Functional plasticity of ground beetles can presume the changes in their community composition by forestry treatments

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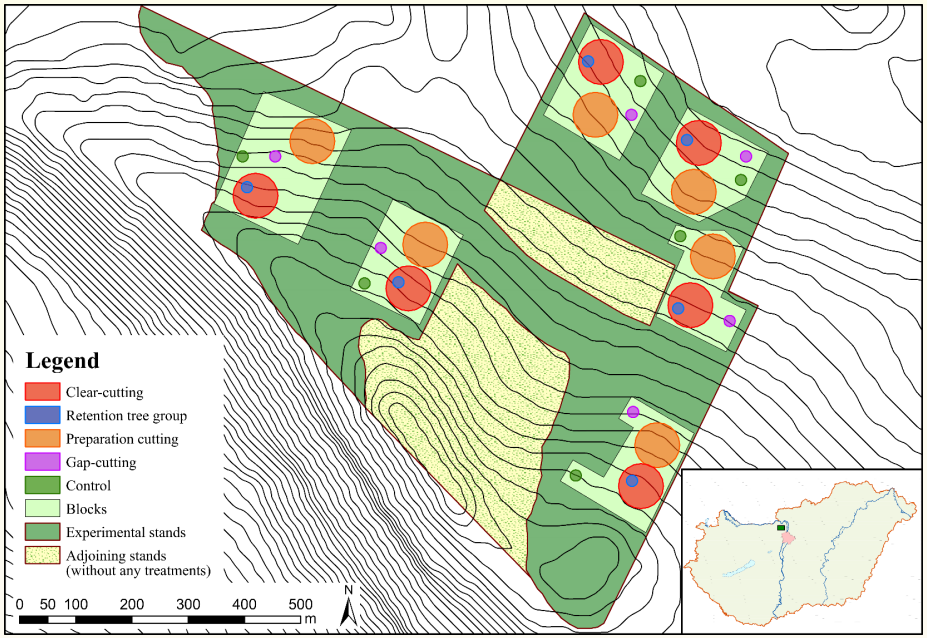
Background

- Ecological consequences of forest management on ground beetles → mostly on community responses, the least on functional traits
- Understanding of mechanisms that underline community responses to habitat alternation and ecosystem functioning
- Community structure descriptors based on taxonomic identity **(T)** → a proxy for biodiversity
- Functional traits responses **(F)** → a proxy for functional potential (toward resilience?)
- **Which descriptor describe better the short-term effects of forestry treatments on ground beetles?**

Methods

Study area[1]

- 70 yr old *Quercus petraea*, *Carpinus betulus* stand
- 5 treatments in 6 replicates:
  - control **(C)**
  - preparation cutting **(P)**
  - gap cutting **(G)**
  - micro-clearcut **(CC)**
  - retention tree group **(R)**

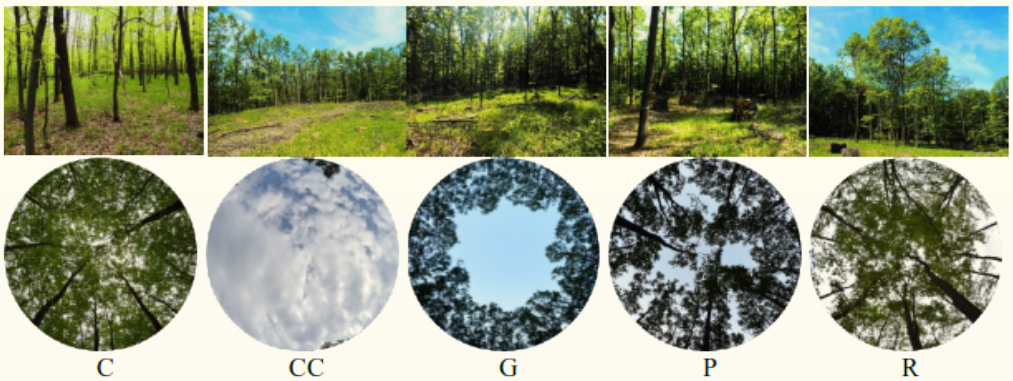


[1] Tinya et al. 2018. European Journal of Forest Research (submitted/under revision)

Sampling

Sampling design

- Treatments were implemented in winter, 2014
- 2014 → baseline study before treatments
- 2016 → short term response check



- Beetles were sampled by pitfall traps, one month in spring and autumn
- 4 pitfall traps/treatment/replicates → 120 pitfall traps
- Mark-recapture of *Carabus scheidleri* in **CC**, **G**, **P** in block no. 1 and 2.

