

What's the deal with woody cover change?

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Center for Ecological Dynamics in a Novel Biosphere (ECONOVO)

Team: Elizabeth le Roux, Jens-Christian Svenning, Joe Atkinson, Andrew Abraham, Oliver Baines, Juraj Bergman, Matthew Child, Hayley Clements, Derek Corcoran, Alta De Vos, Rebecca M. Garland, Michelle Greve, Erick J. Lundgren, Andrew Taylor, Wanben Wu, Robert Buitenwerf

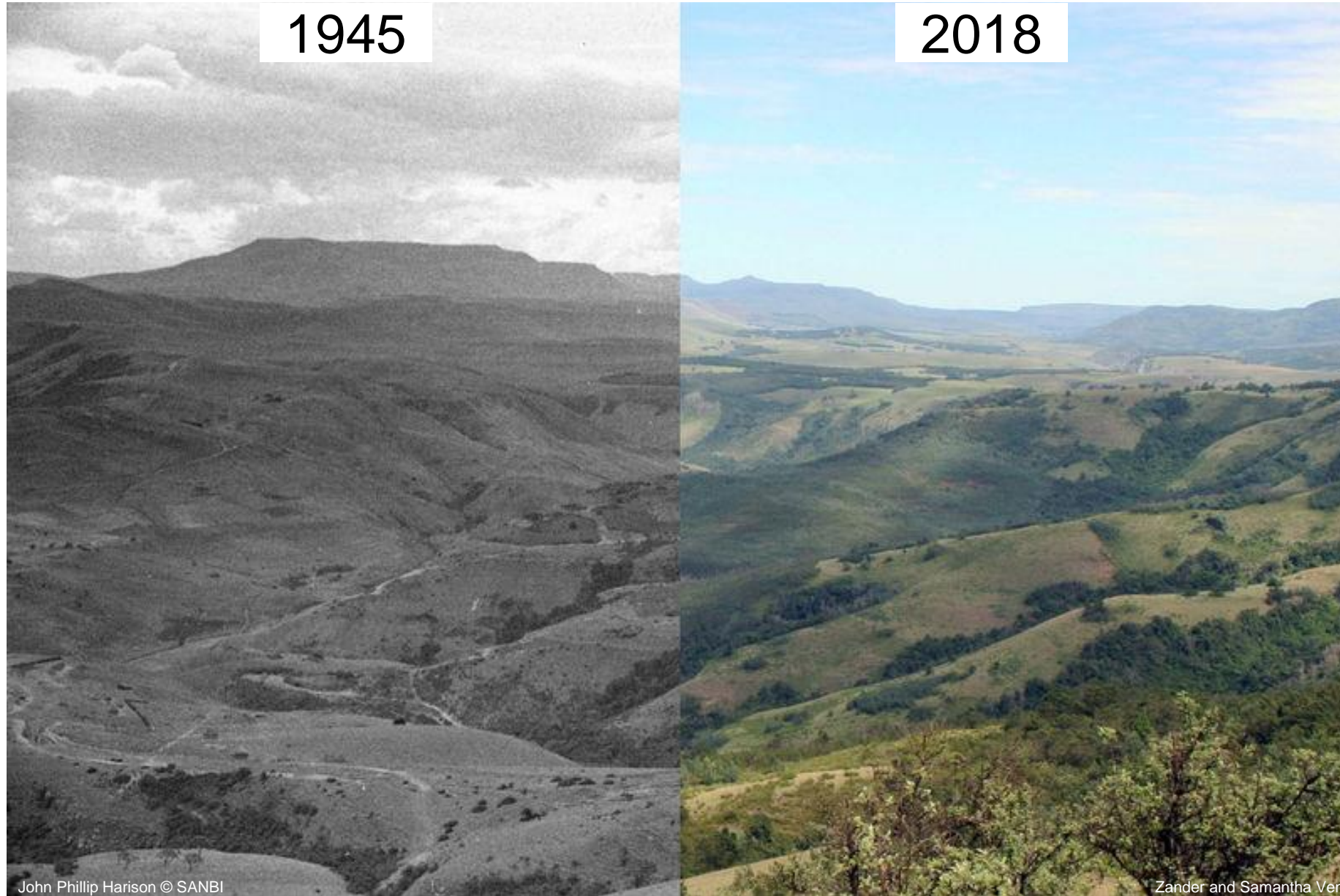


ECONOVO
CENTER FOR ECOLOGICAL DYNAMICS
IN A NOVEL BIOSPHERE



AARHUS
UNIVERSITY
DEPARTMENT OF BIOLOGY

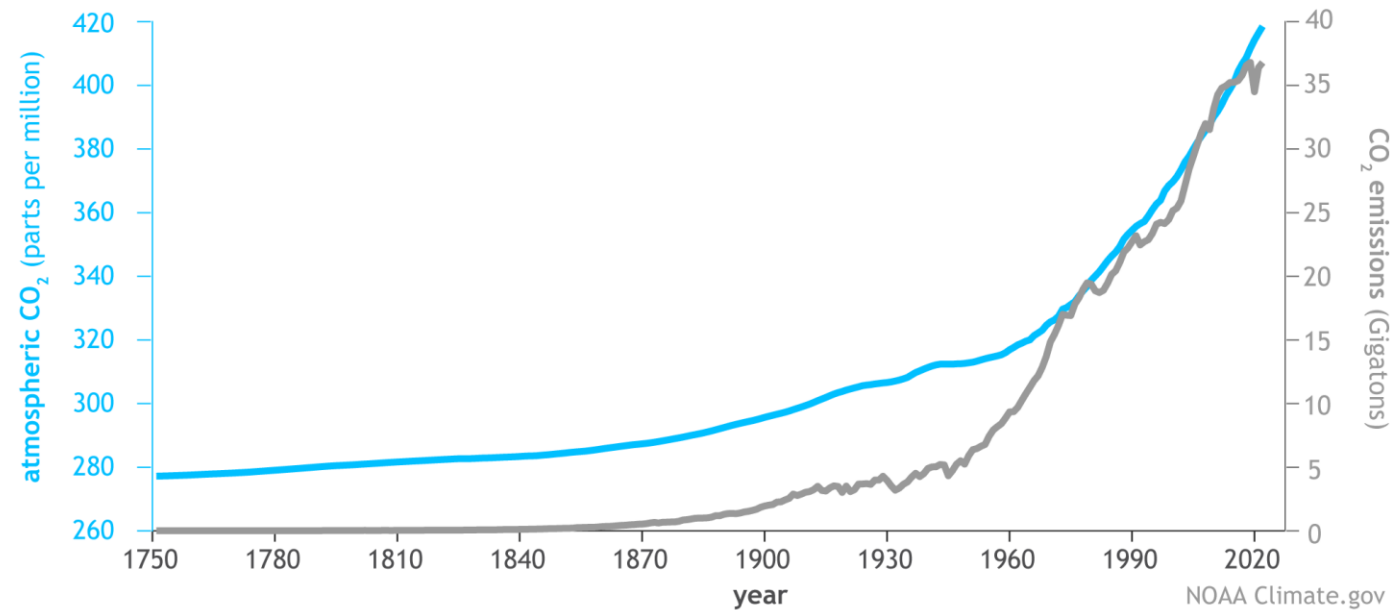
Woody cover is changing



Why is woody cover changing?

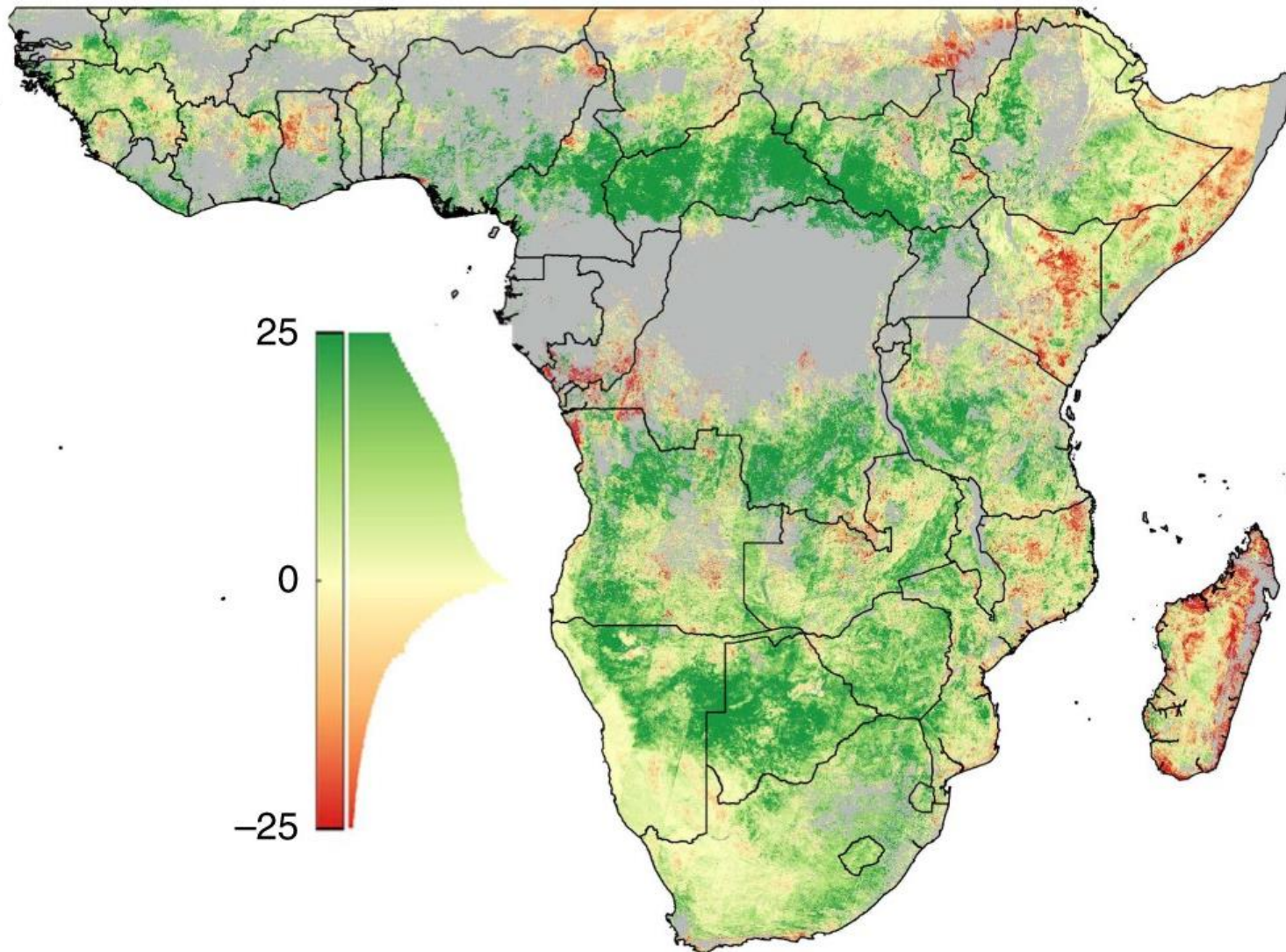
- **CO₂?** (e.g., Buitenwerf et al. 2012, Global Change Biology)

