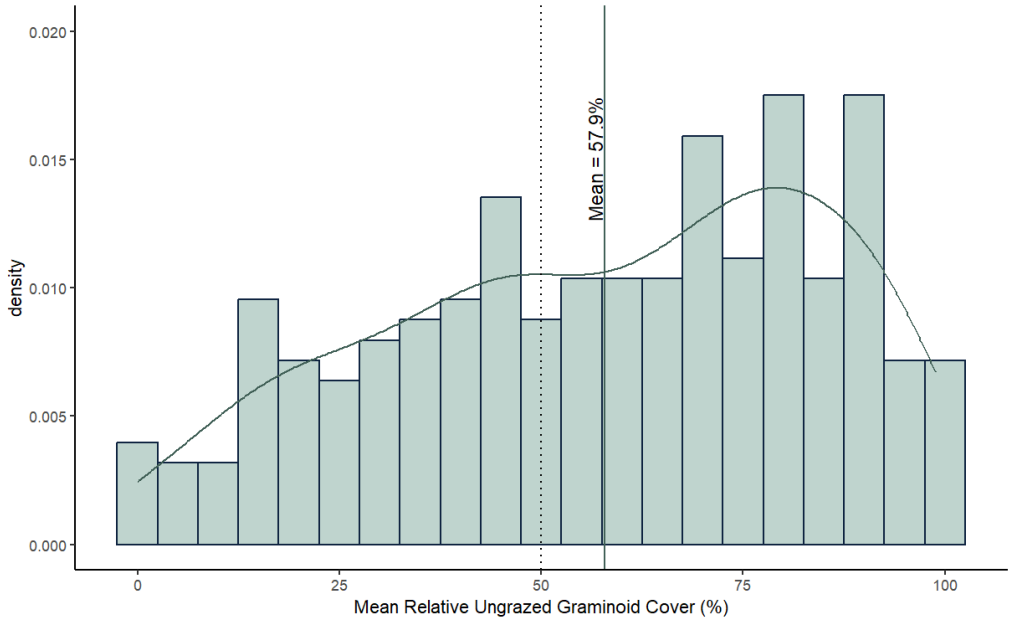
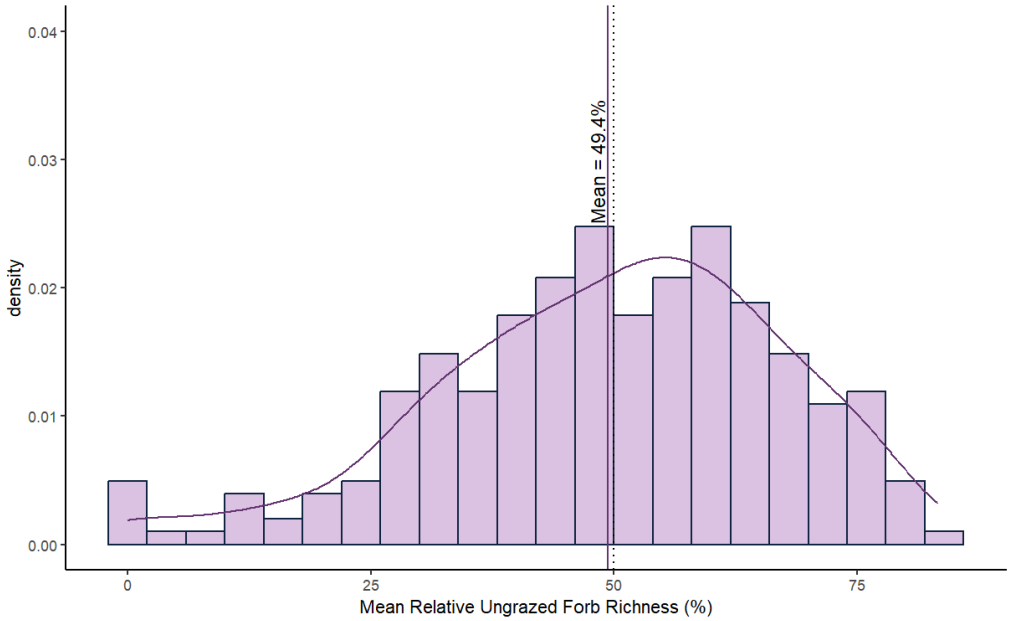
CONCLUSIONS

