

# Contrasting consumers: Insights from a targeted approach to plant functional traits related to fire and grazing

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# Savanna vegetation

Fire



Wildlife



# Savanna landscape

Fire



Wildlife



# Global Change

Land-use change

Increased  
atmospheric CO<sup>2</sup>

Climate change

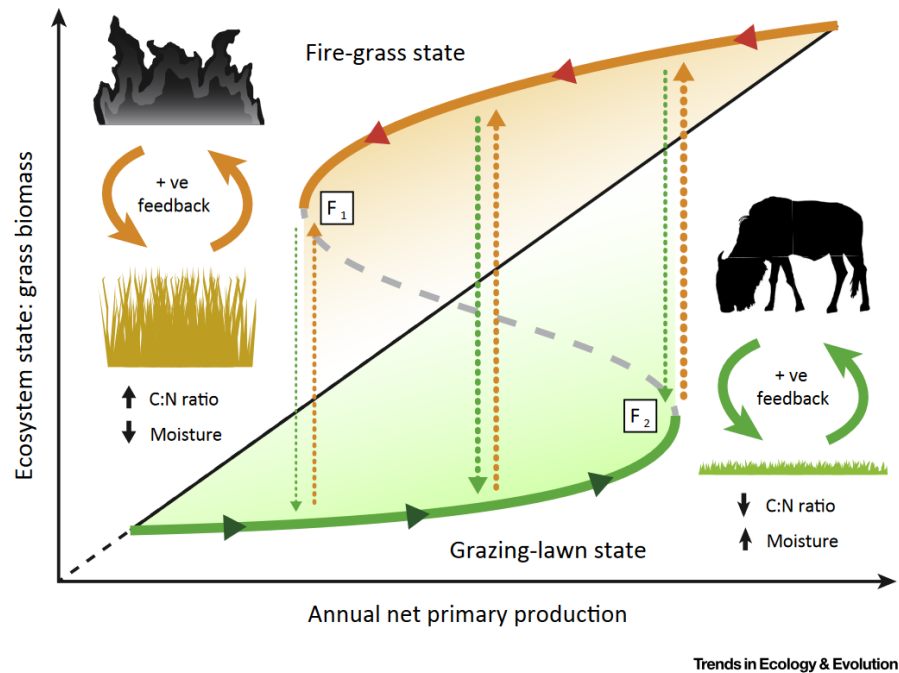




Nicholas Romeril, Hluhluwe-Imfolozi Park



Cesar Manso/AFP/Getty Images



Hempson et al., 2019. *TREE*

(a) Flammable grass



Low	← Leaf moisture content →	High
High	← C : N and C : P ratios →	Low
Aerated	← Canopy architecture →	Dense
High	← Tannins & volatile oils →	Low

Palatable grass



(b) Vertical growth form



Vertical	← Culm angle →	Horizontal
Intravaginal	← Branching →	Extravaginal
Basal	← Tillering →	Distal
Short	← Rhizomes →	Long