Global atmospheric carbon dioxide compared to annual emissions (1751-2022)



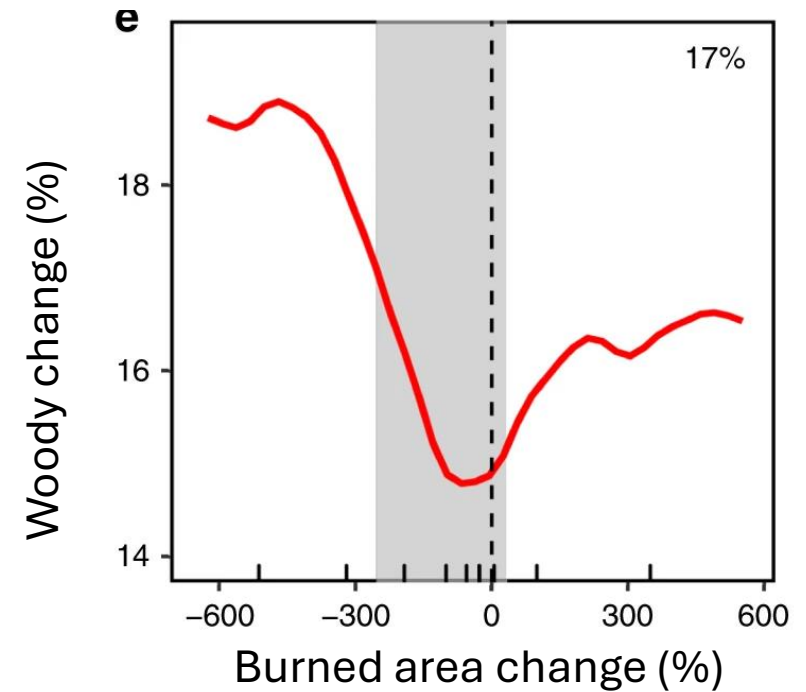
NOAA Climate.gov
Data: NOAA, ETHZ, Our World in Data

Woody cover change (%)



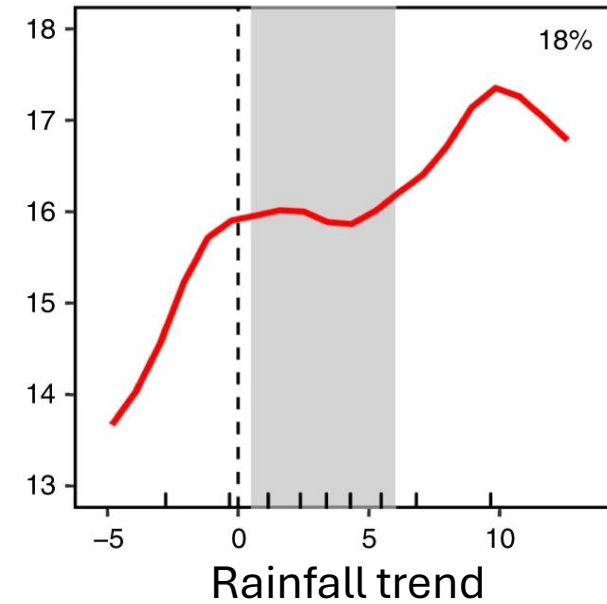
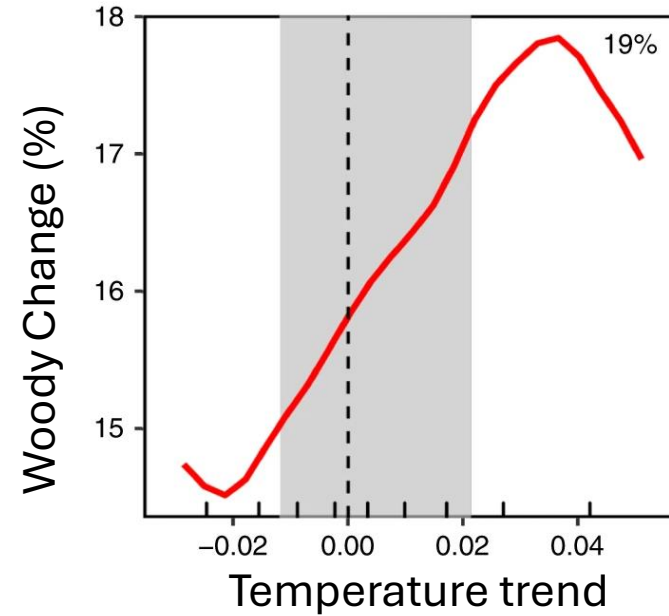
Why is woody cover changing?

- **CO2?** (e.g., Buitenwerf et al. 2015, Global Change Biology)
- **Fire?** (e.g., Venter et al., 2018, Nature Comms)



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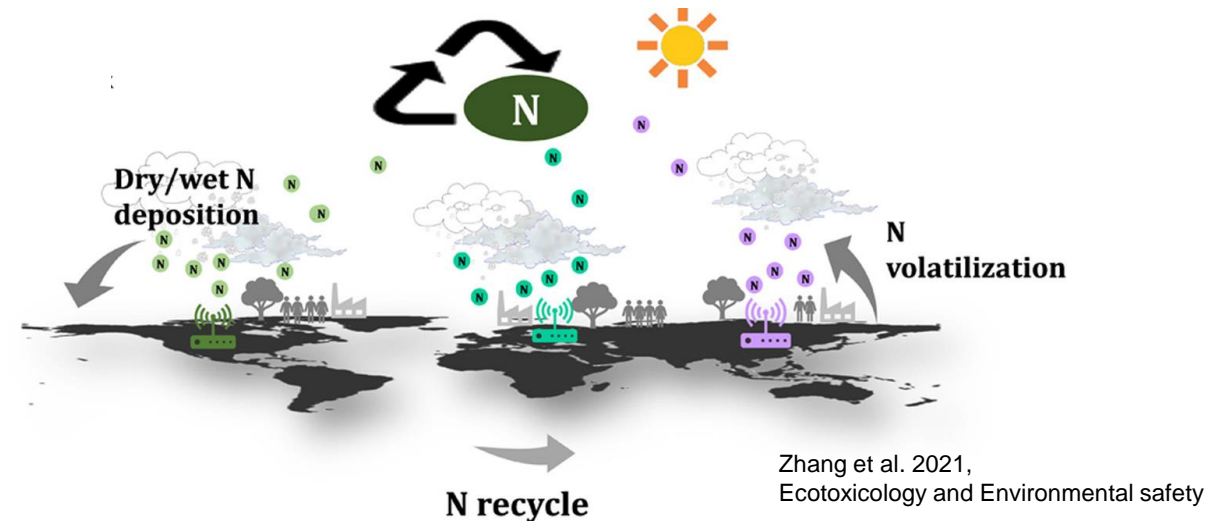
Why is woody cover changing?

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- **Fire?** (e.g., Venter et al., 2018, Nature Comms)
- **Climate?** (e.g., Venter et al., 2018, Nature Comms)
- **Large herbivores?**

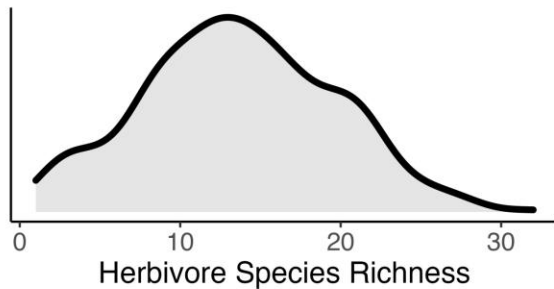
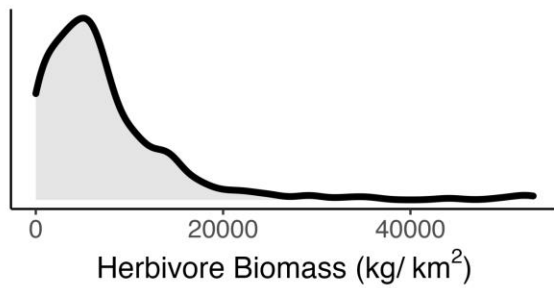
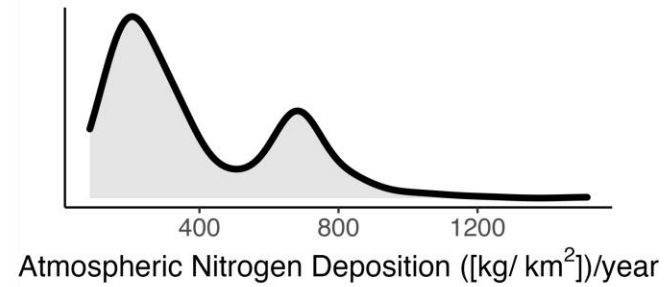
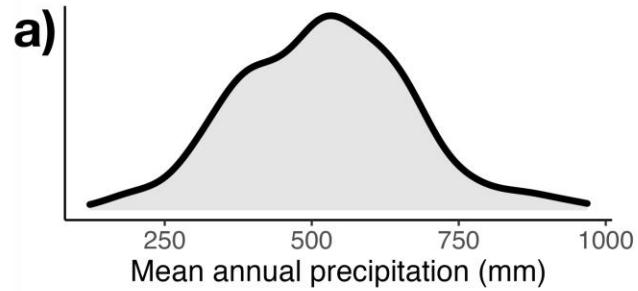