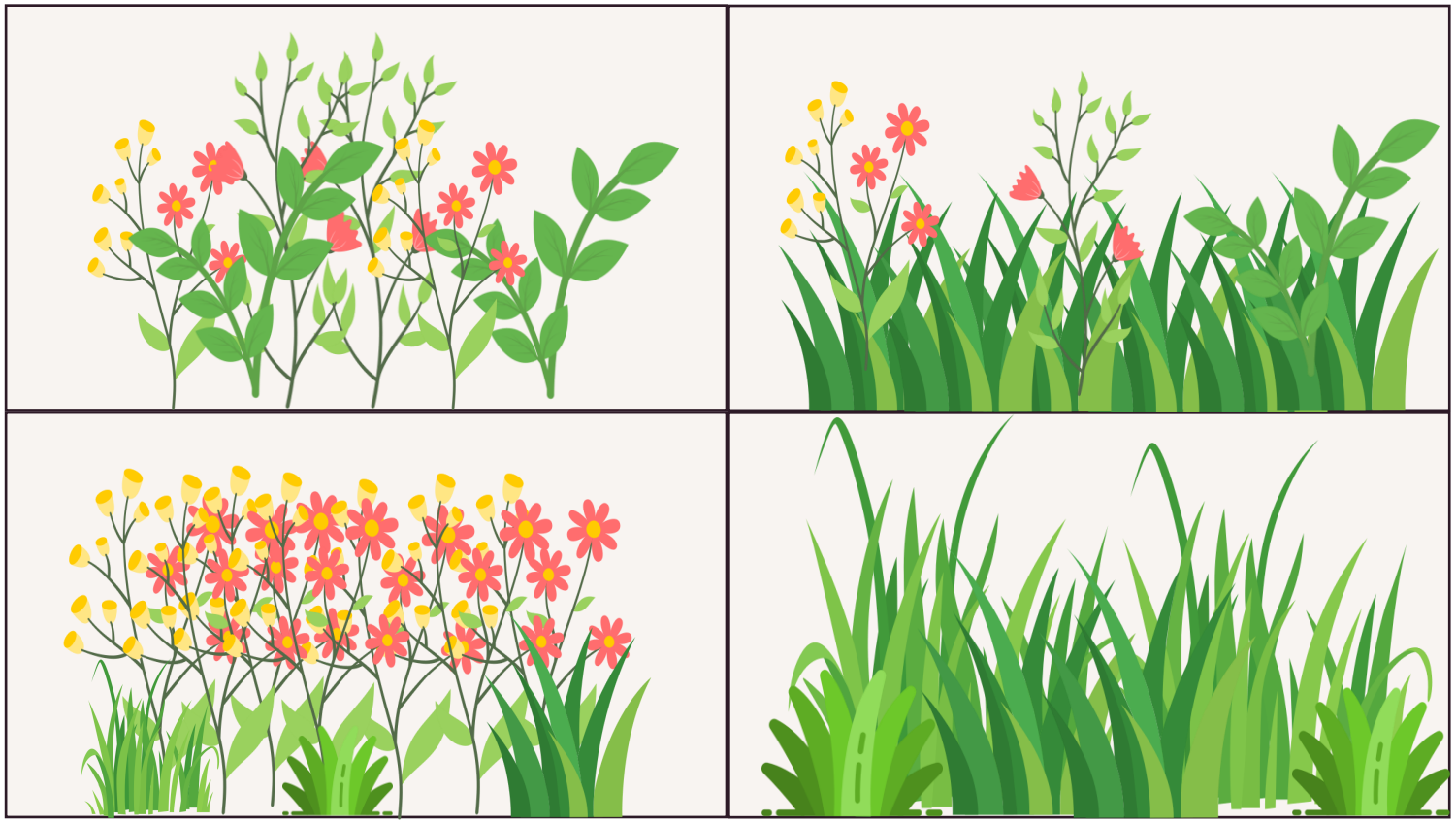
GLOBALLY, GRASSLANDS ONLY PARTIALLY SATISFY TYPICAL COMPOSITIONAL ASSUMPTIONS





