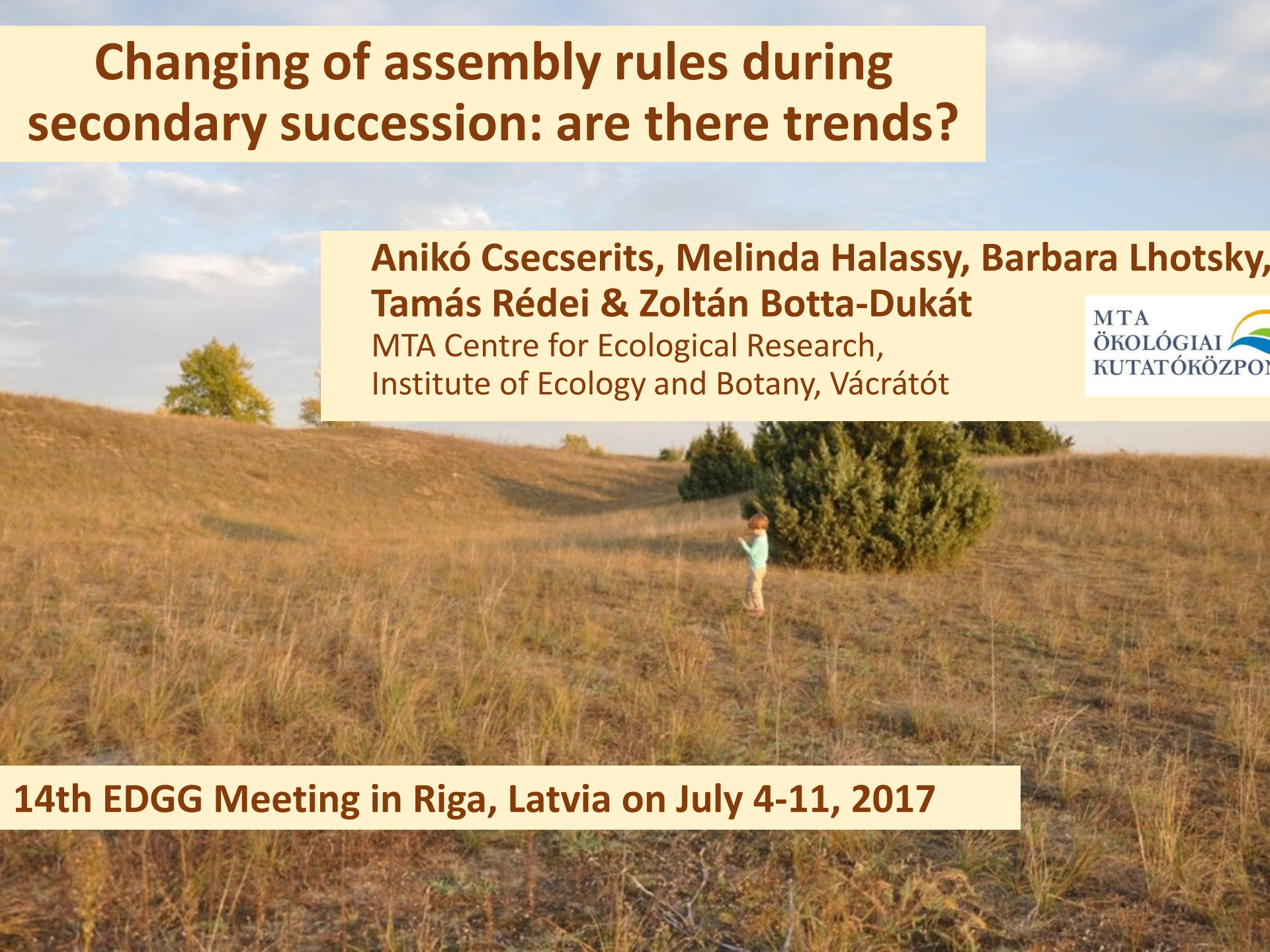
Changing of assembly rules during secondary succession: are there trends?