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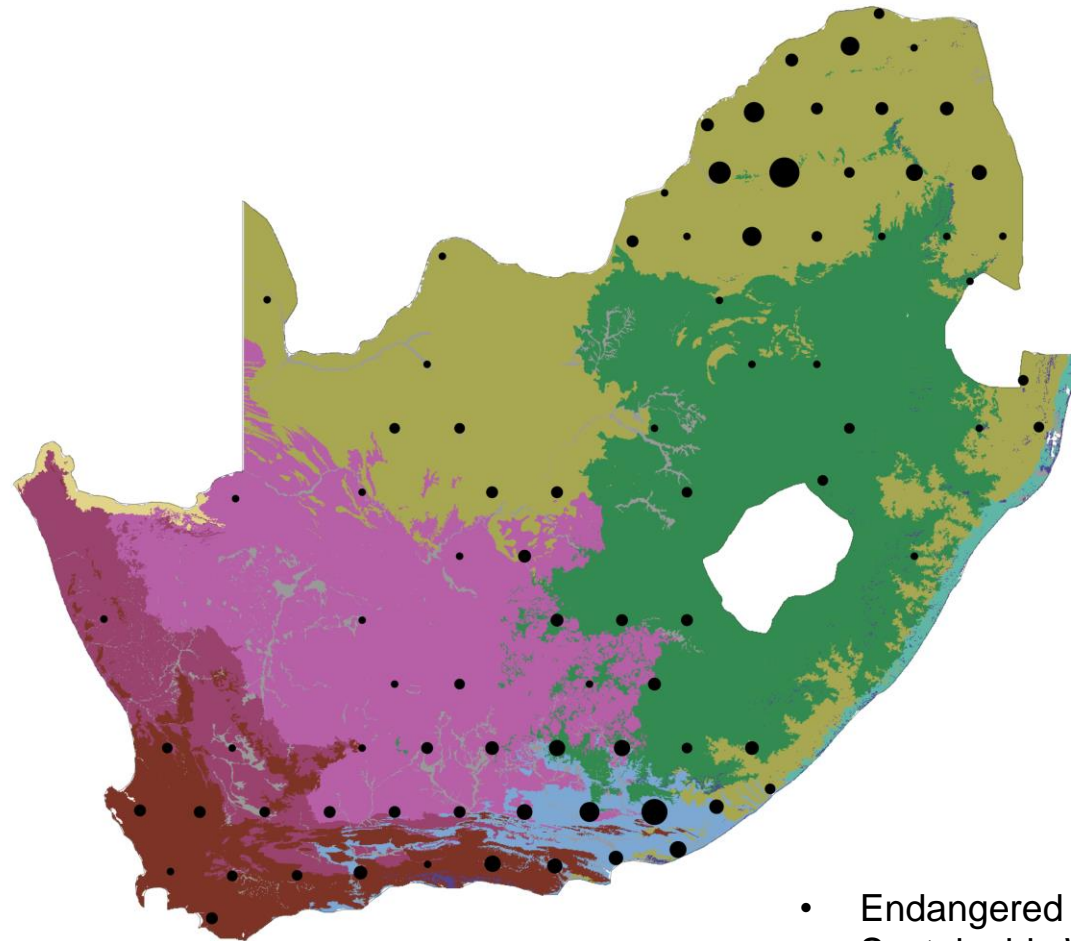
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- **Fire?** (e.g., Venter et al., 2018, Nature Comms)
- **Climate?** (e.g., Venter et al., 2018, Nature Comms)
- **Large herbivores?**
- **Nutrient addition?**



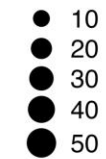
396 reserves across South Africa



b)



Number of reserves



Biome

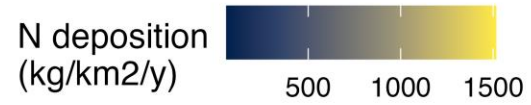


- Endangered Wildlife Trust (EWT)
- Sustainable Wildlife Economies Project (SWEP)
- Hayley Clements
- SANParks

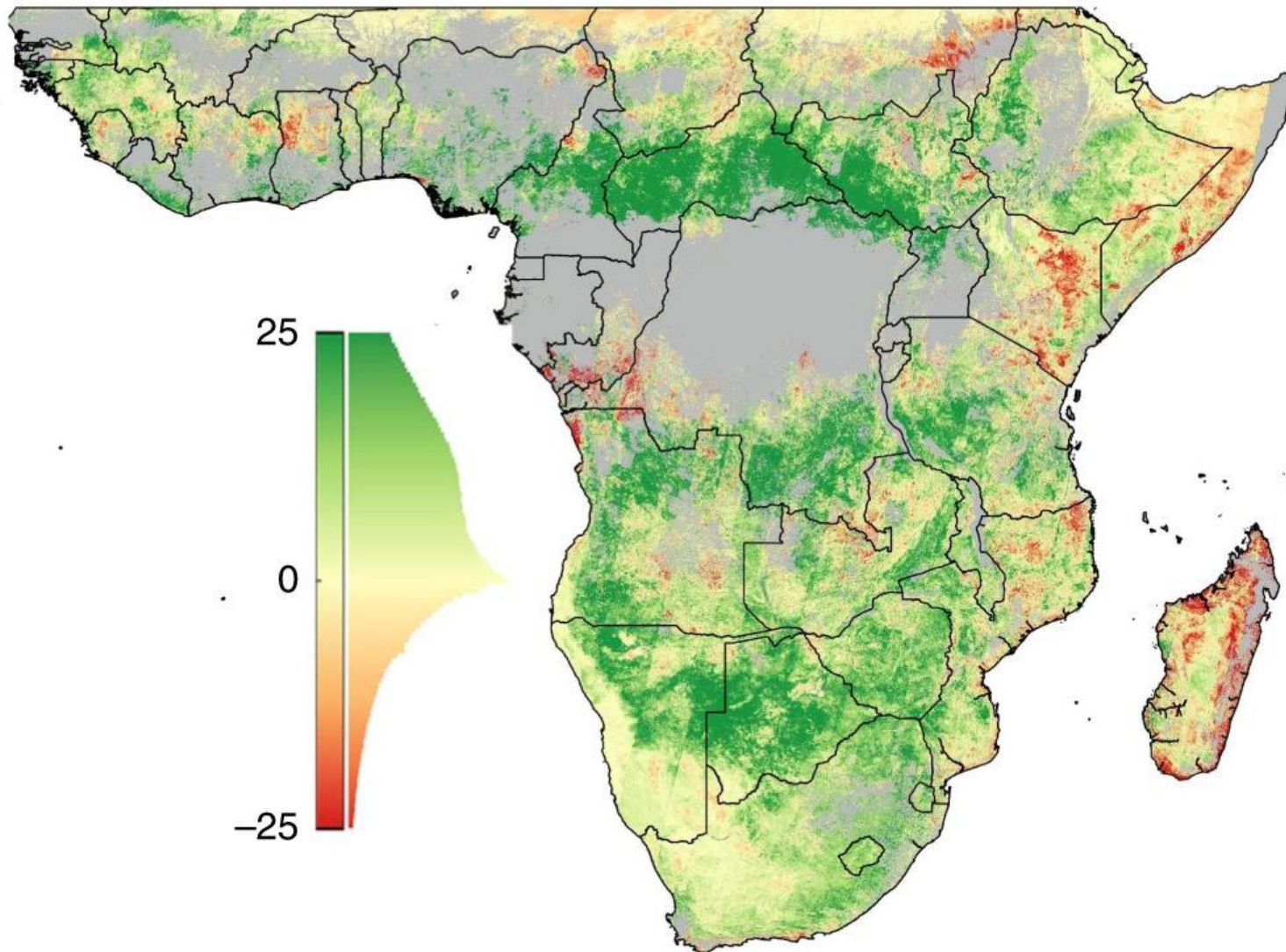
a)



b)