Analyses

Taxonomical approach[2]

- Non-metric Multidimensional Scaling - community composition
- Species richness, activity density(abundance)
- Alpha diversity - Rényi diversity ordering

Functional approach

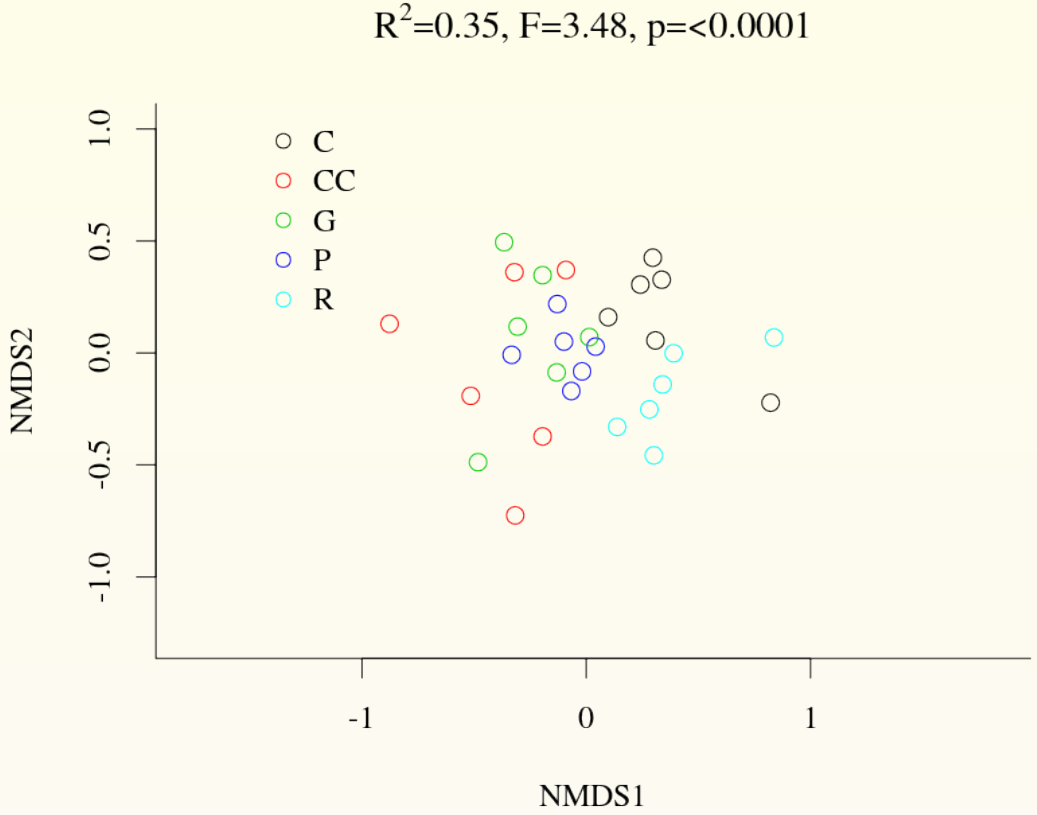
- Species richness, activity density for habitat affinity, body size classes and wing type
- Functional diversity - Rao's Q, no. of singular species
- Species level responses - *C. scheidleri* (MRR)

TesteR - non-linear mixed effect models: nlme, multcomp

- model1=lme(sqrt(response) treatment,random= 1|block, method="ML"); comp.F<- glht(model1,linfct = K); alpha=0.05