Lateral growth form



Archibald, Hempson & Lehmann, 2019. *New Phytologist*

## Functional grass types

Bunch grass



Lawn grass



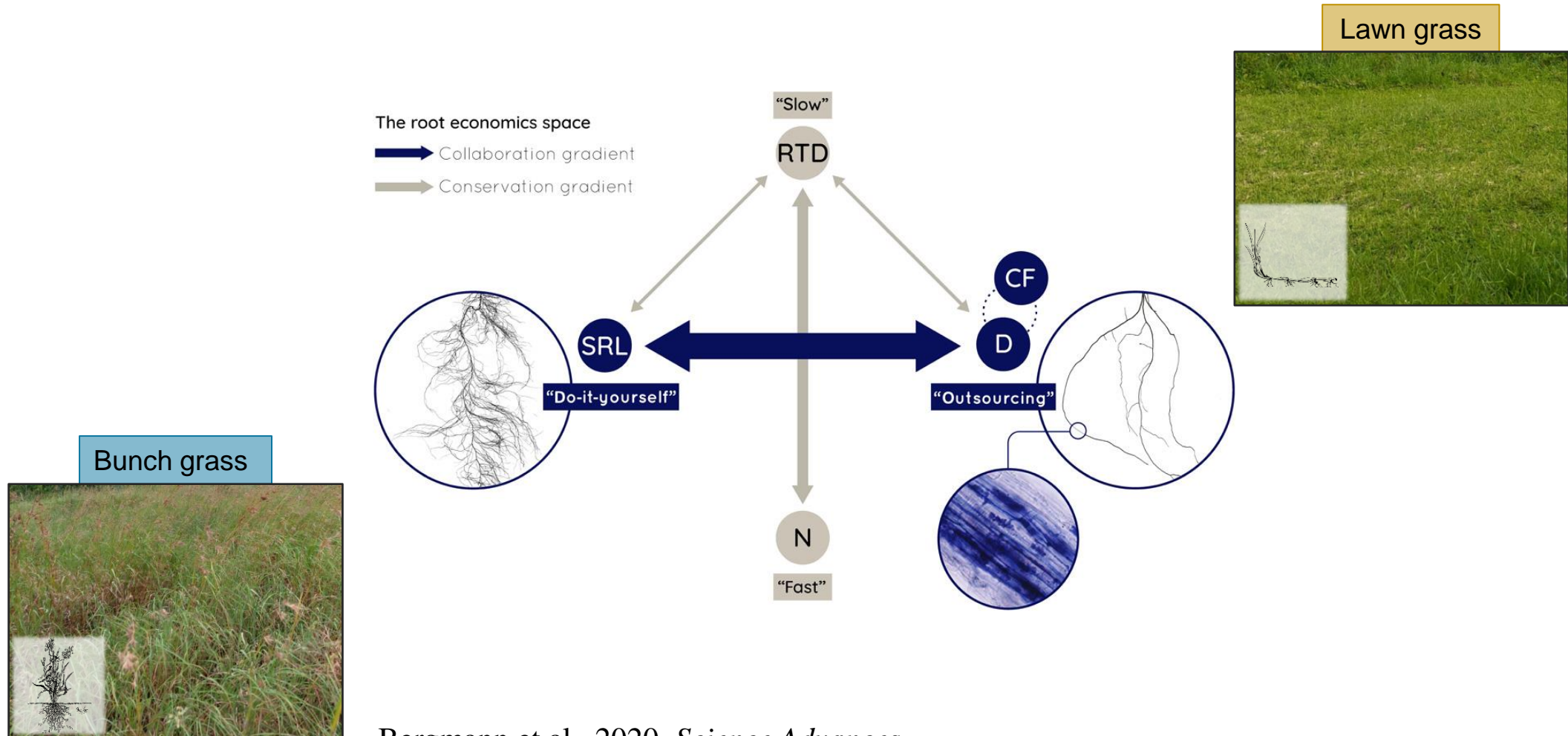
## A handbook for the standardised sampling of plant functional traits in disturbance-prone ecosystems, with a focus on open ecosystems

B. J. Wigley<sup>id</sup>, T. Charles-Dominique, G. P. Hempson, N. Stevens, M. te Beest<sup>id</sup>, S. Archibald, W. J. Bond, K. Bunney, C. Coetsee, J. Donaldson, A. Fidelis, X. Gao, J. Gignoux, C. Lehmann, T. J. Massad, J. J. Midgley, M. Millan, D. Schwilk, F. Siebert, C. Solofondranohatra, A. C. Staver, Y. Zhou and L. M. Kruger

*Australian Journal of Botany* 68(8) 473–531. doi:10.1071/BT20048

# Don't forget the belowground dimension!

Figure 1. Conceptual framework for the root economic space.