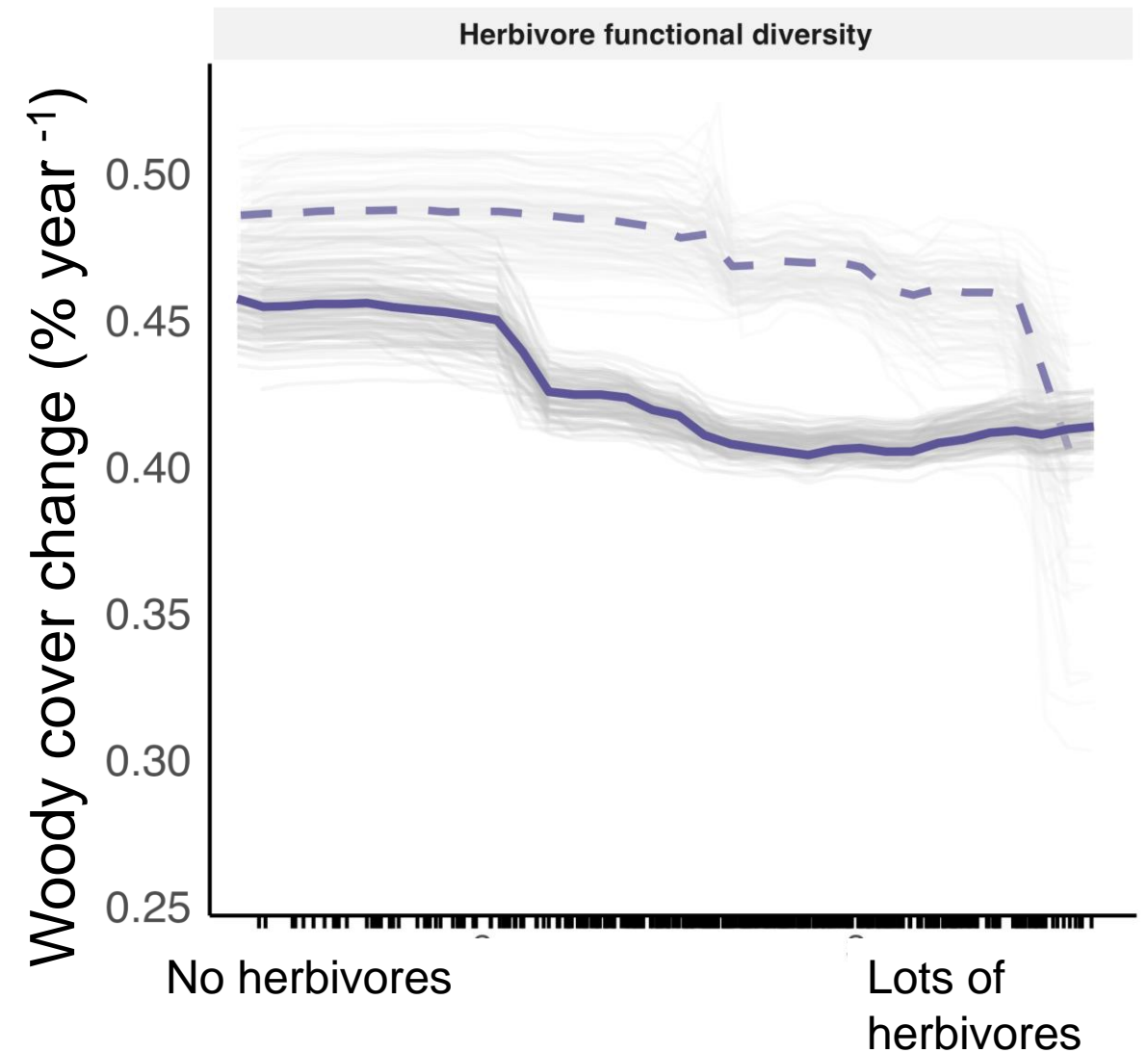


Woody cover change (%)

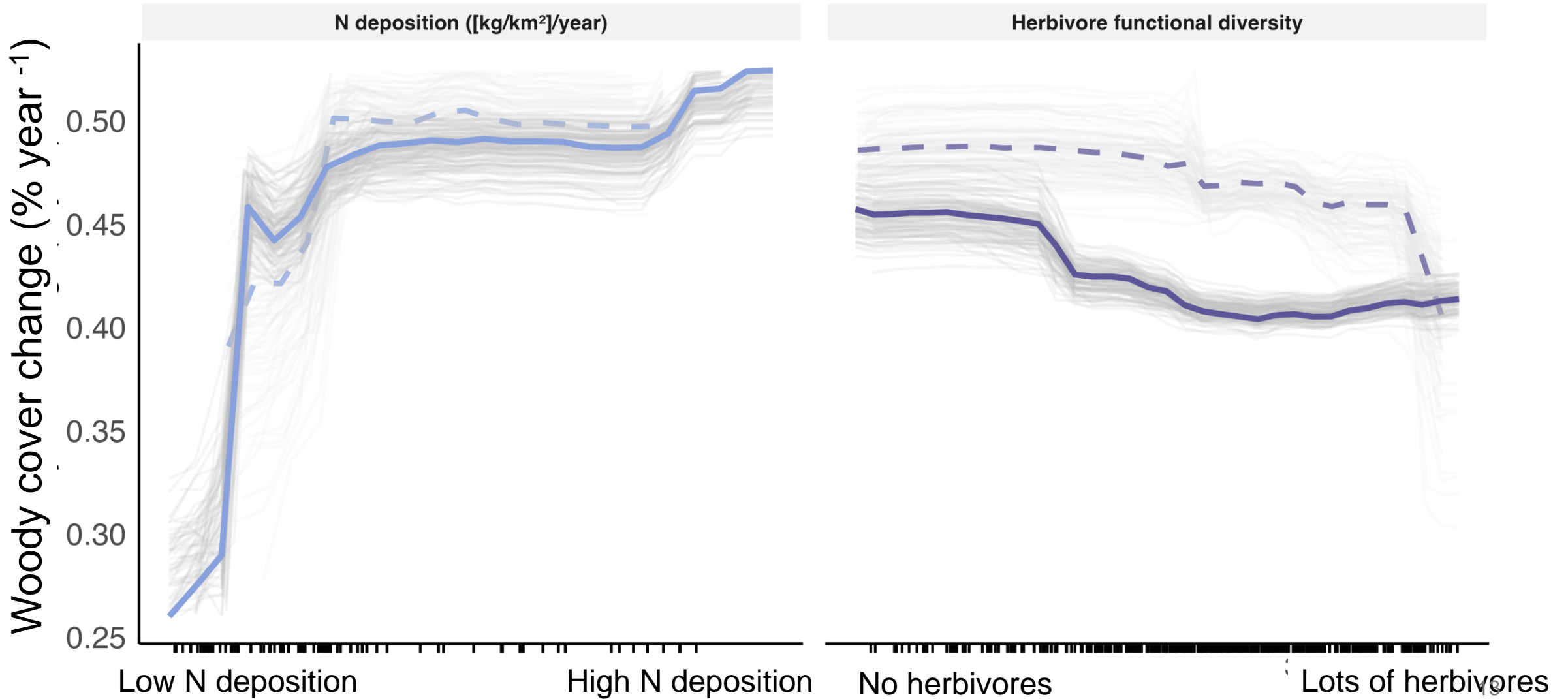


Venter et al., 2018; Nature Comms

Slightly slower increase of woody cover in reserves with functionally diverse herbivore communities



Considerably stronger increase in areas exposed to high N deposition

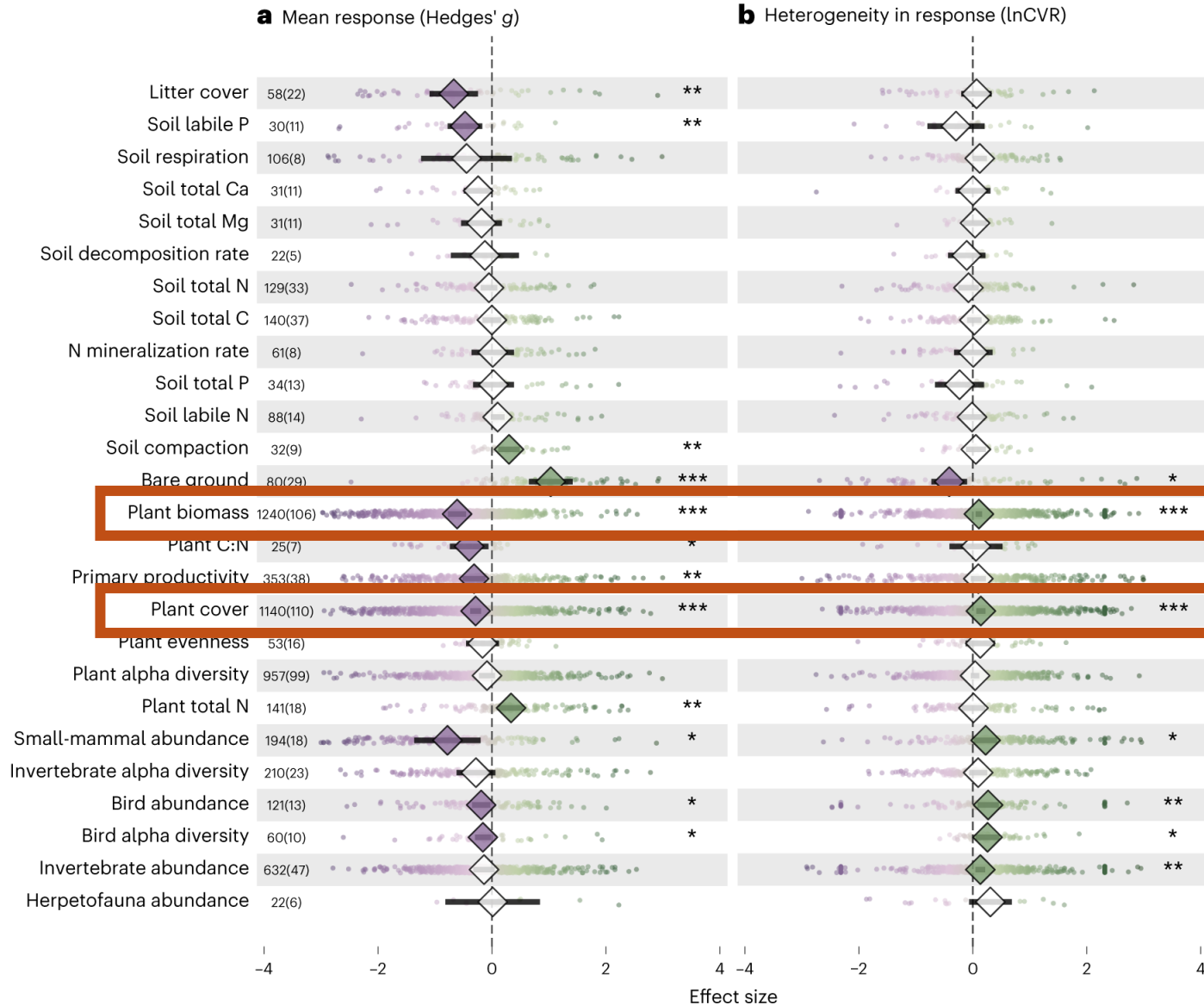


Net increase of woody cover in most reserves (88
%)

Trend unlikely to turn soon

What now?