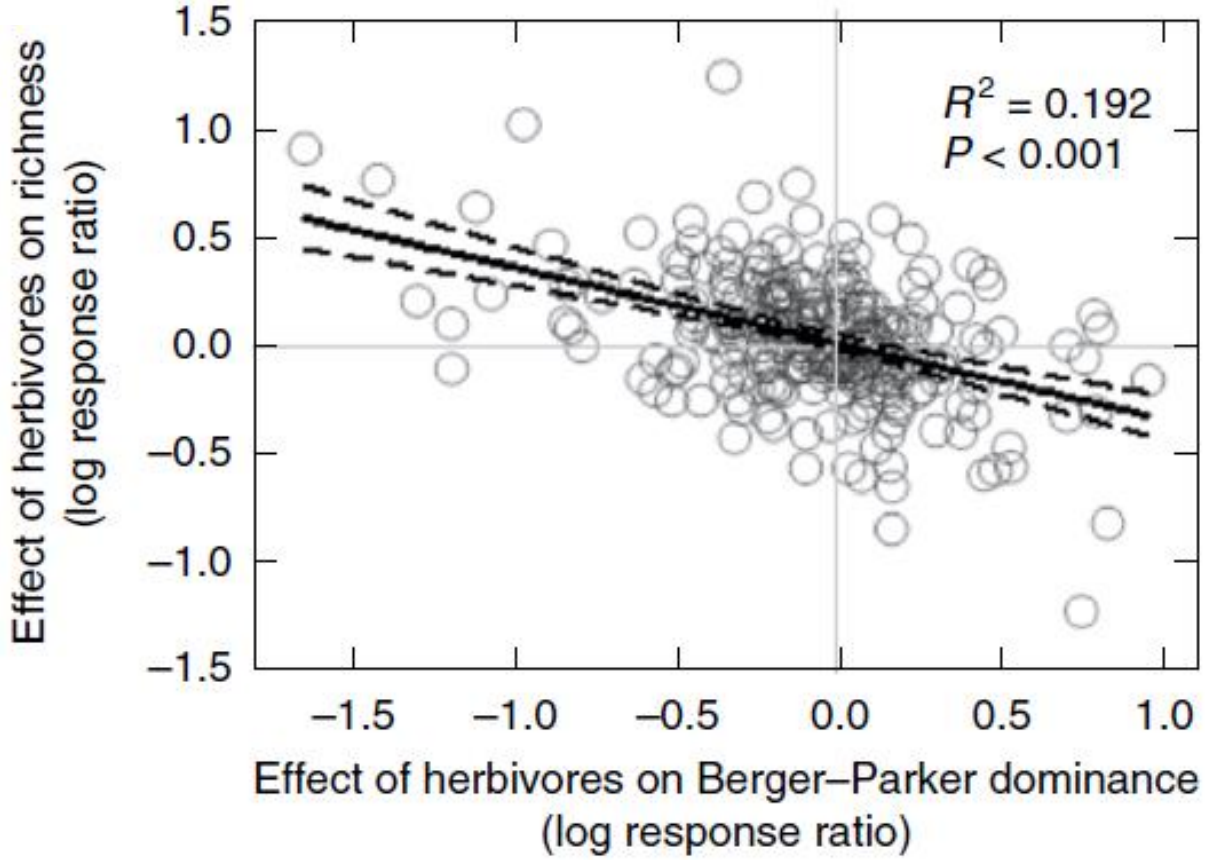
- Typical predictors do not predict graminoid/forb abundance and richness