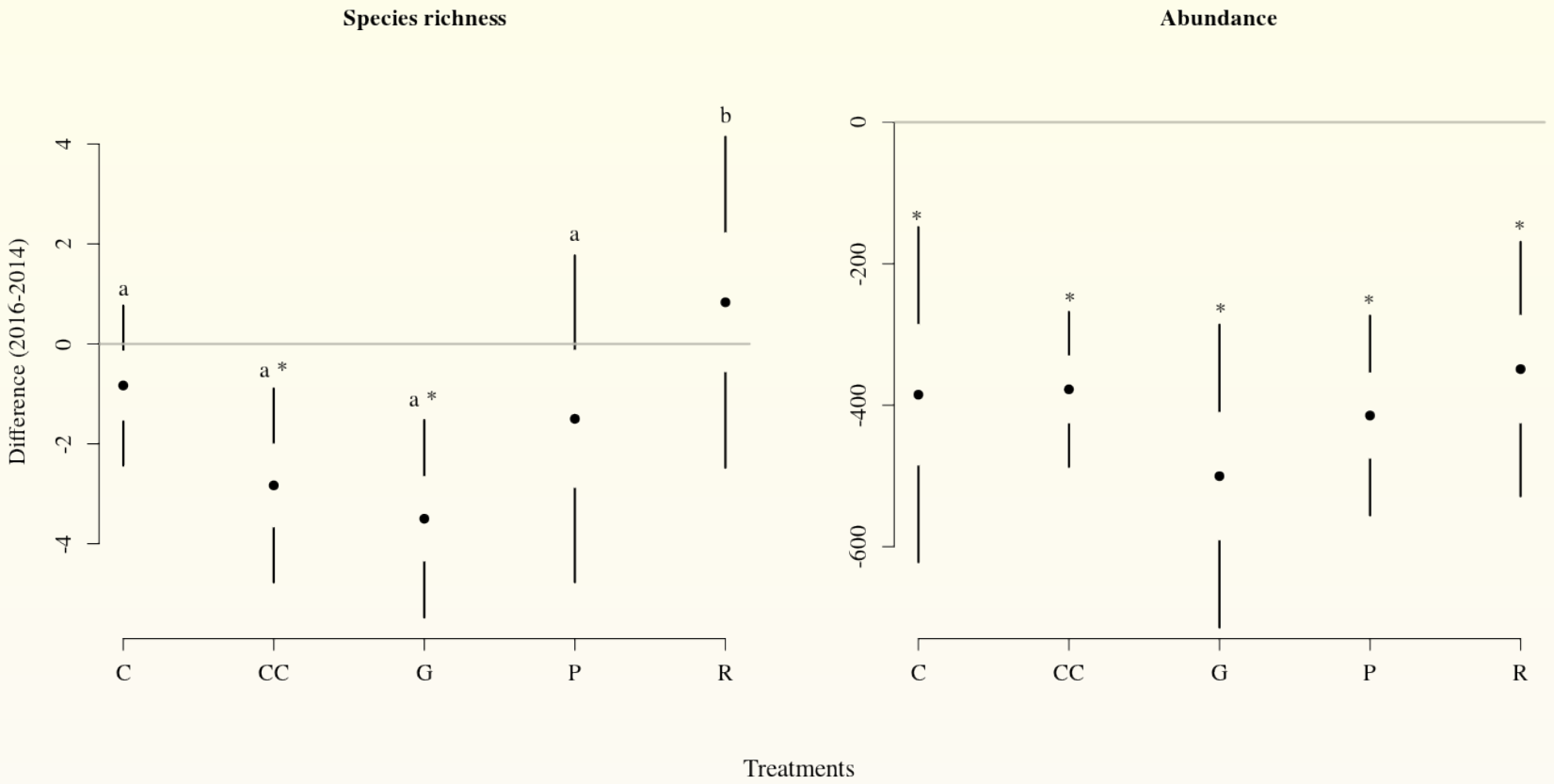
[2]Elek et al. 2018. Scientific Reports (submitted)