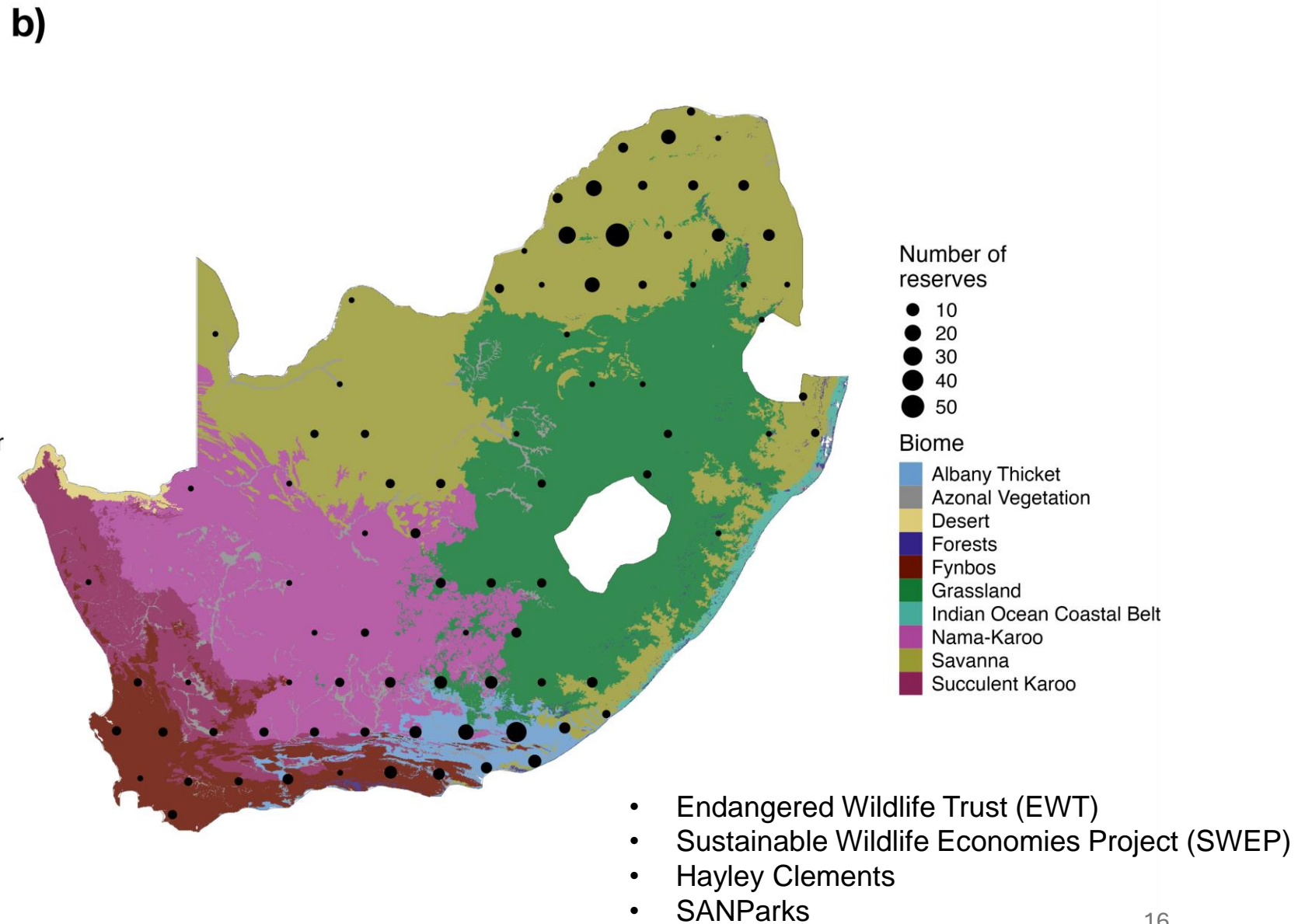
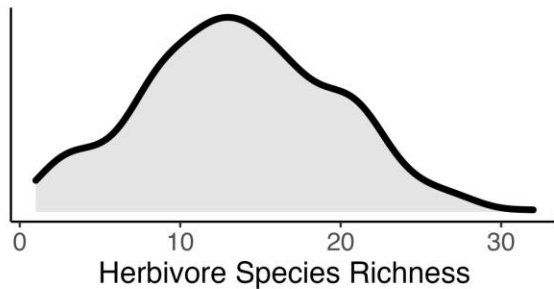
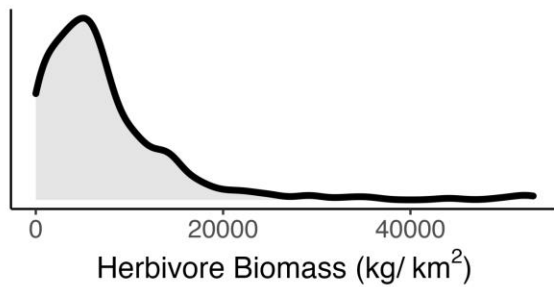
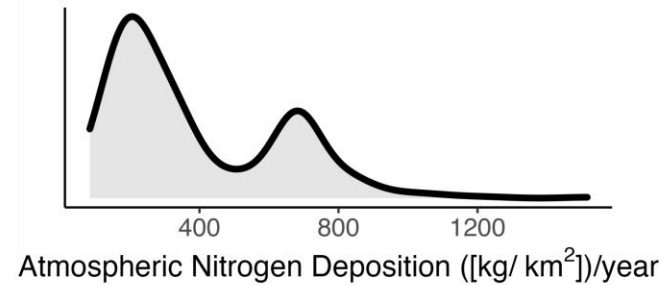
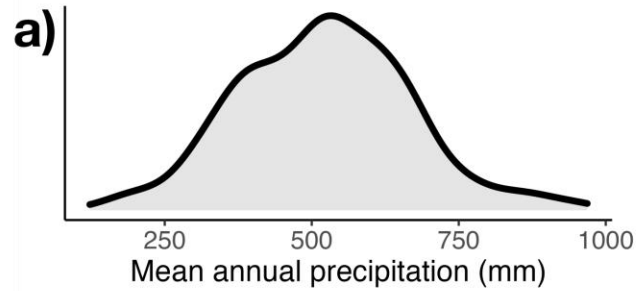
Large herbivores can increase heterogeneity at plot scale



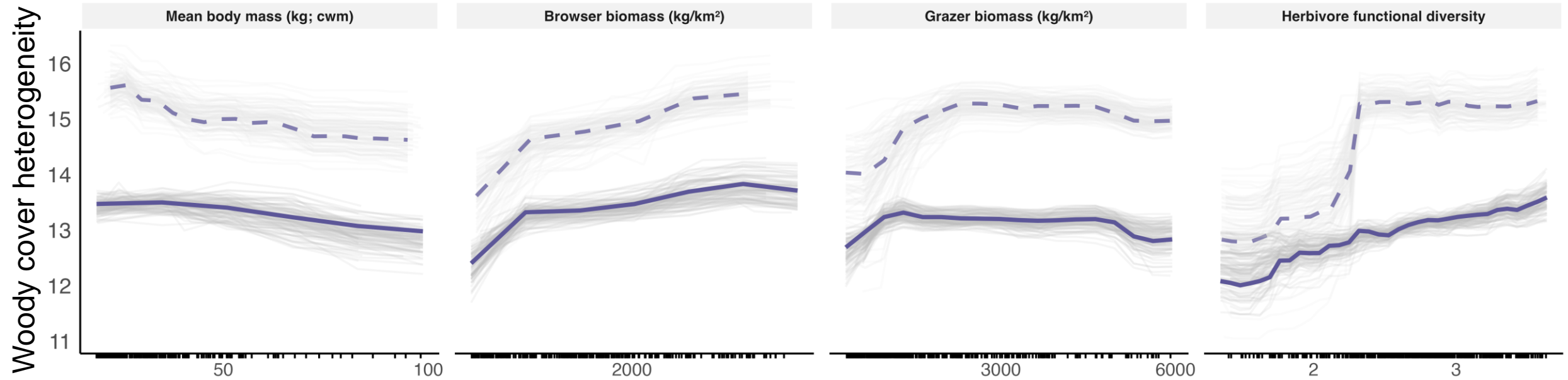
Heterogeneity in plant biomass ~ megafauna

Heterogeneity in plant cover ~ megafauna

396 reserves across South Africa



Functionally diverse herbivore communities and browsers increase heterogeneity



4 most important herbivore related variables

Take home

- Nitrogen deposition strongly associated with increases in woody cover
- Large herbivores may mitigate, but only when reducing N and CO₂ emissions
- Functionally diverse large herbivore communities may increase biodiversity potential of increasingly woody systems