Bergmann et al., 2020. *Science Advances*

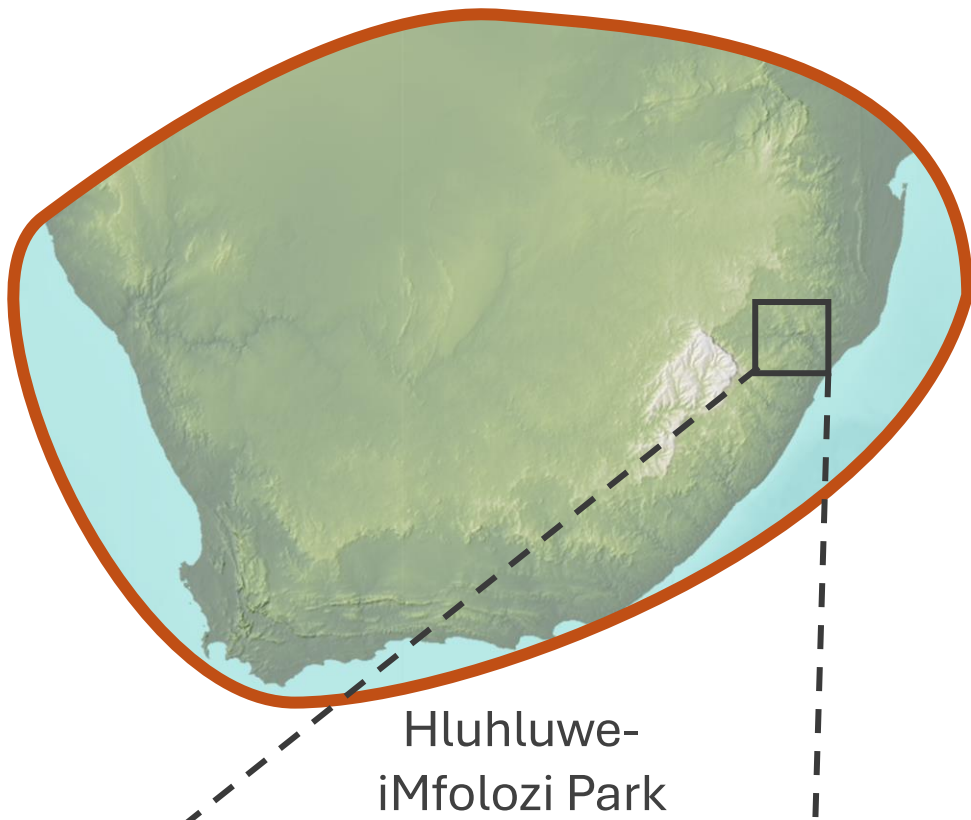


## Sample sites

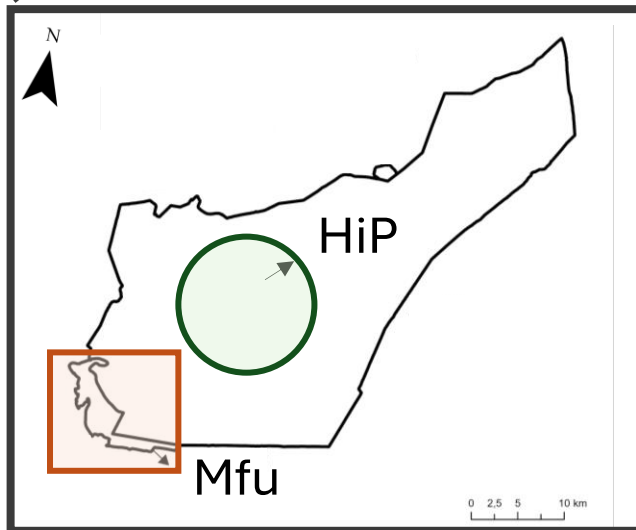
HiP



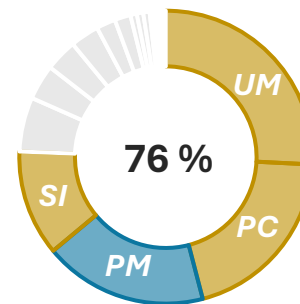
Mfu



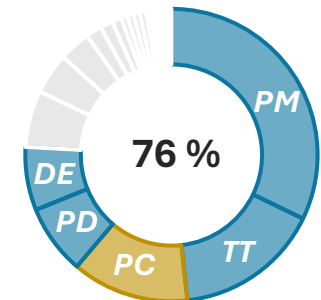
Hluhluwe-iMfolozi Park



## Dominant grass species

















HiP



Mfu



# Grass traits

Trait	Description	Association
<i>Aboveground</i>		
Plant height ( <i>H</i> )	Measured in cm from soil surface to 80% of plant biomass.	 
Stemminess ratio ( <i>SS</i> )	Ratio of stem to leaf material in aboveground biomass.	
Grass bulk density ( <i>GBD</i> )	Ratio between grass biomass and the volume it occupies in $\text{g cm}^{-3}$ .	 
Crown depth ( <i>CD</i> )	Depth of crown positioned below the soil surface, measured in cm ( $n = 3$ ).	 
Leaf sheath packing ( <i>LSP</i> )	Ratio of basal leaf sheaths in the short internode zone to length of short internode zone ( $n = 3$ ).	
Culm diameter ( <i>CUD</i> )	Maximum diameter of the second internode on the tallest culm, measured in mm ( $n = 3$ ).	
Leaf area ( <i>LA</i> )	One-sided projected surface area of a leaf in $\text{mm}^2$ .	
Specific leaf area ( <i>SLA</i> )	One-sided area of a leaf divided by its oven-dry mass in $\text{mm}^2 \text{mg}^{-1}$ .	
Leaf dry matter content ( <i>LDMC</i> )	Oven-dry mass of a leaf divided by its wet mass in $\text{mg g}^{-1}$ .	
<i>Belowground</i>		
Branching frequency ( <i>RBF</i> )	Number of branch points per mm of root ( $n = 8$ ).	
Mean root diameter ( <i>RD</i> )	Mean root diameter in mm ( $n = 8$ ).	