Community composition



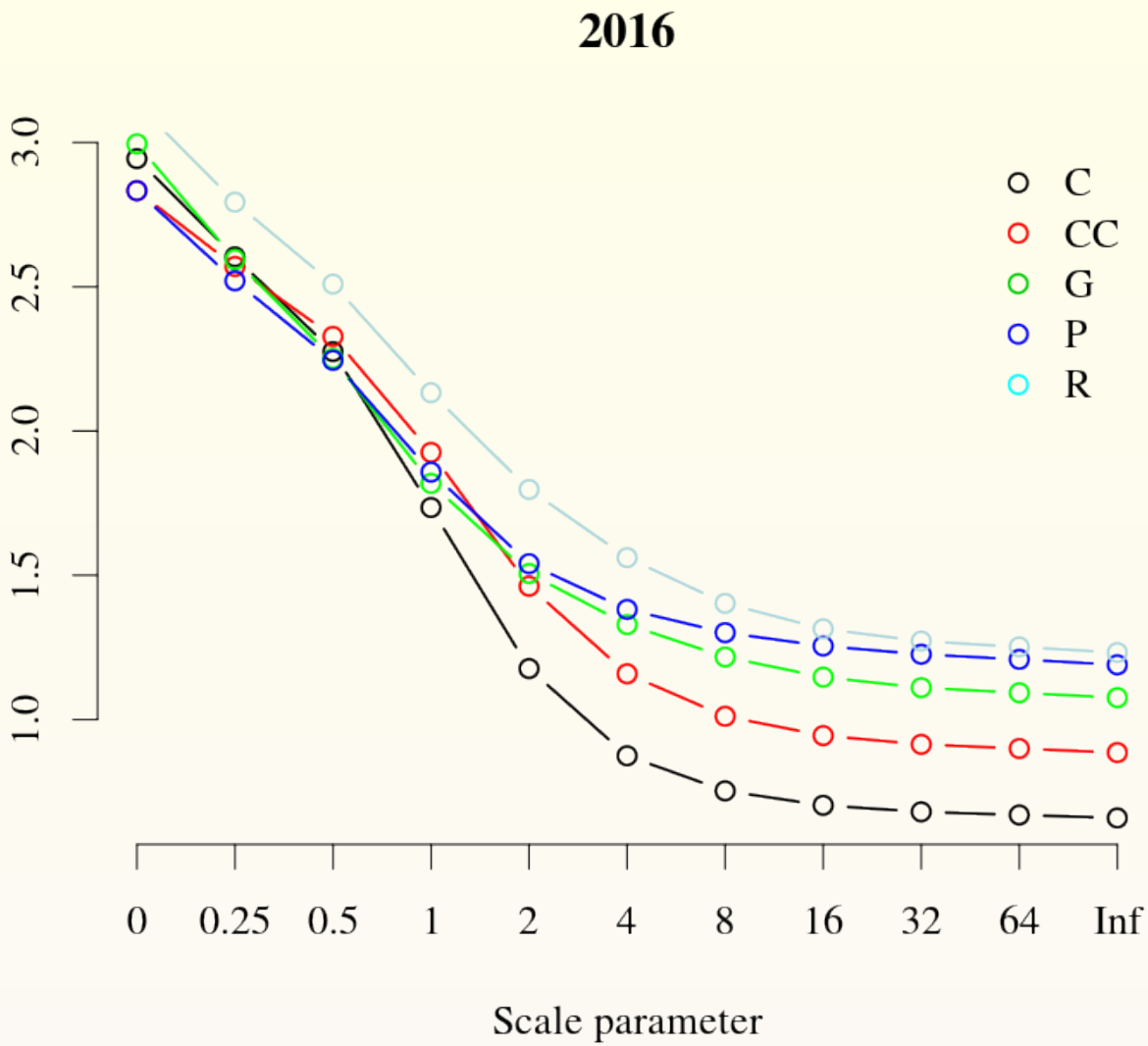
- Slight differences, **C** and **R** form a group (stress=0.21)