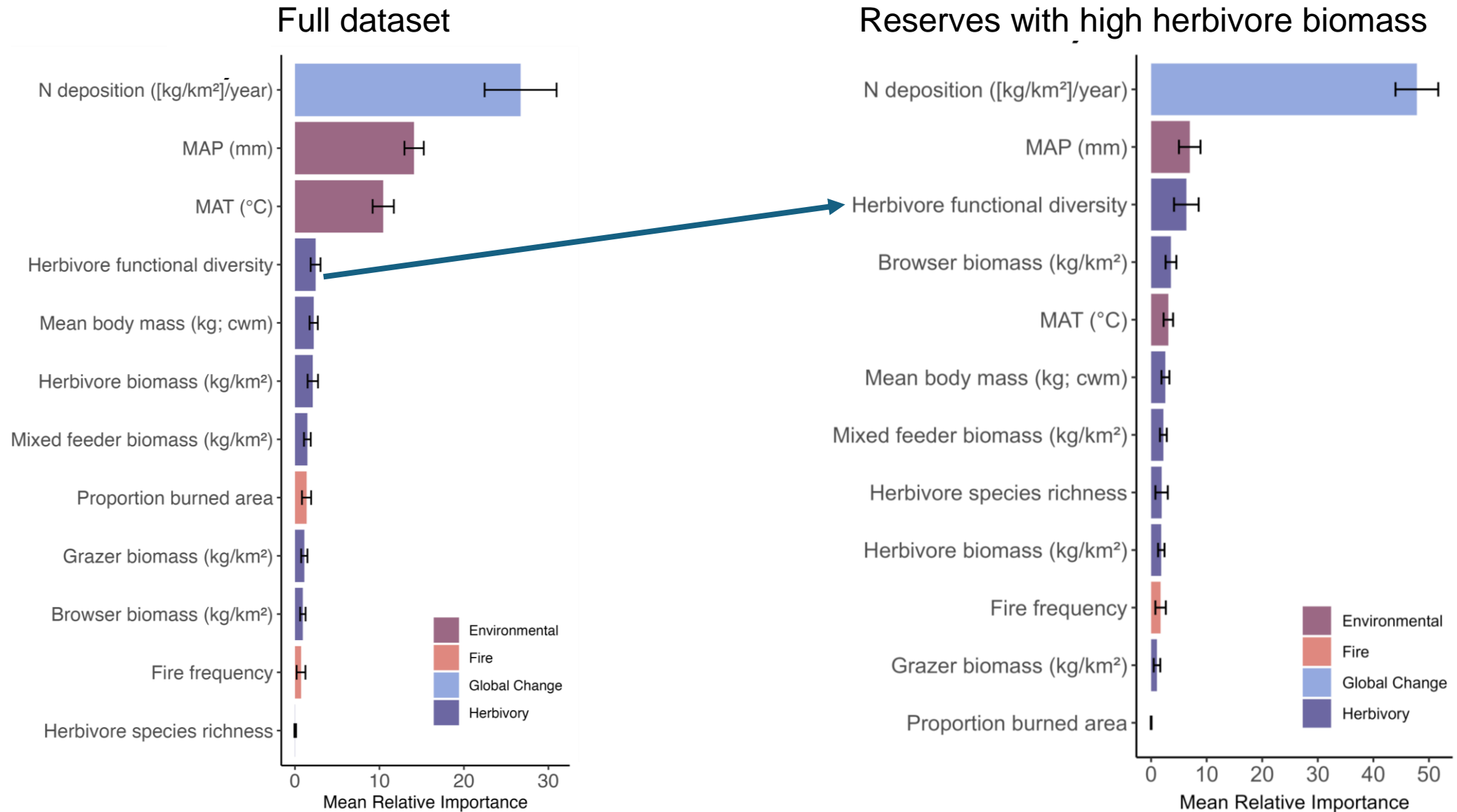
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Thanks!

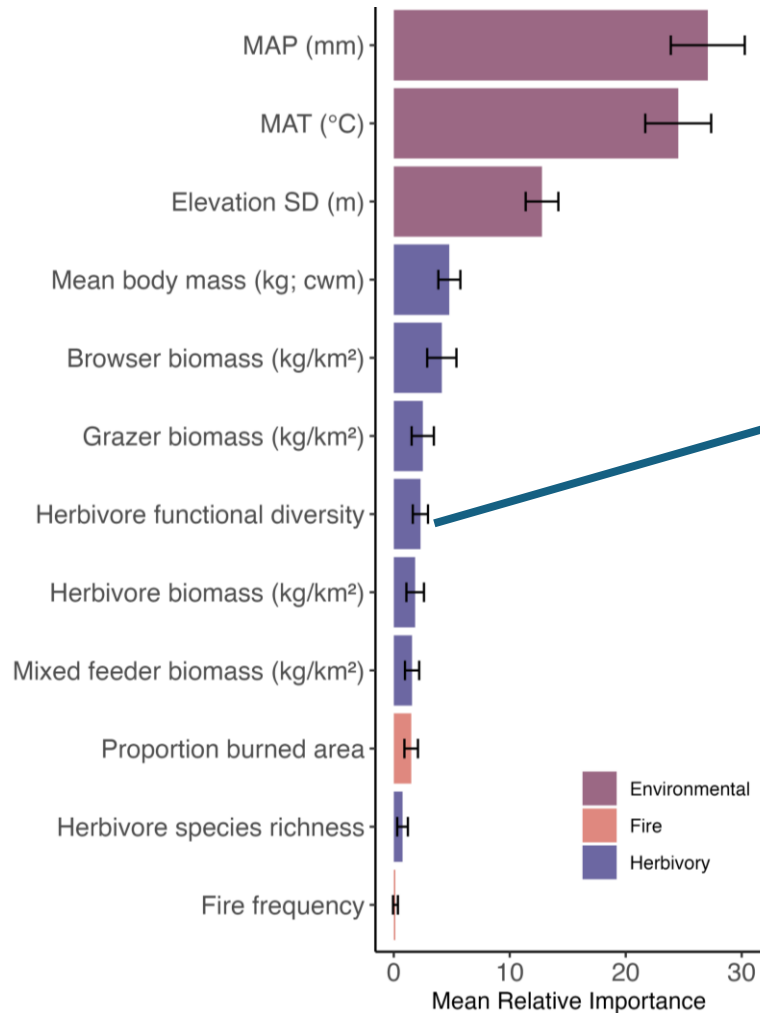
Further questions? Contact me!
Jonas Trepel
Email: jonas.trepel@bio.au.dk

