Exploring the effects of biodiversity and elemental stoichiometry on terrestrial carbon balance?

Marcos Fernández-Martínez,
J. Sardans, Josep Peñuelas, Ivan A. Janssens
Universiteit Antwerpen - PLECO

EGU 2020, Vienna, 08/04/2020

Universiteit Antwerpen

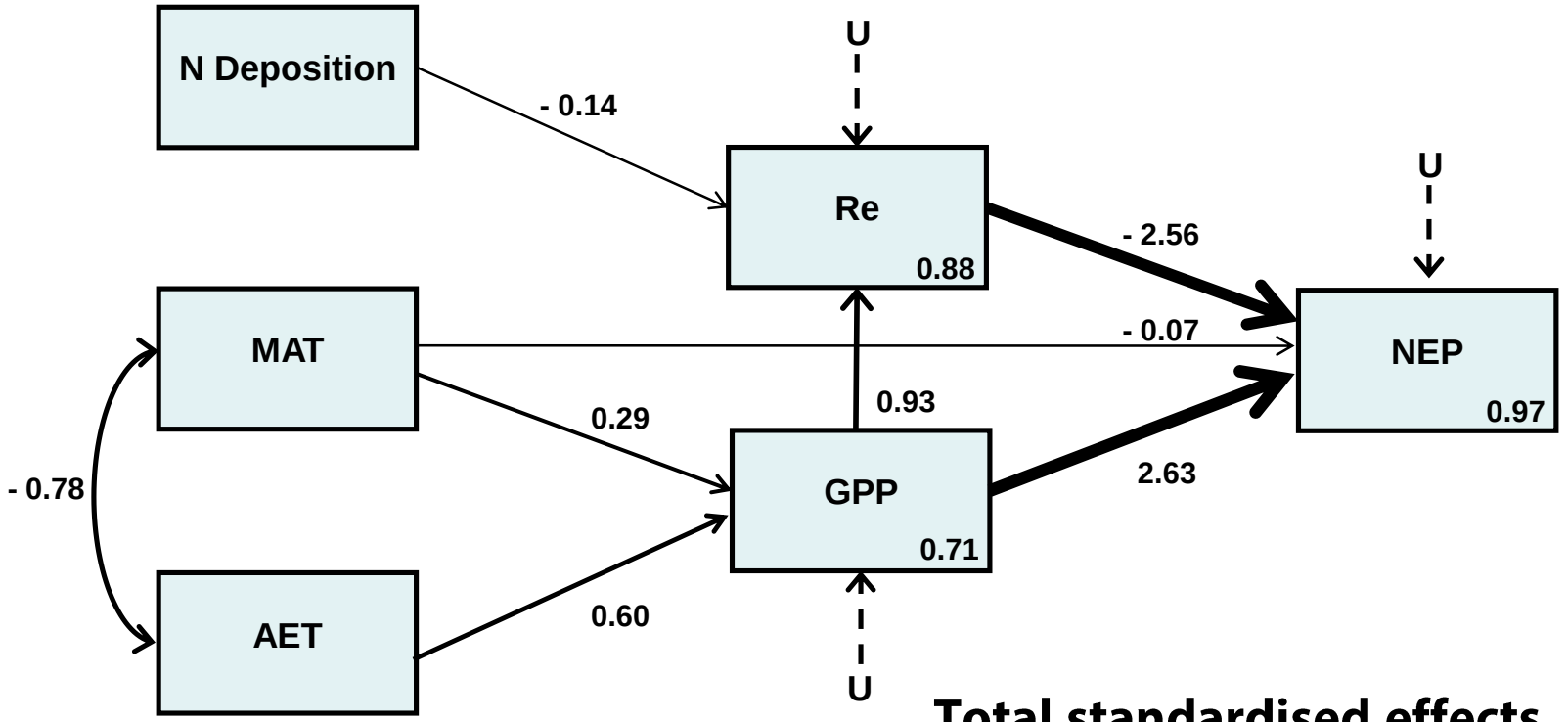
Research Foundation Flanders
Opening new horizons