Species richness/activity density



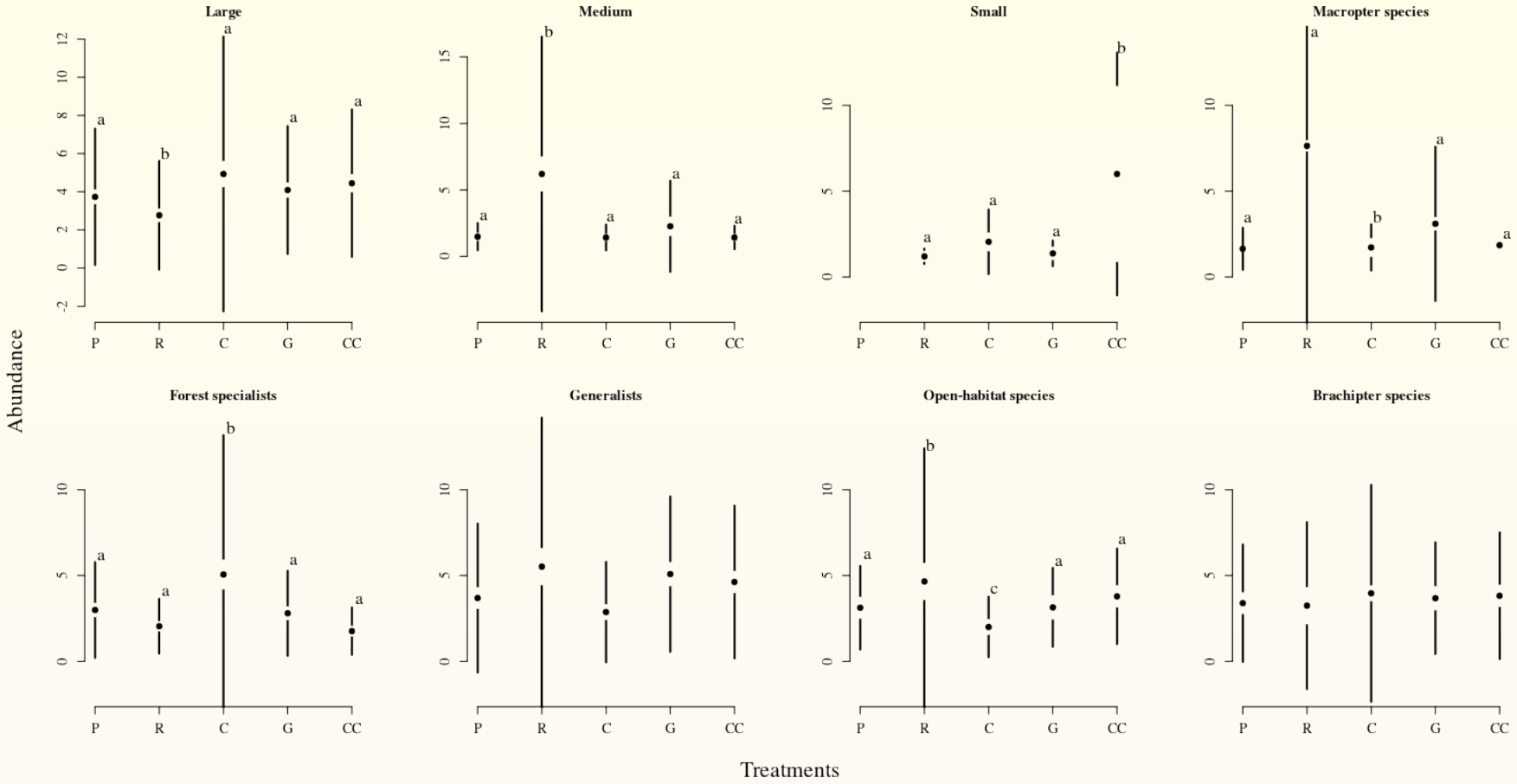
- More species in **R**, abundance unaffected

Alpha diversity



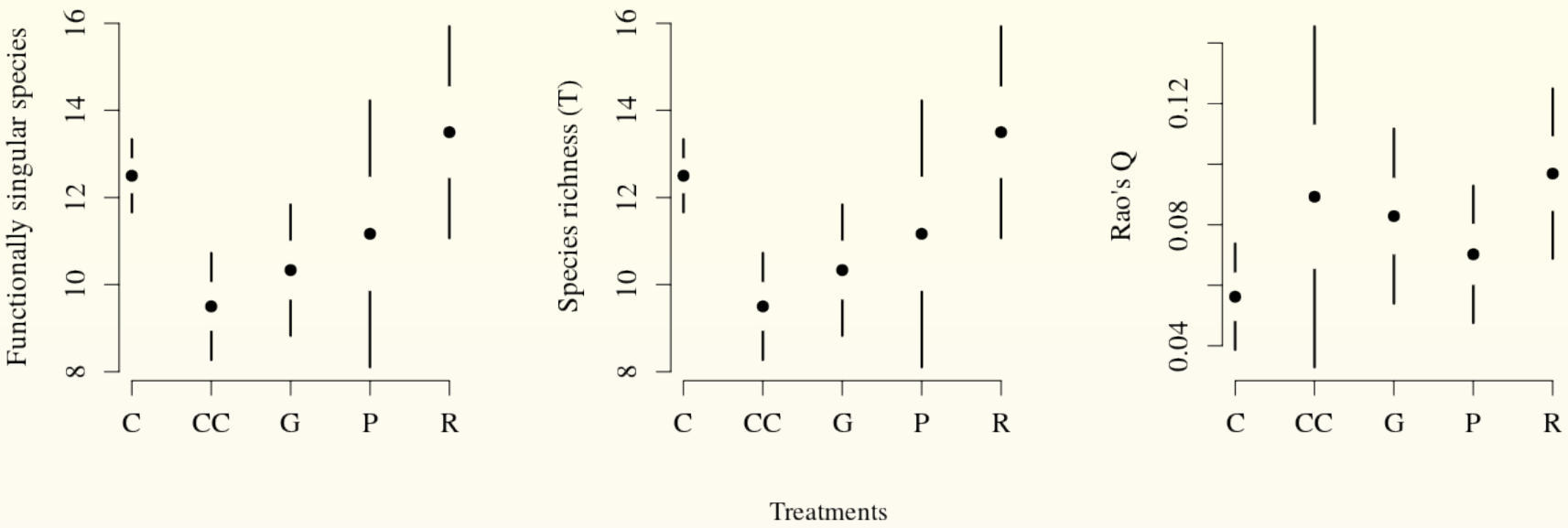
- **R** more diverse than other treatments