Herbivores more important in reserves with higher densities

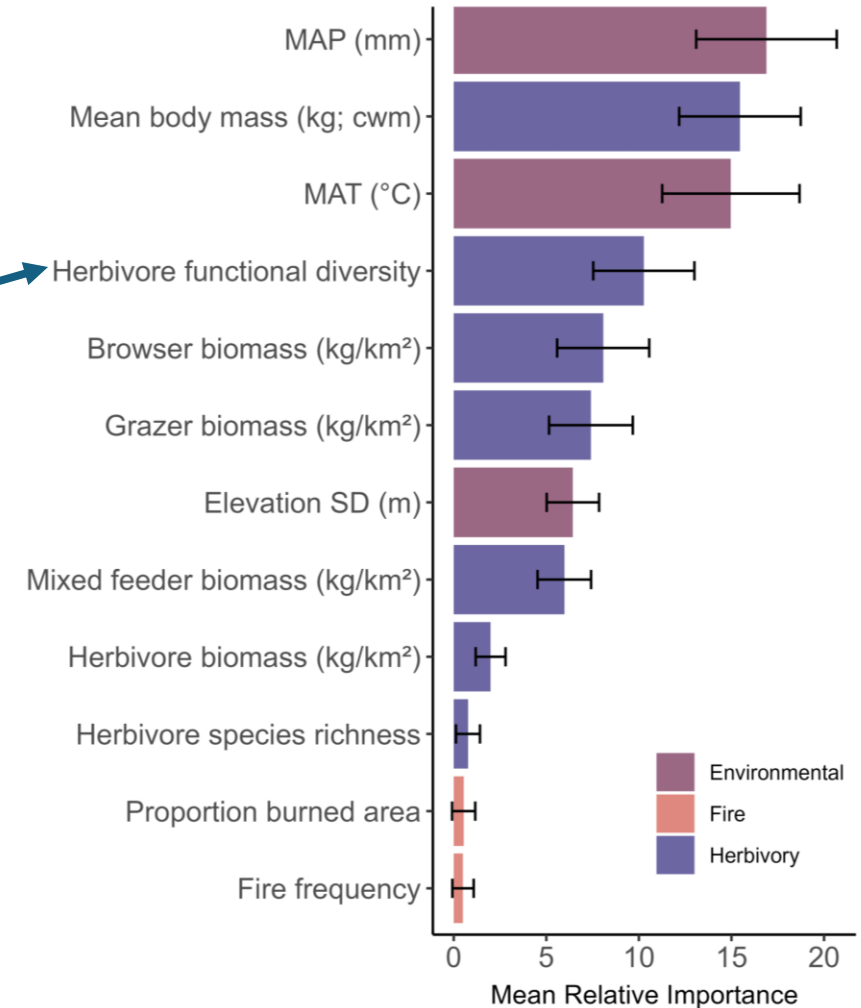


Herbivores more important in reserves with higher densities

Full dataset

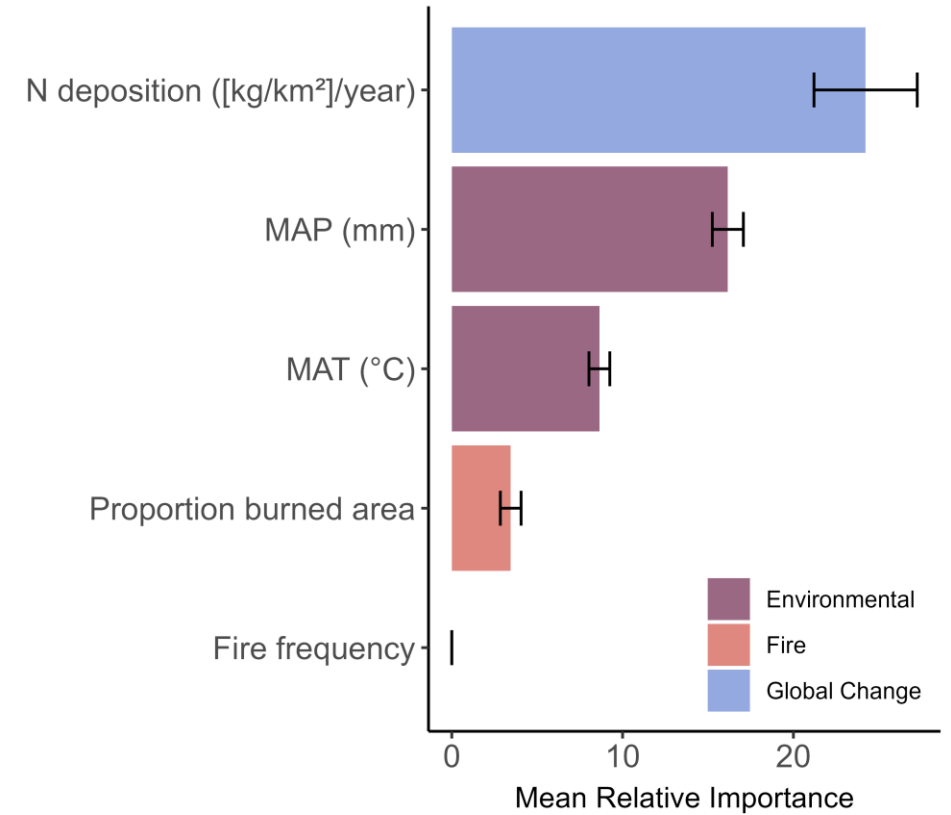
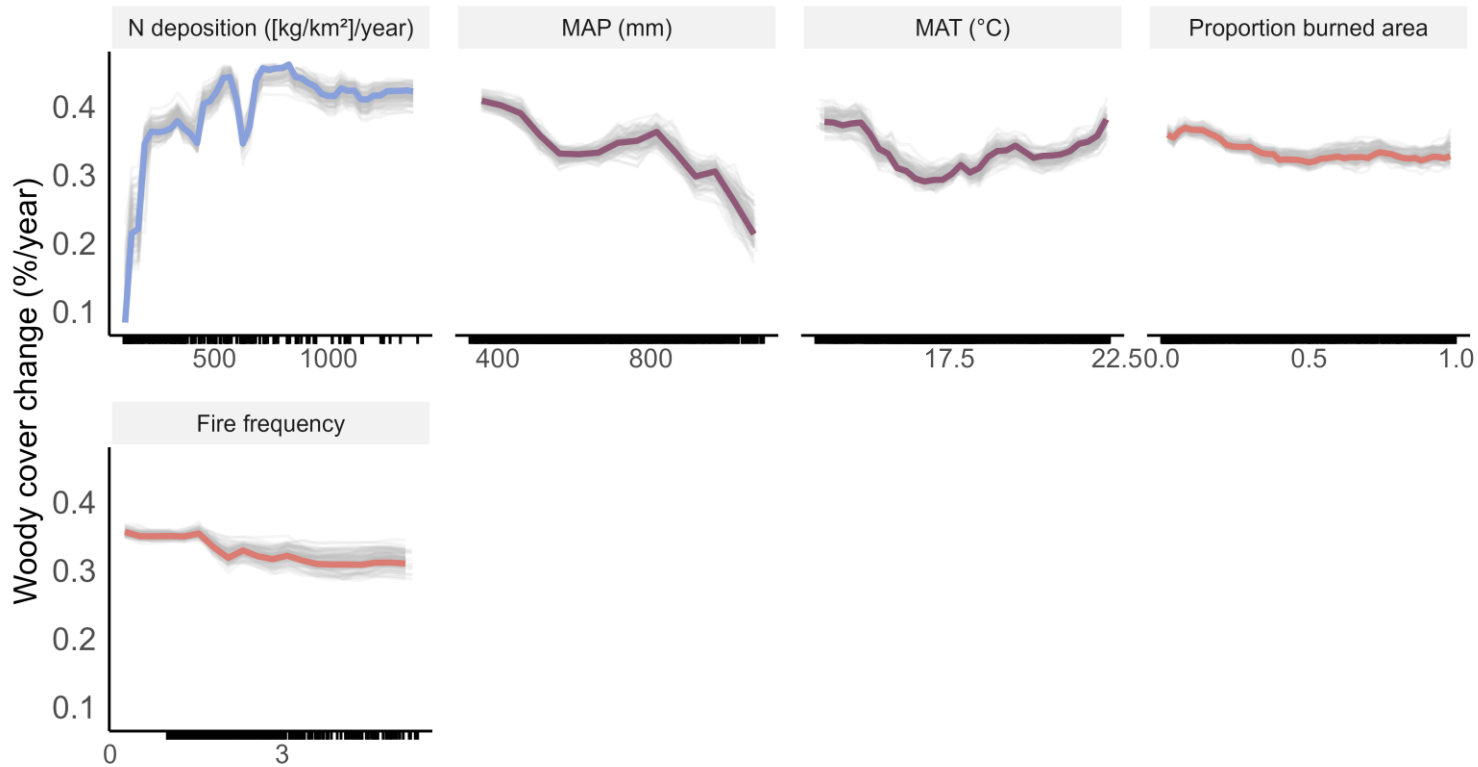


Reserves with high herbivore biomass



South African PAs

Woody cover change (%/year)
Full model (n = 1399; R-sq = 0.6±0.04; RMSE = 0.26±0.02)