GEU

CREAF

Known drivers of terrestrial C balance

- Climate, management, atmospheric deposition, land-use change…



Total standardised effects

	N dep	AET	MAT	GPP	Re
GPP		0.60 ± 0.09	0.29 ± 0.09		
Re	-0.14 ± 0.05	0.55 ± 0.08	0.27 ± 0.08	0.93 ± 0.03	
NEP	0.37 ± 0.14	0.16 ± 0.31	0.01 ± 0.30	0.26 ± 0.11	-2.55 ± 0.05

Modified from Fernández-Martínez et al., 2014 – *Trees*

Known drivers of terrestrial C balance

- **Nutrient availability** ~ altered atmospheric deposition and CO_2

Graph not shown due to copyright,

See de Vries et al., 2014 – *Nature Climate Change*

The role of biodiversity on ecosystem functioning

- **Biodiversity increases productivity and stability in terrestrial and aquatic ecosystems (biomass production, decomposition)**

- **Shown to be as important as other drivers of global change (nutrients, drought)**

- **But it's role on C balance is unknown!**

Altered biogeochemical cycles and biodiversity

- **Altered biogeochemical cycles and climate change C:N:P stoichiometry and reduce biodiversity**

Graph not shown due to copyright,

see Steffen et al., 2015 - Science

Objectives:

Effects of foliar N and P and biodiversity on C balance

- **Local scale:**

  ~ 62 Fluxnet sites (GPP, Re and NEP) including:

  Forests (41), savannas, shrublands and grasslands (21)

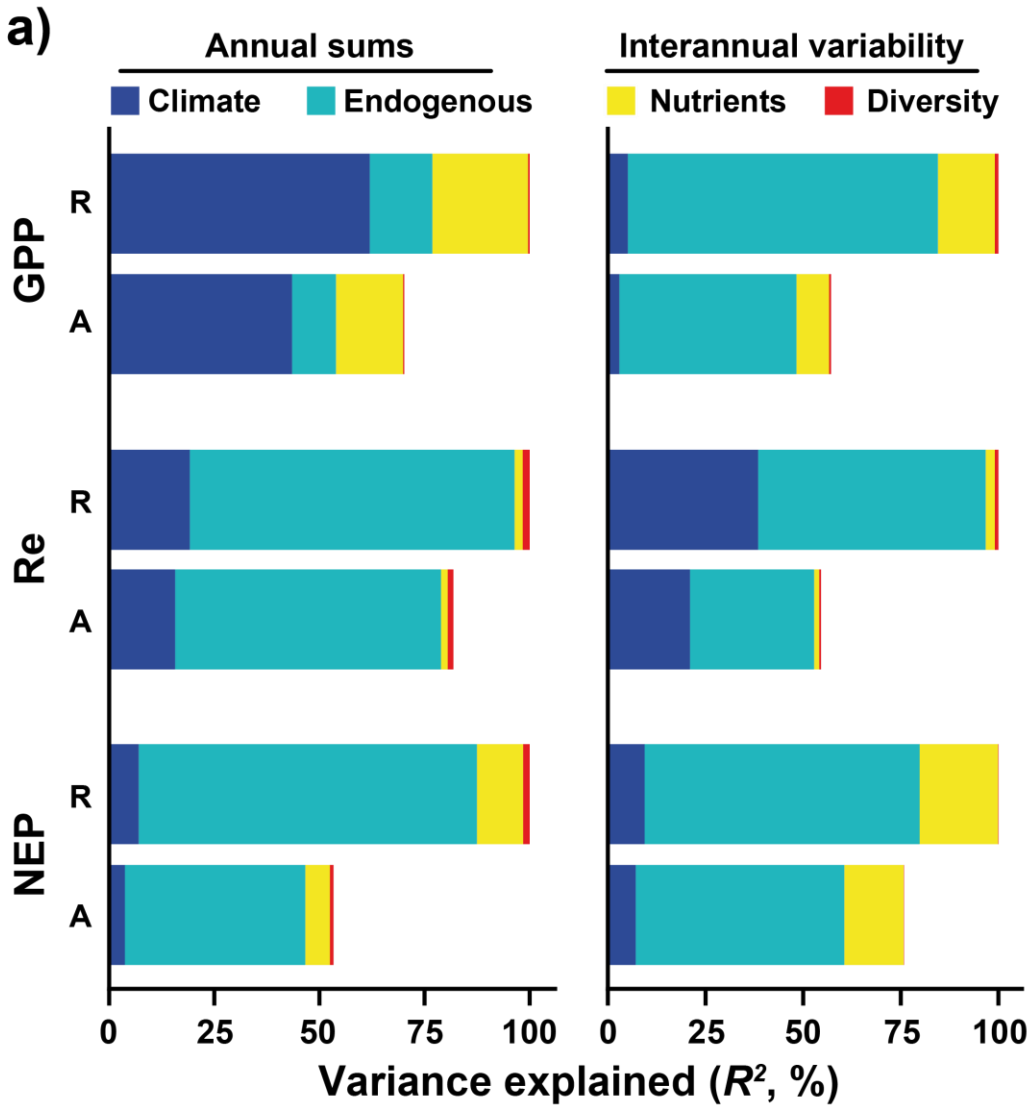
  C flux means and their interannual variability (1/stability)