GRASSLANDS ARE COMPOSITIONALLY DIVERSE AND FALL INTO FOUR MAJOR CATEGORIES



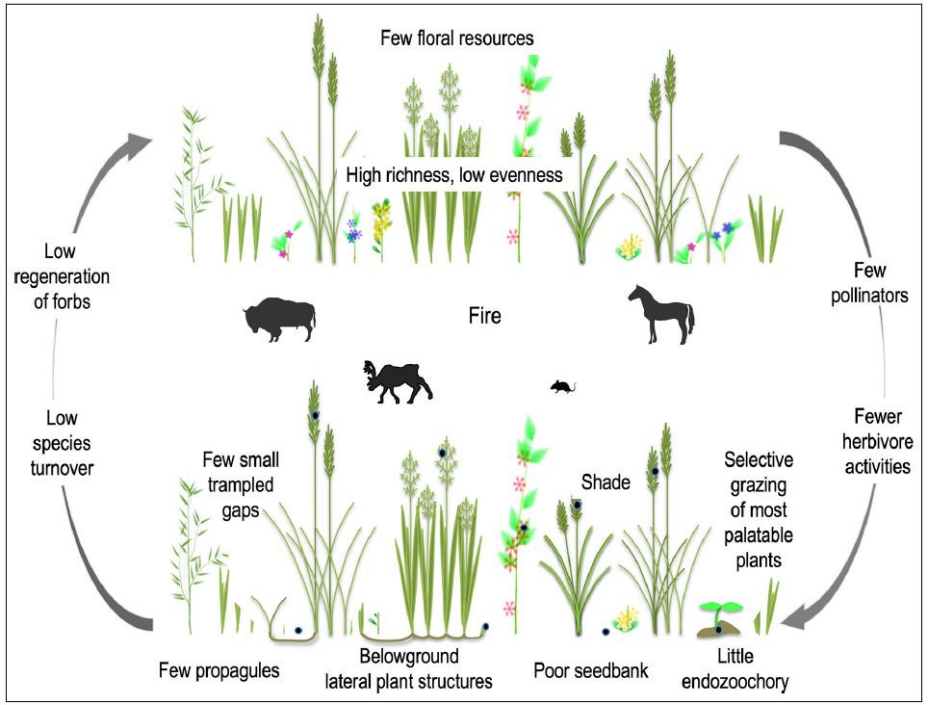
GRASSLAND COMPOSITION IS ALSO VARIED IN ITS RESPONSE TO GRAZING

- Typical predictors do not predict graminoid/forb abundance and richness response to grazing
- Response may rely on grazing's effect on dominance in a system



Koerner *et al.* (2018) *Nat Ecol Evo.*

GLOBALLY, MODERN GRAZING DOES NOT MAINTAIN FORBLANDS AS IT DID HISTORICALLY



Bråthen *et al.* (2021) *Front Ecol Environ.*

UNDERSTANDING OUR GRASSLANDS

ACKNOWLEDGEMENTS

- University of North Carolina Greensboro
- Grazing Exclosure Consortium
- USDA NIFA
- CoRRE Trait Database

THANK YOU – LET'S CHAT!