Functional trait responses



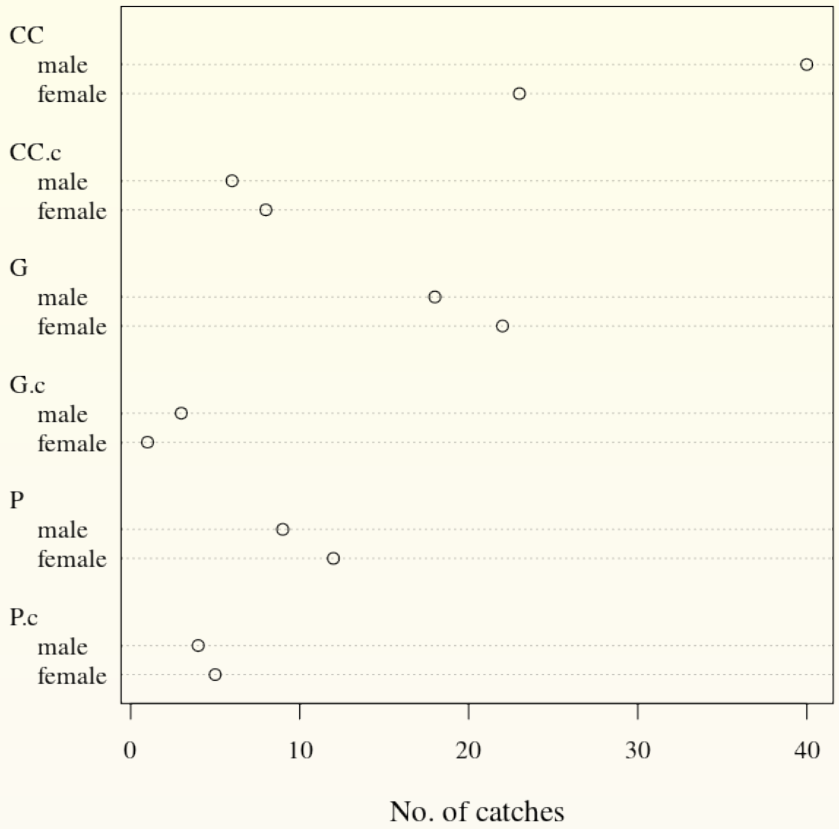
- Large, forest specialist in **C**
- Small sized, good dispersers, open-habitat species in **R, CC, (G)**
- Generalists and poor dispersers occurred all treatment

Functional diversity



- Singular and (taxonomic) species richness are identical in all treatment → all species are functionally different
- High functional diversity in **CC** and **R** → trait divergence

+1 behavioural responses - MRR *C. scheidleri*



- High movement fidelity in control forest stands (*.c)
- Decreasing activity in treatments from **CC** → **G** →**P**

Summary and Conclusions[3]

Summary

- Functional traits seems more appropriate than taxonomical approaches
- The high species richness and alpha diversity in **R** $\rightarrow$ dominance of small sized species, good dispersers and open-habitat species
- The more drastic forestry treatments, the higher divergence in functional traits of ground beetles

Conclusions

- Mobility and the resilince is the key for survival in managed forests
- The high trait divergence in **CC, R** $\rightarrow$ high resilience against stochastic environmental influences

[3] *Acknowledgements:* Hungarian Research Found (OTKA 111887), National Research Development and Innovation Office (GINOP-2.3.2-15-2016-00019), LaTeX 2_ε and Beamer package