Grazing-associated



Fire-associated



Opportunistic root strategy



Conservative root strategy

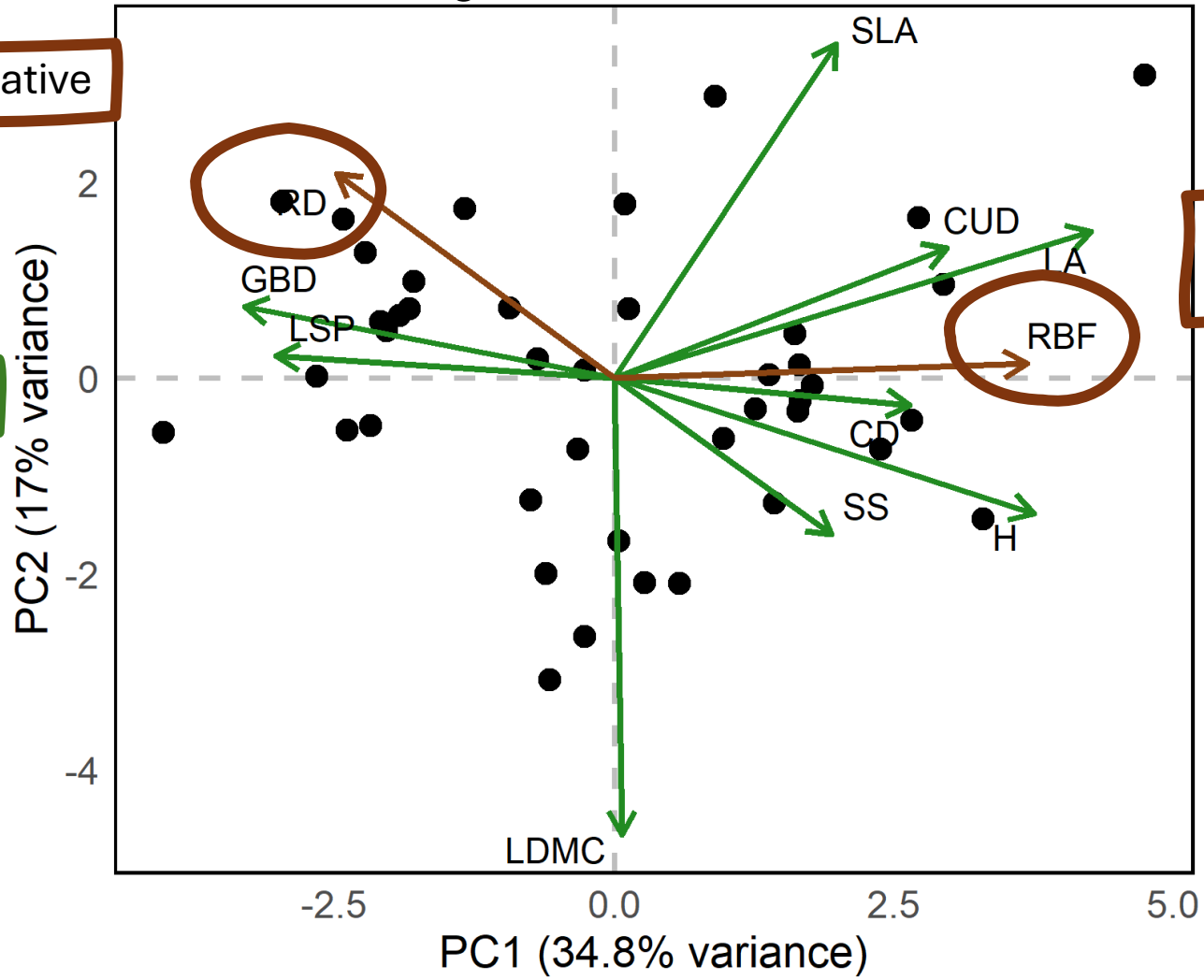
# Patterns in grass traits

→ Aboveground trait    → Root trait