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ADDITIONAL GEX SITE INFO

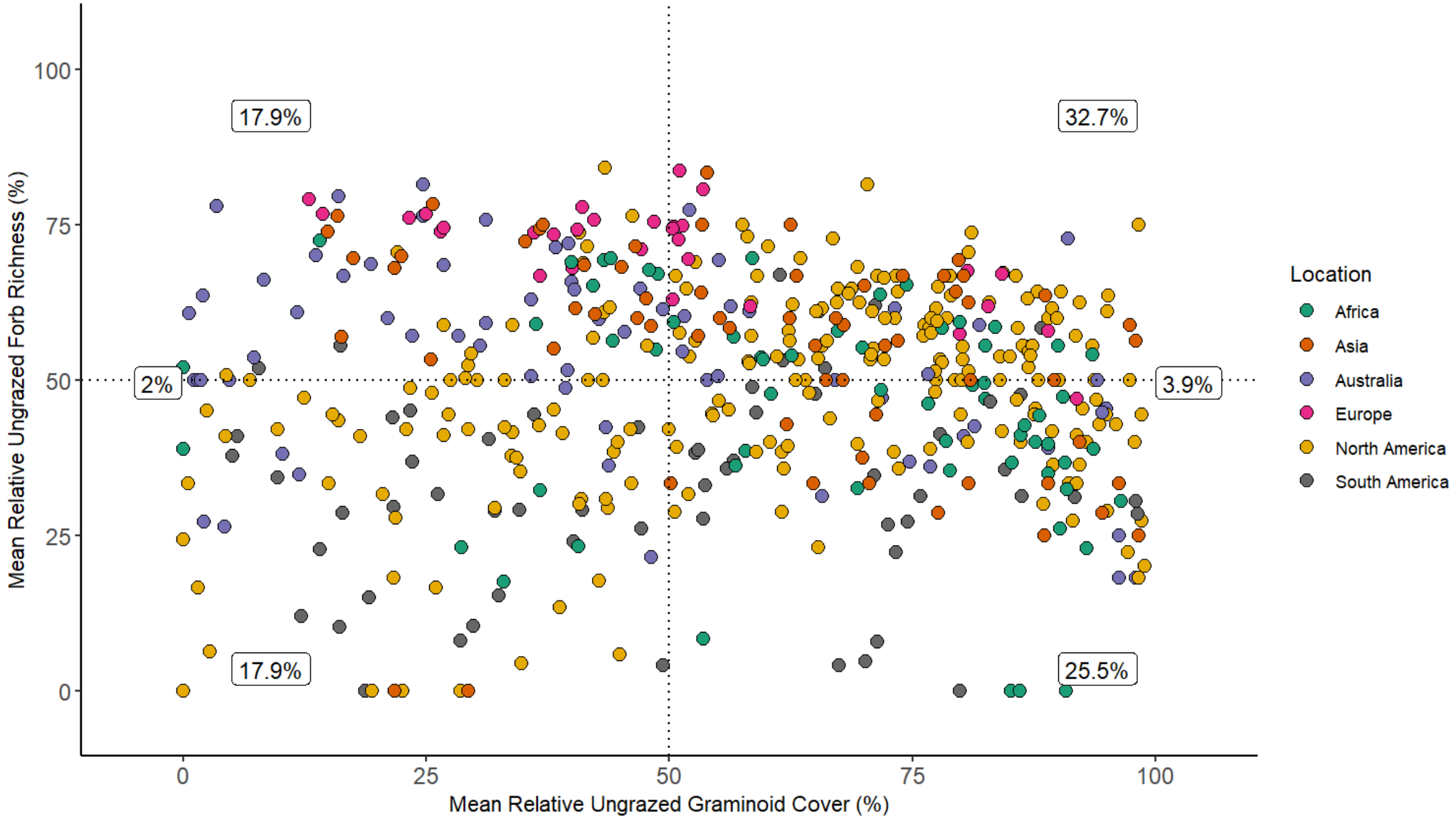
Sites by continent

- Africa: 31
- Asia: 32
- Australia: 34
- Europe: 15
- North America: 109
- South America: 31