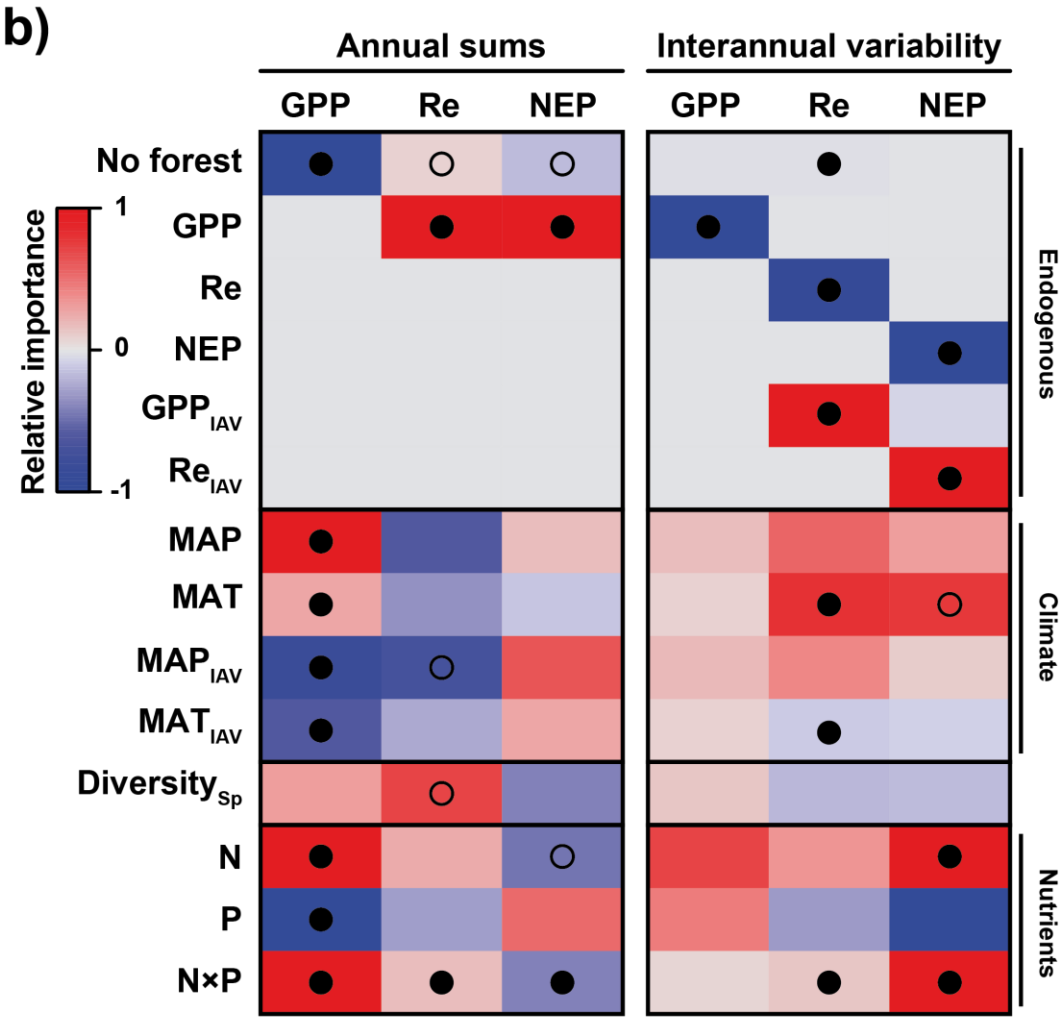
  Climate means, climate variability

  Site species abundance (species and phylogenetic diversity)

  Foliar N & P concentration (community weighted means)

Climate, nutrients and biotic factors drive C fluxes (all sites)