Root diameter - Conservative

Grass-bulk density

Leaf-sheath packing



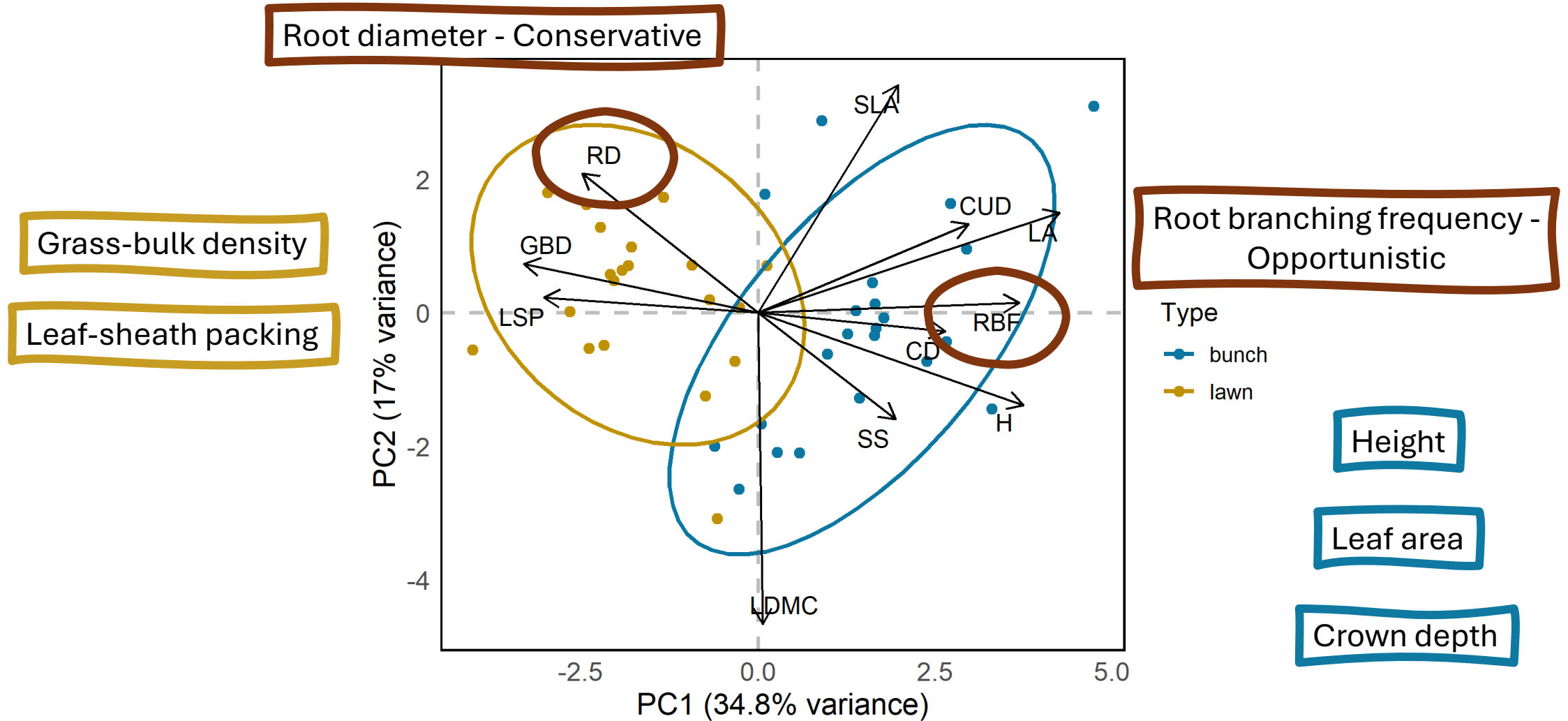
Root branching frequency - Opportunistic