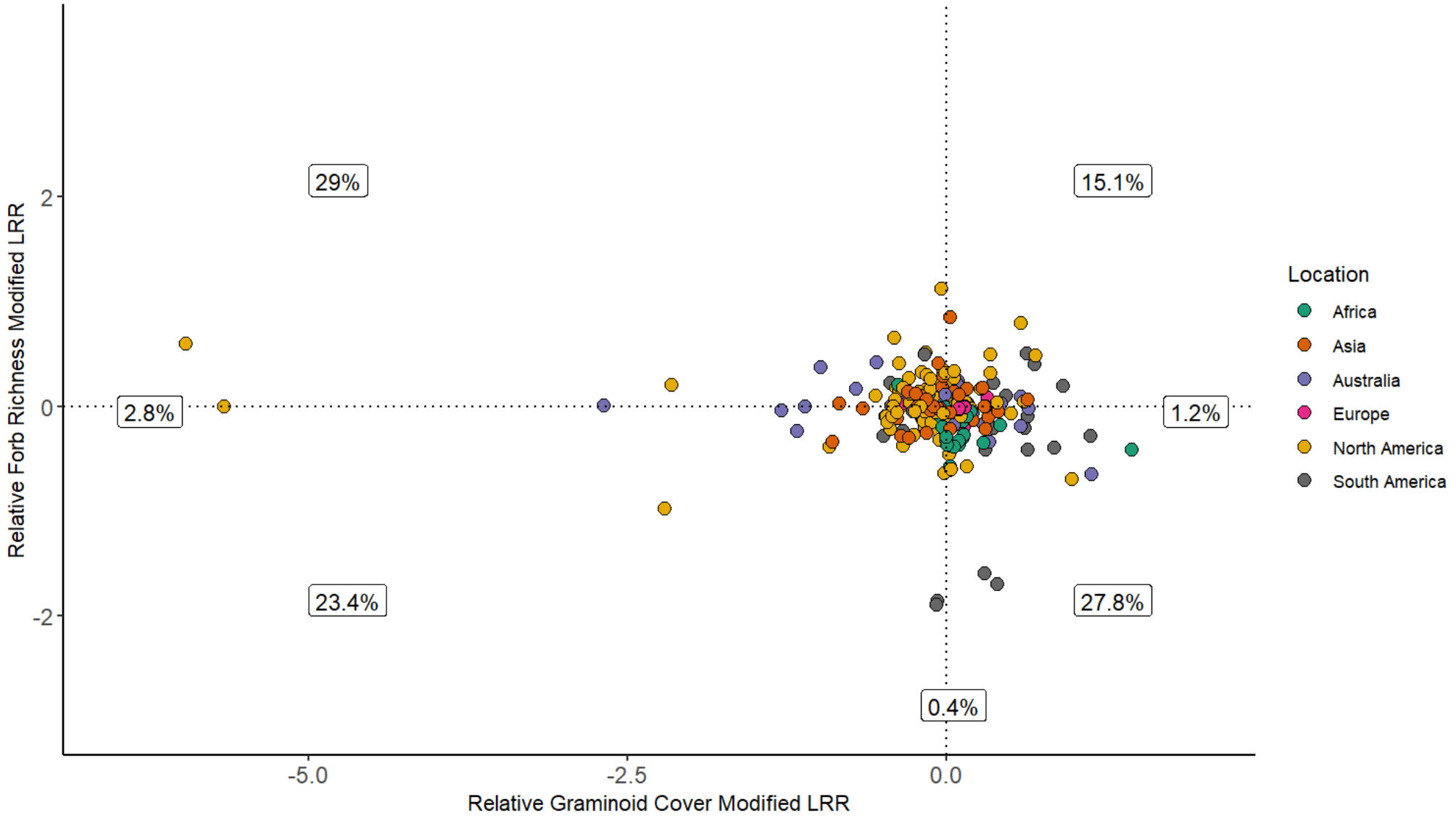
Exclosure age

- At least 3 years of grazing exclusion
- Mean: 14 years
- Median: 7 years

COMPOSITION QUADRANT WITH CONTINENT



RESPONSE QUADRANT WITH CONTINENT



COMPOSITION QUADRANT WITH UNGRAZED RICHNESS