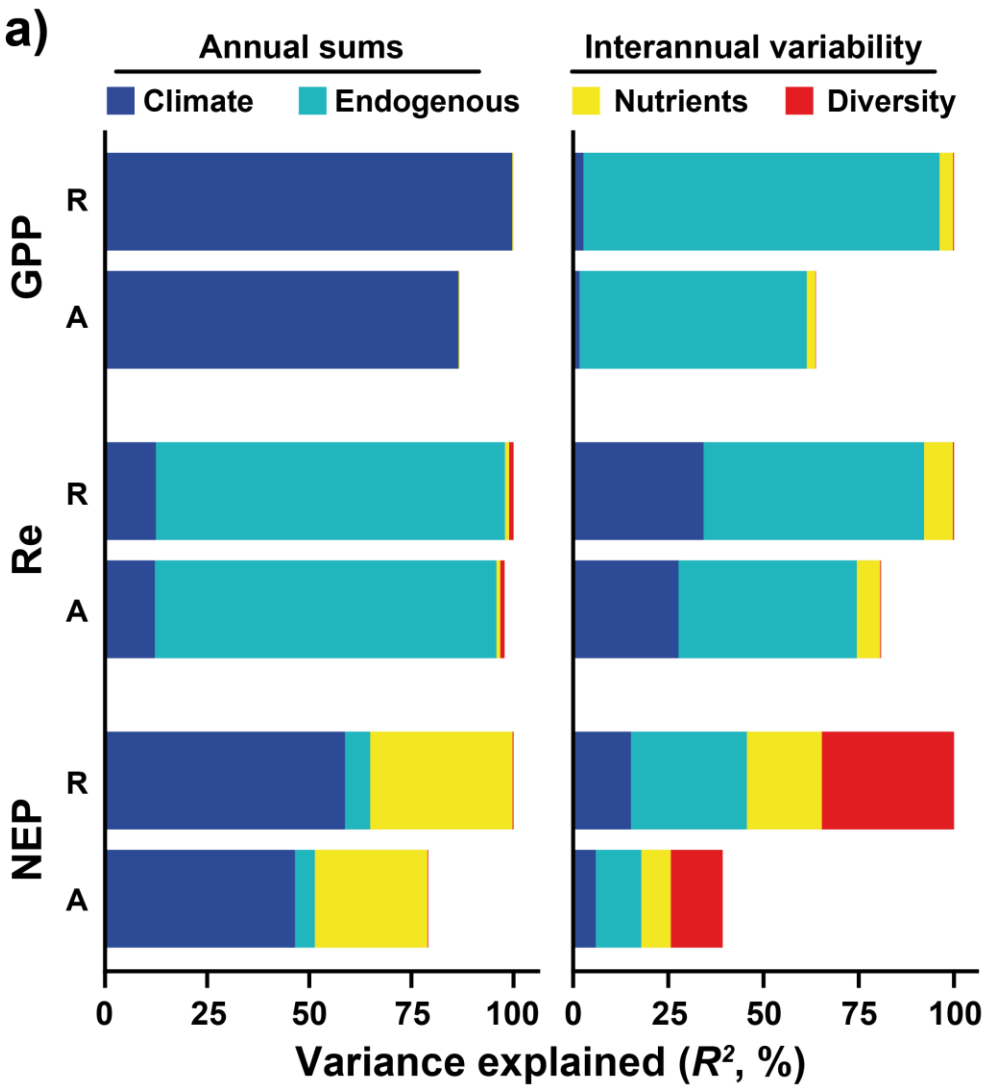


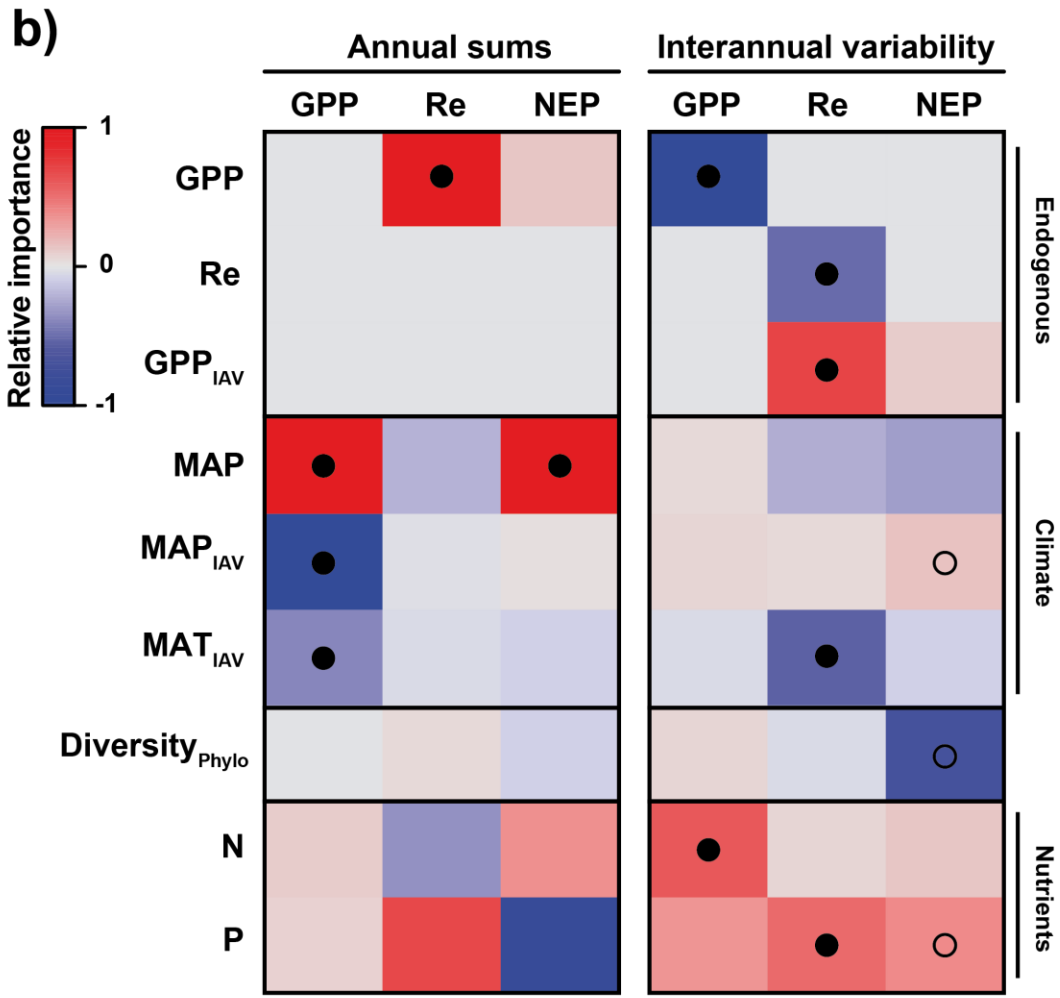
Species diversity weakly increases Re

IMBALANCE-P

Universiteit Antwerpen

Phylogenetic diversity stabilises NEP in non-forest ecosystems