Height

Leaf area

Crown depth

# Functional grass types

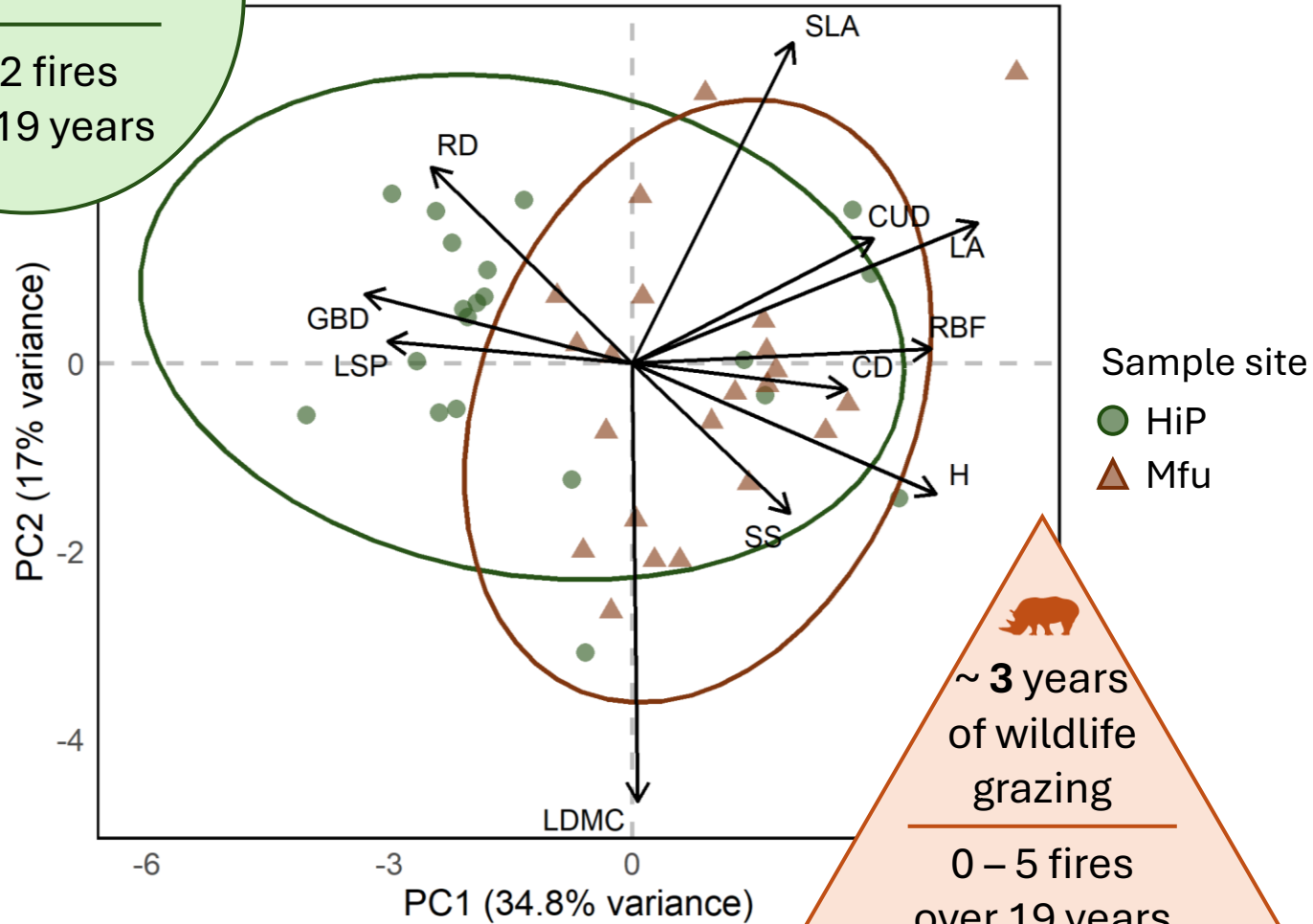


# Sample sites



> **120** years of  
wildlife grazing