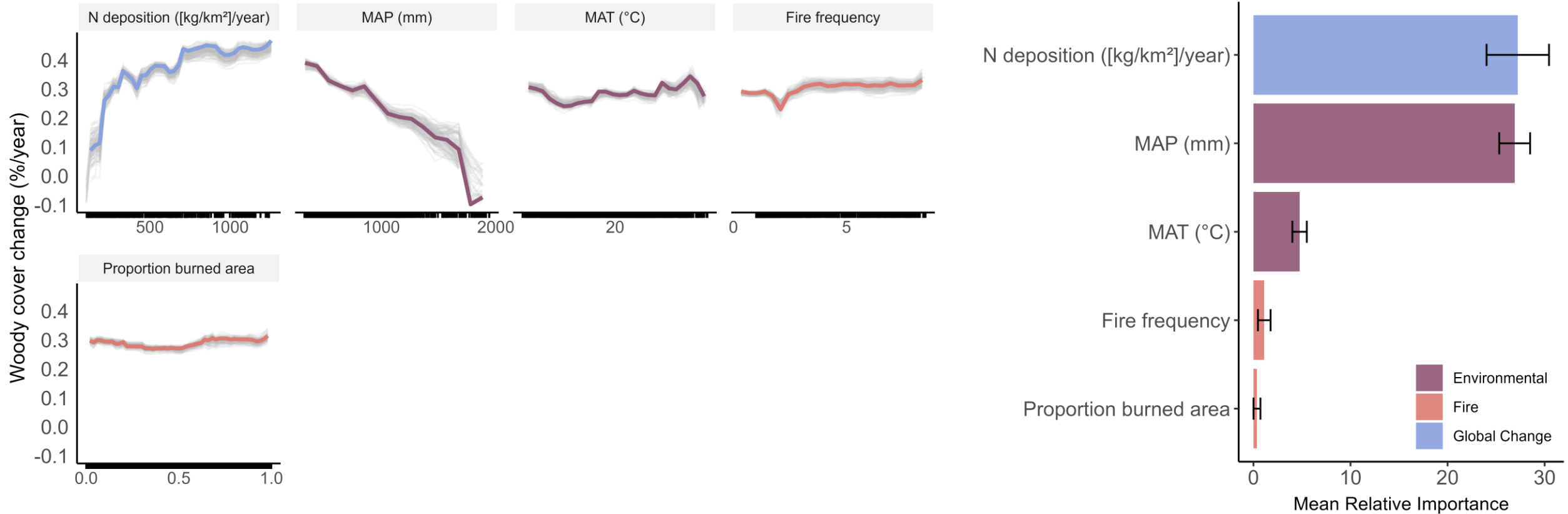


Best method: ensemble

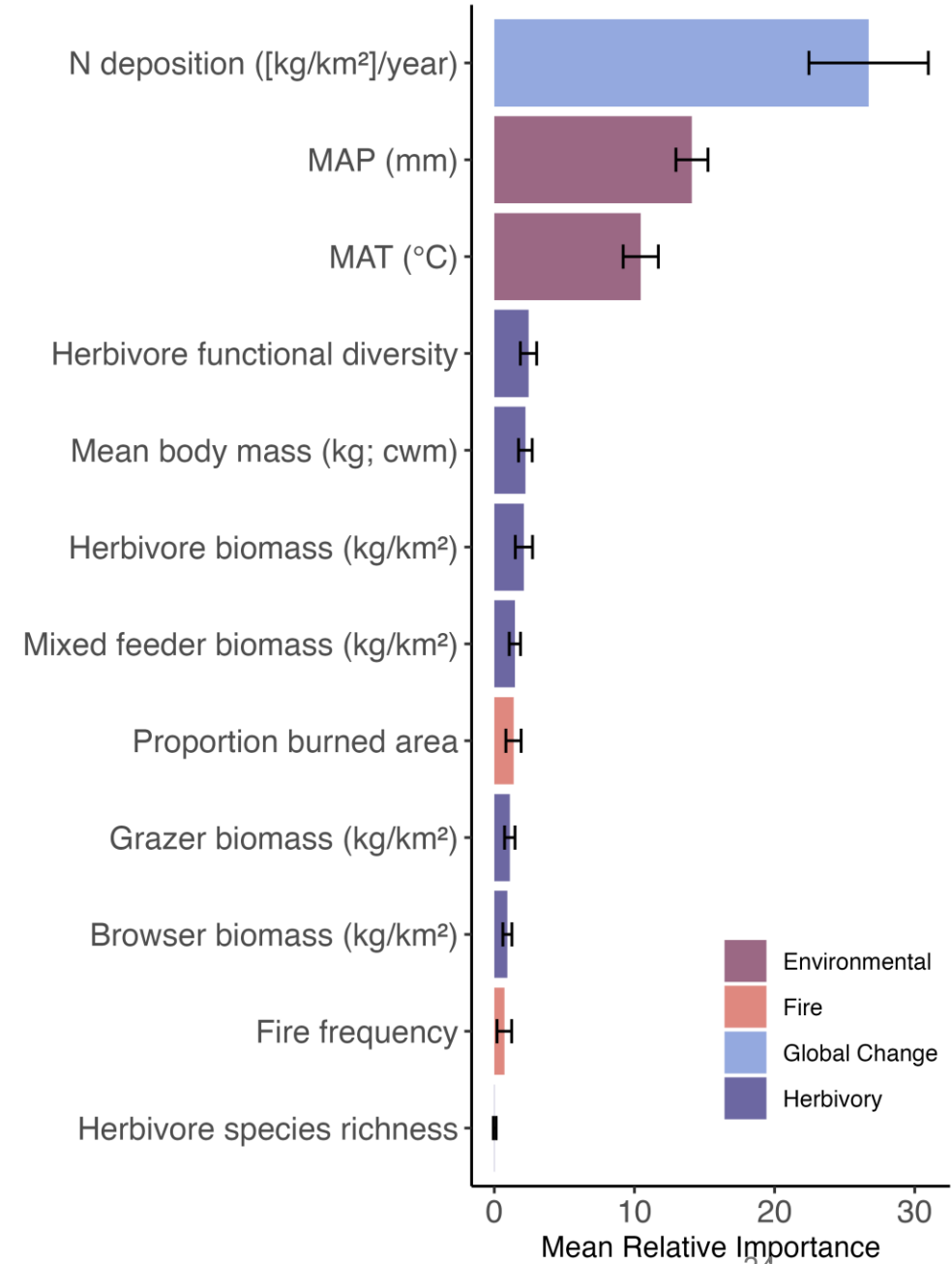
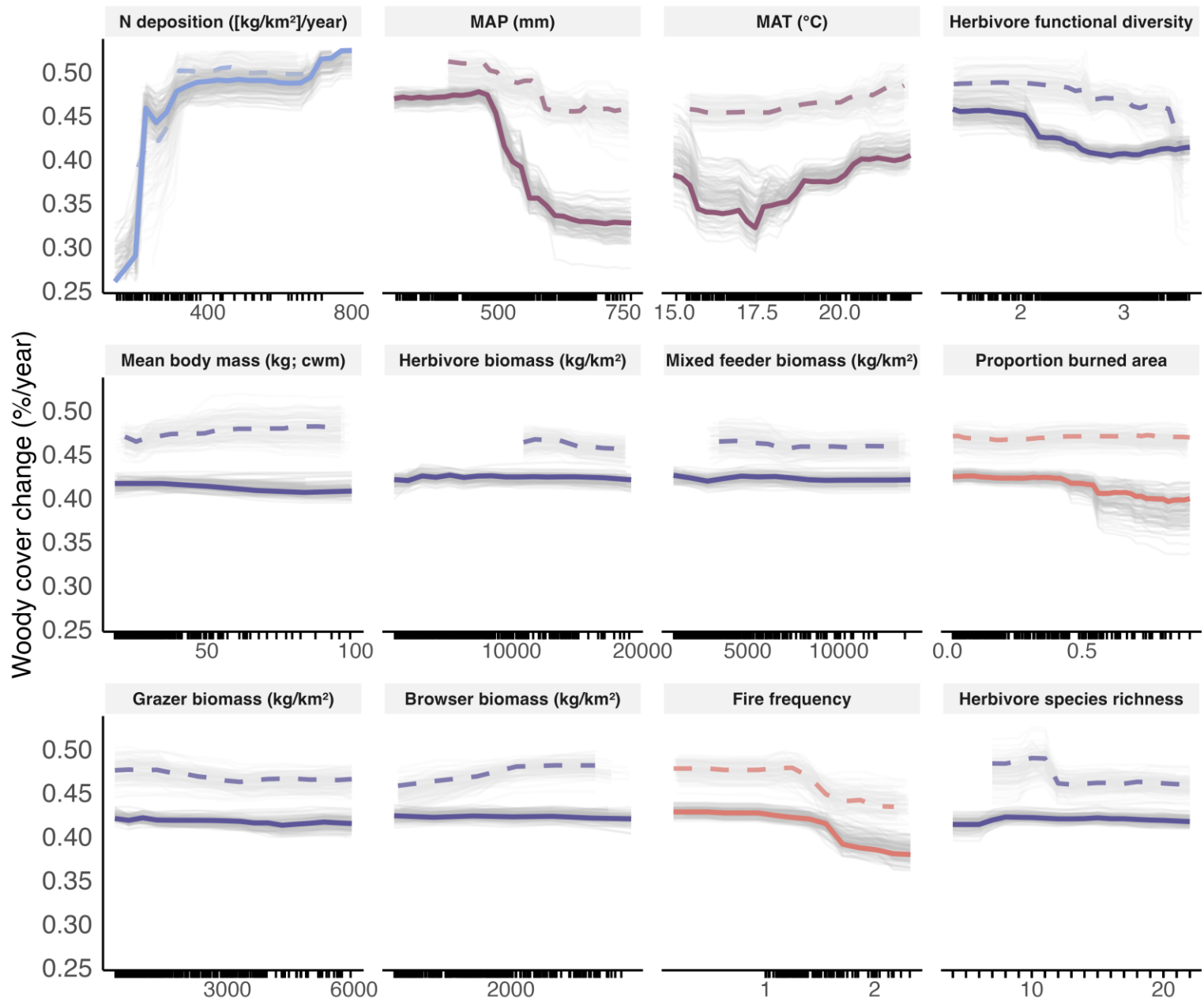
Sub Saharan PAs

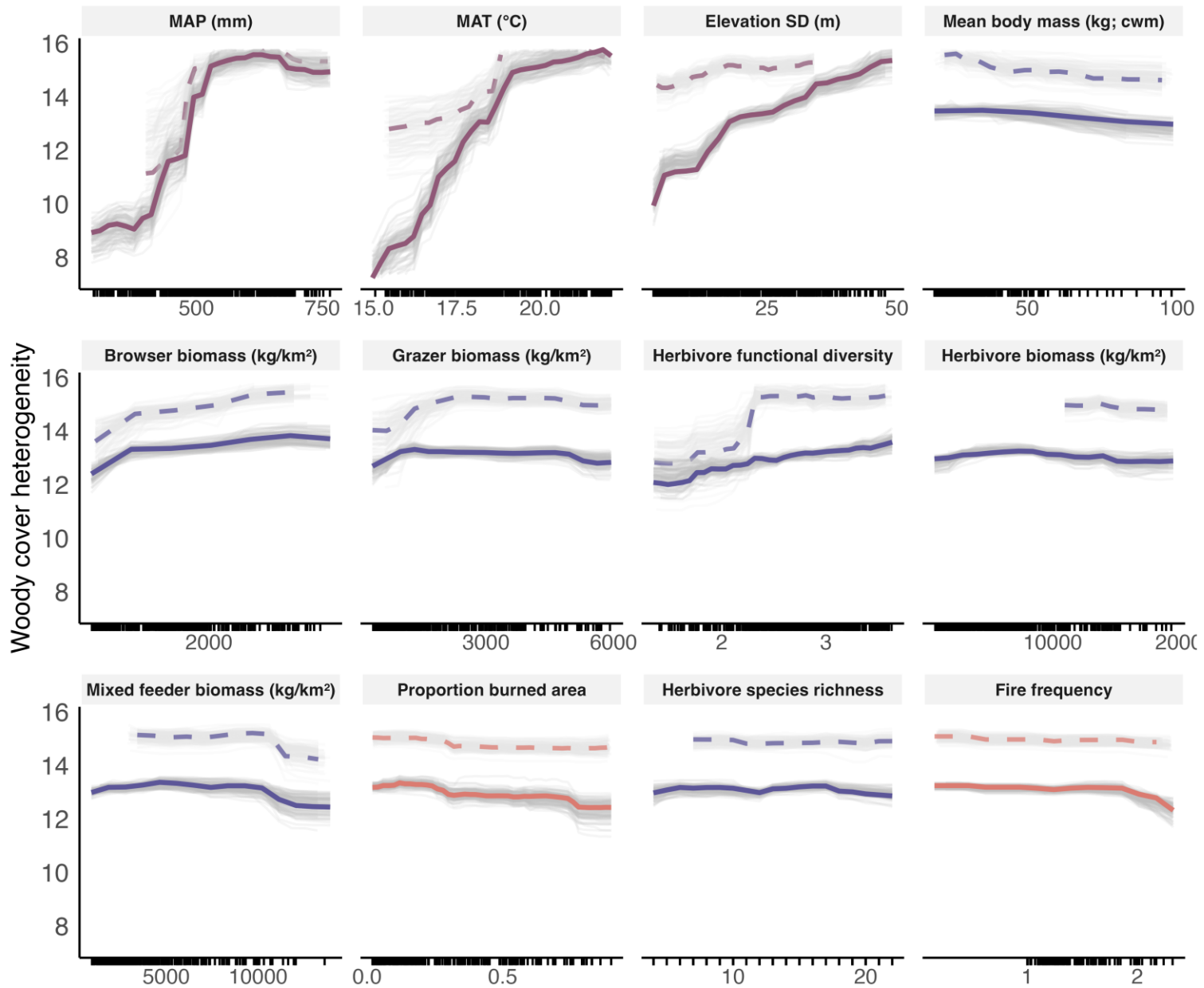
Woody cover change (%/year)

Protected areas across Sub-Saharan Africa (n = 1866; R-sq = 0.62±0.04; RMSE = 0.3±0.02)



Best method: ensemble





Woody cover heterogeneity