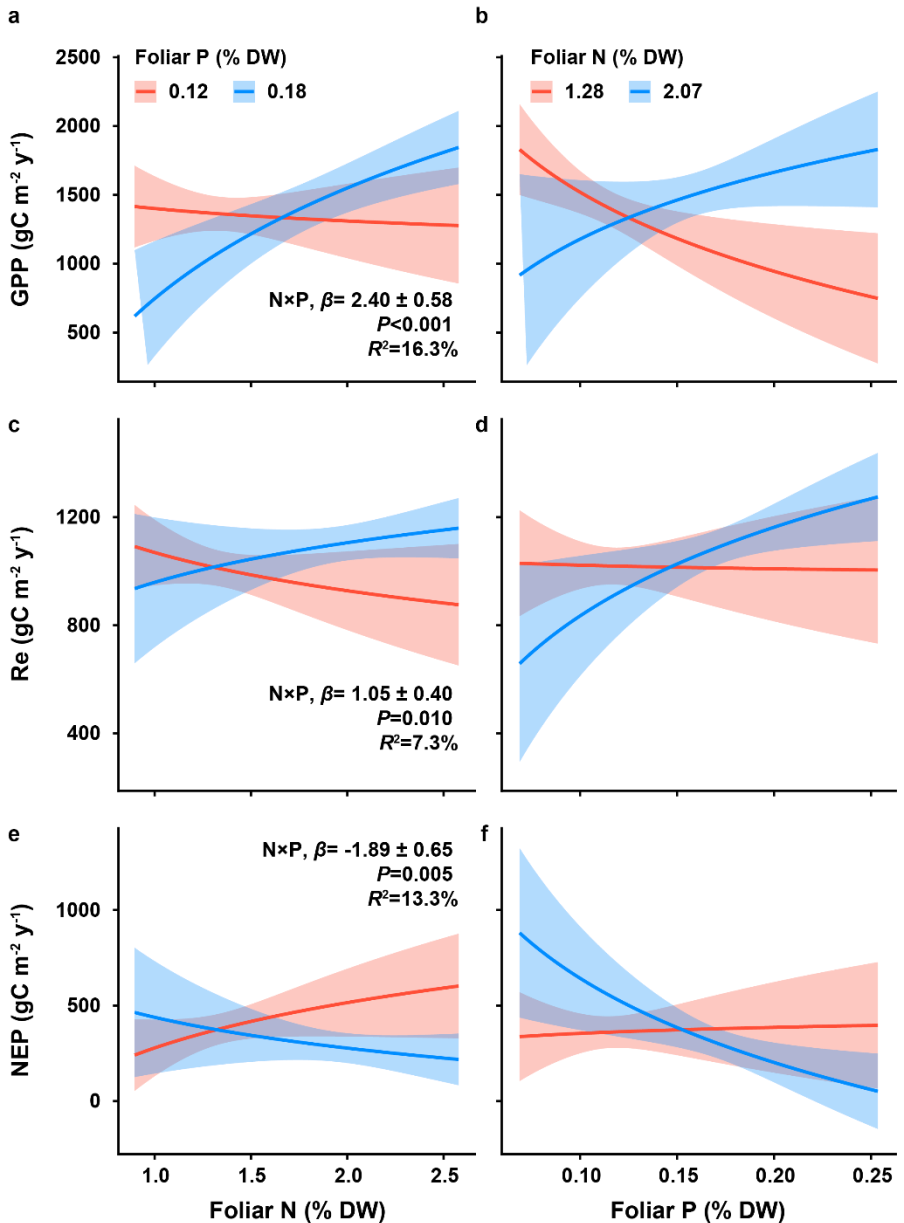




IMBALANCE P

Universiteit Antwerpen

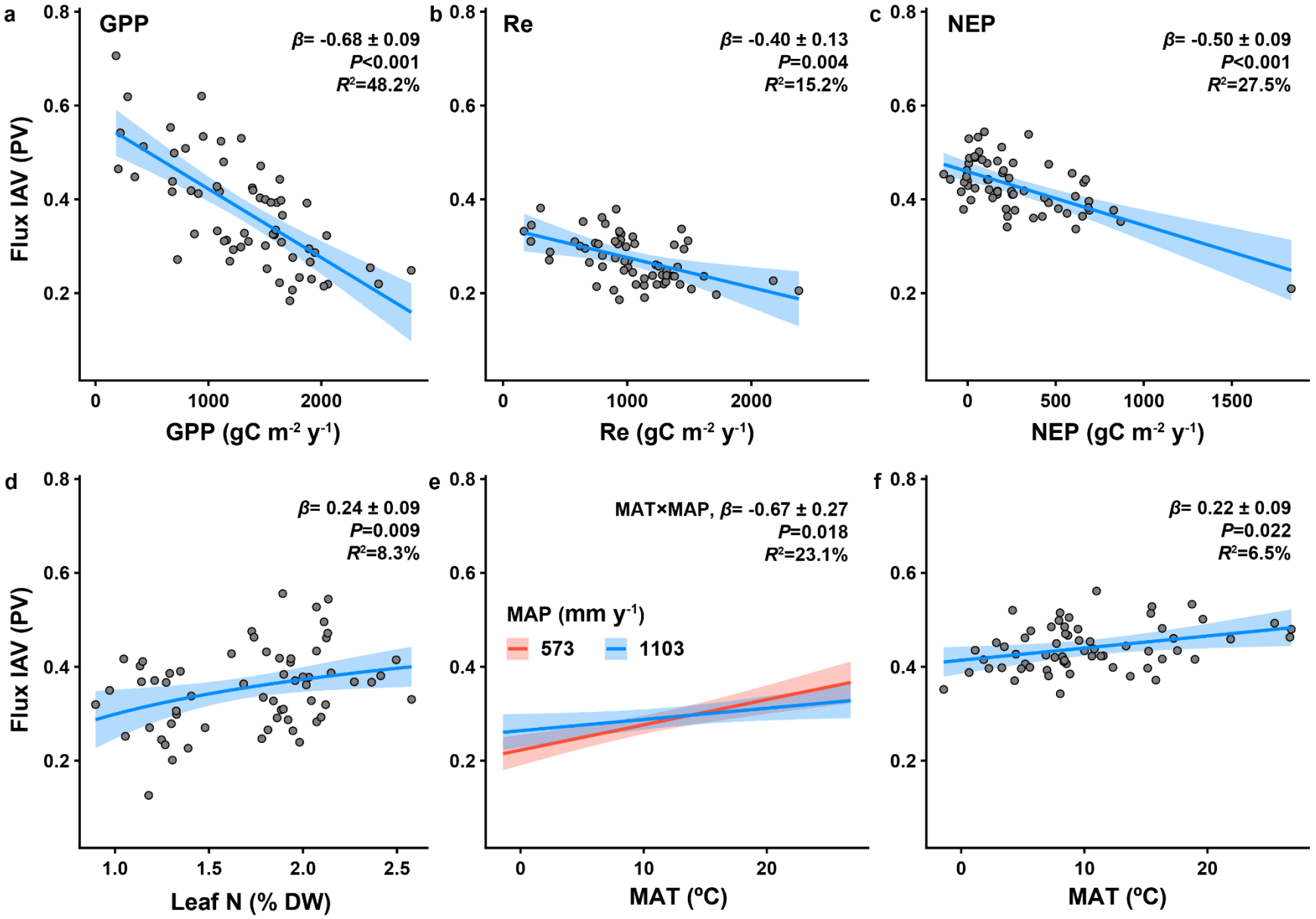
Foliar stoichiometry affects C fluxes



IMBALANCE P

Universiteit Antwerpen

The magnitude of the flux controls its temporal variability



IMBALANCE P

Universiteit Antwerpen

Take-home messages

- Larger C fluxes tend to be more stable over time

- Foliar N:P stoichiometry affects GPP, Re and NEP. Changes are expected if stoichiometry and/or species change

- Better biodiversity assessments are needed to understand the role of biodiversity on C balance

Thanks for your attention!

IMBALANCE P
fwo Research Foundation Flanders Opening new horizons
Universiteit Antwerpen