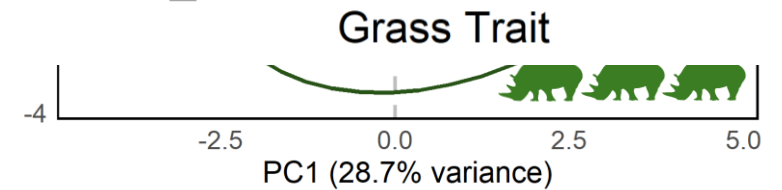
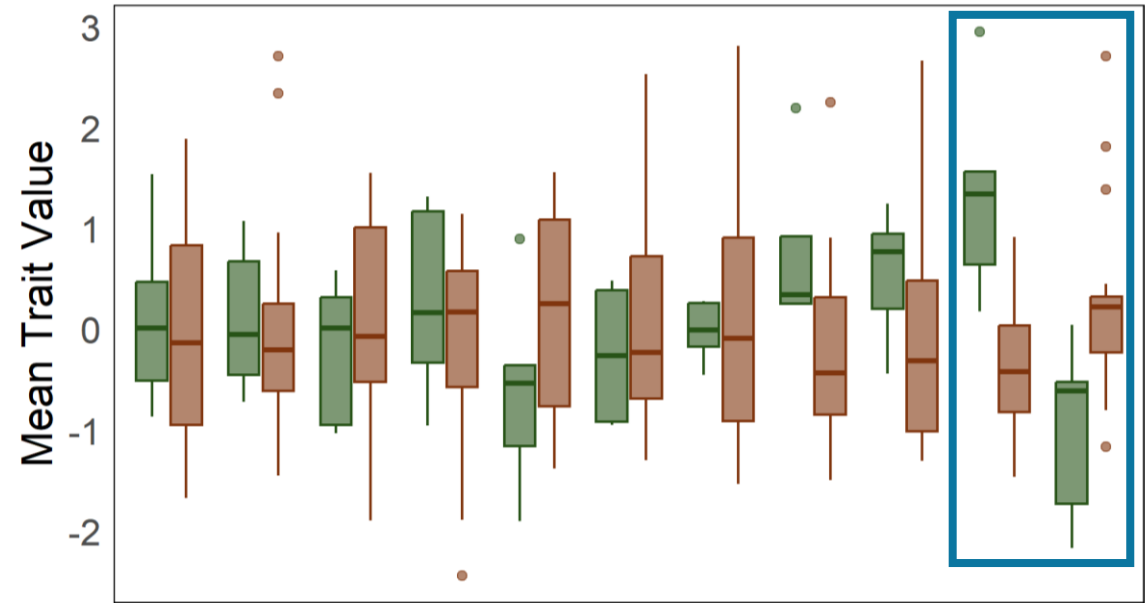
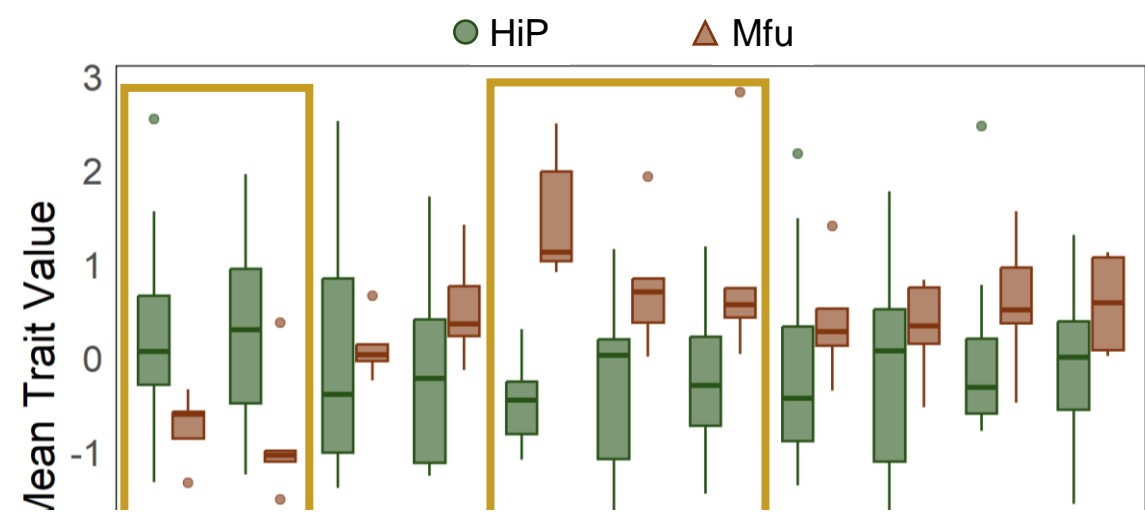
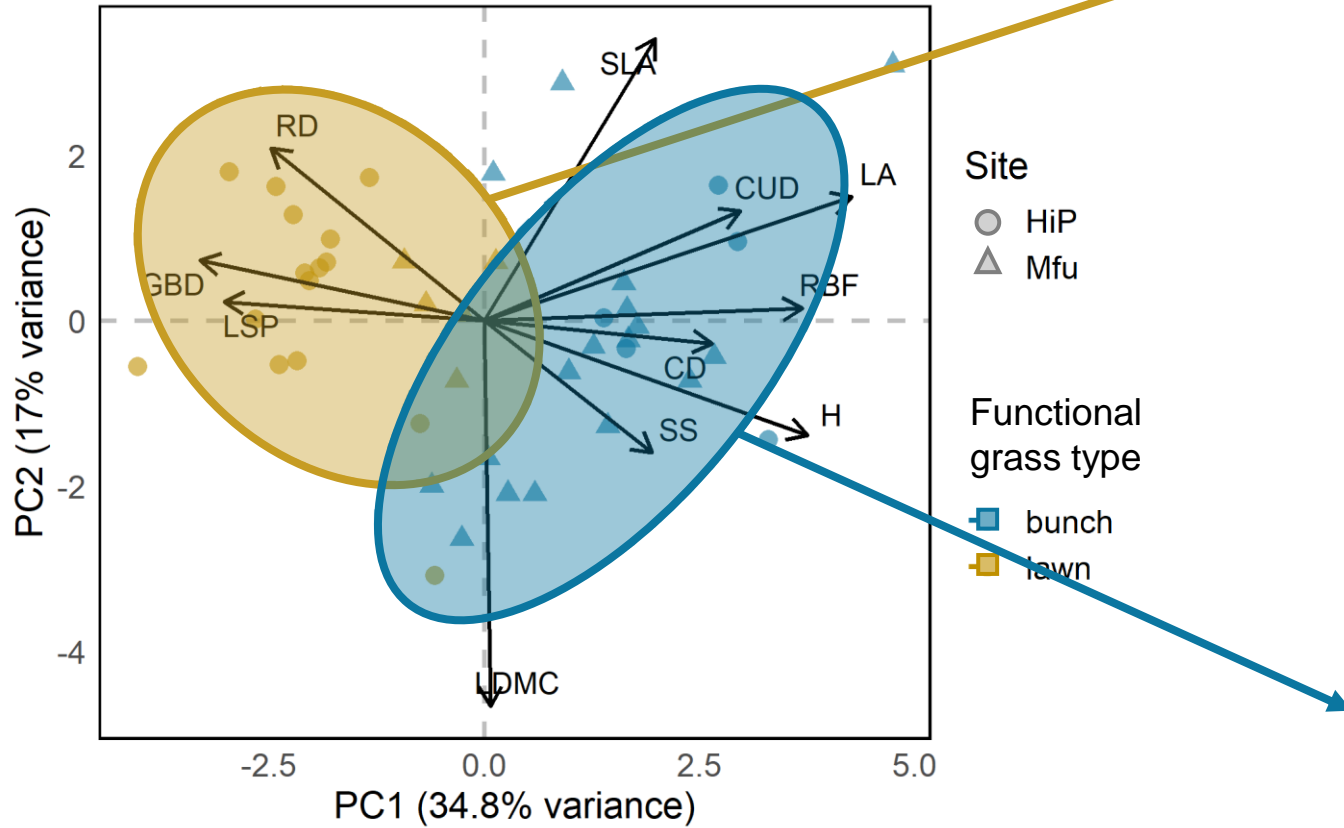
0 – 2 fires  
over 19 years



~ **3** years  
of wildlife  
grazing

0 – 5 fires  
over 19 years

# Types and sites



# What does this mean?



①

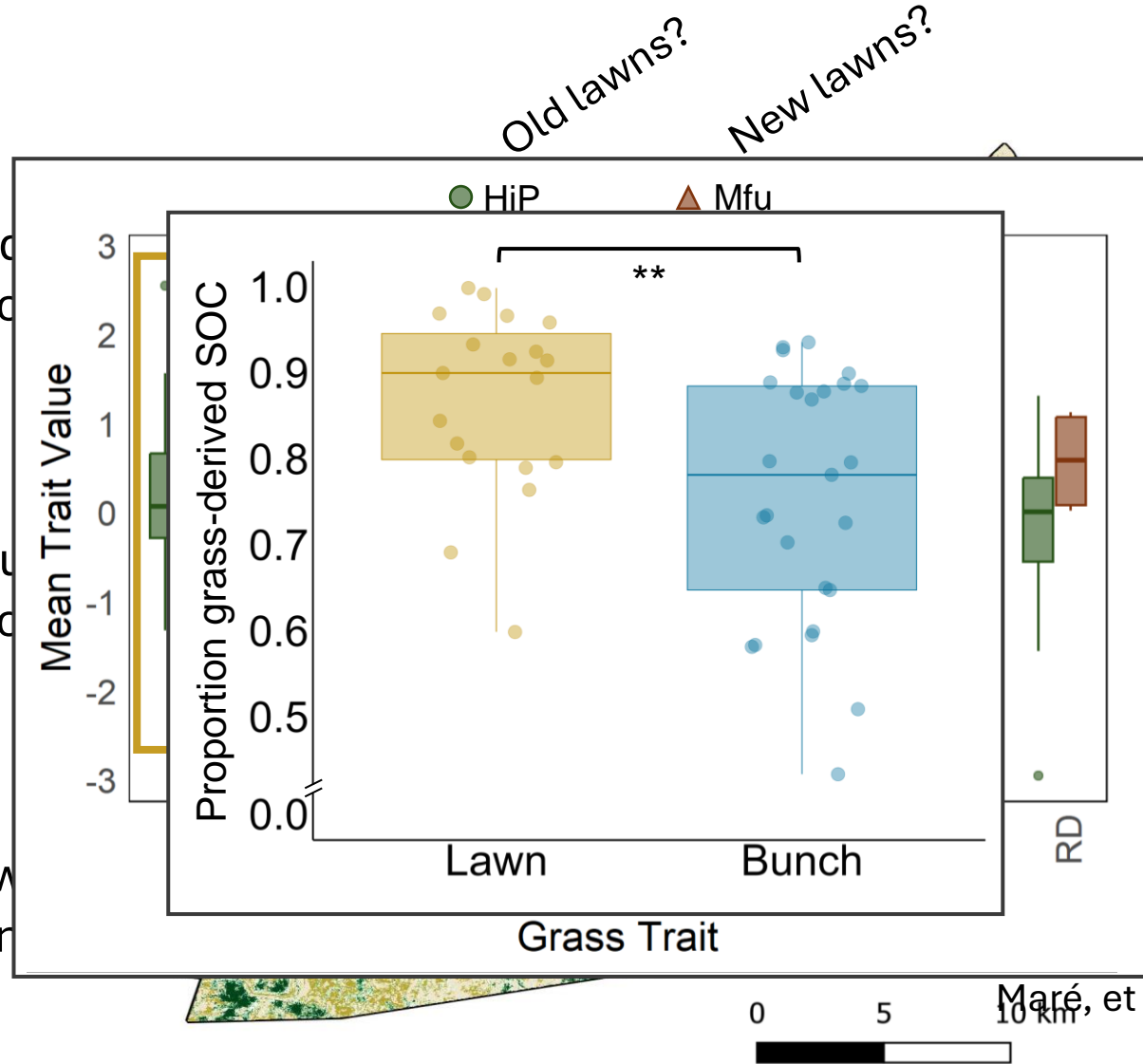
Clear structural differences between functional types and rock types

②

Link between functional types and rock types

③

Differences between sites (grazing intensity, soil type, etc.)



Is data to predict processes across space?

Are predictions about processes across space?

Maré, et al. (In Prep)

Thank you!

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