Anikó Csecserits, Melinda Halassy, Barbara Lhotsky, Tamás Rédei & Zoltán Botta-Dukát
MTA Centre for Ecological Research,
Institute of Ecology and Botany, Vácrátót



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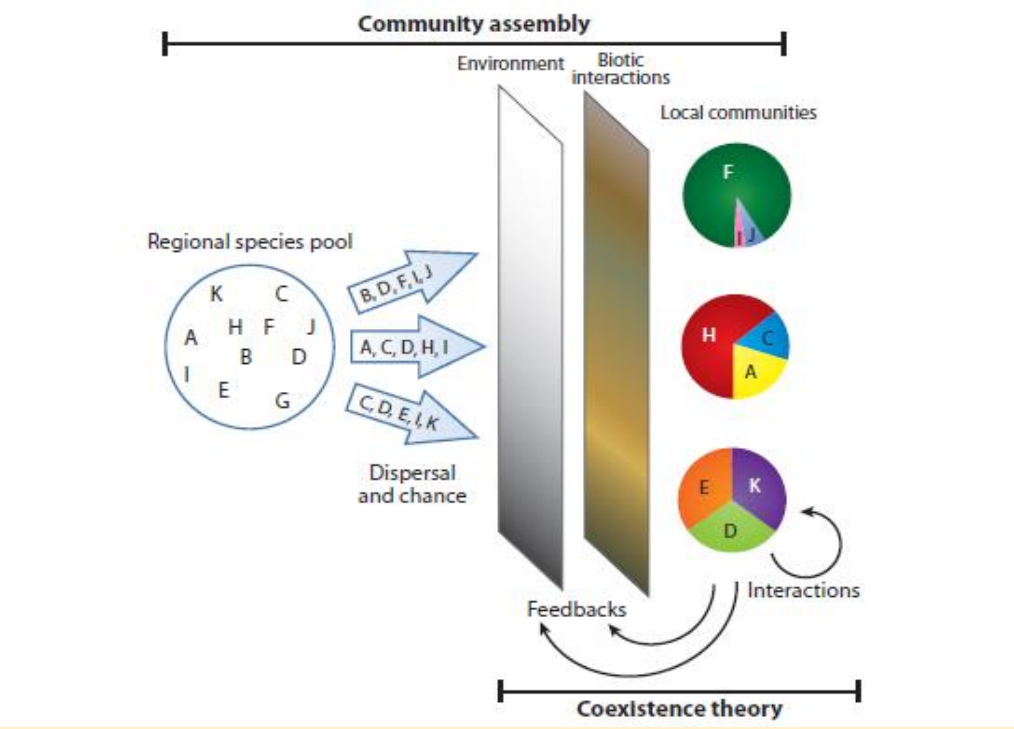
Introduction

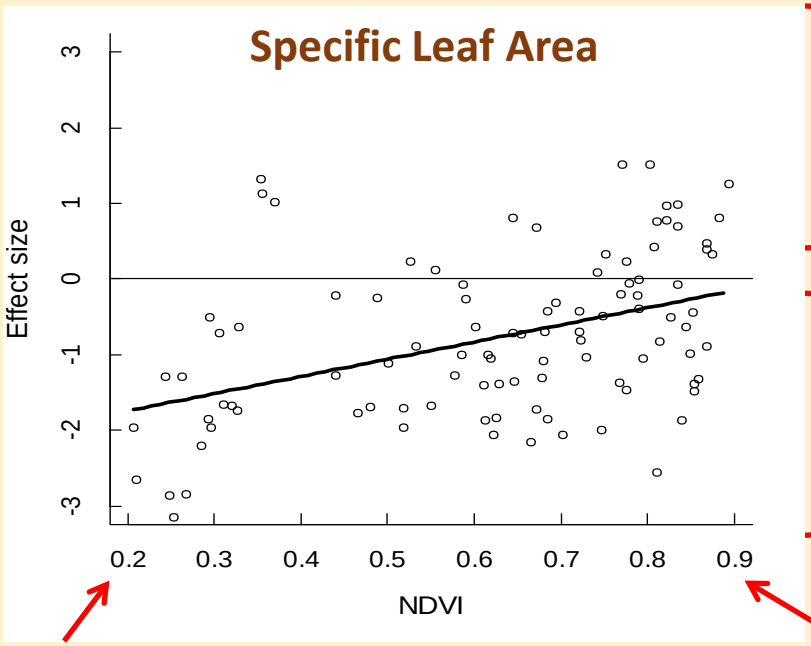
- **Assembly rule** – (Diamond 1975, Keddy 1992): **ecological process** selecting species from regional species pool and thus determining local community composition (HilleRisLambers et al. 2012, Götzenberger et al. 2012)
- Rules ~ filters
- Dispersal, environmental and biotic filters
- Aiming to detect possible processes from observed data



HilleRisLambers et al. 2012

Study of assembly rules

- Species-based or trait-based approach
- Appropriate spatial scale, environmental gradient, heterogenity
- Detect the assembly rule = detect the departure from random pattern,
- Trait specific pattern
- An example: Lhotsky et al. 2016, J of Ecology – trait based, long environmental gradient



Divergence in trait distribution →
Biotic filter

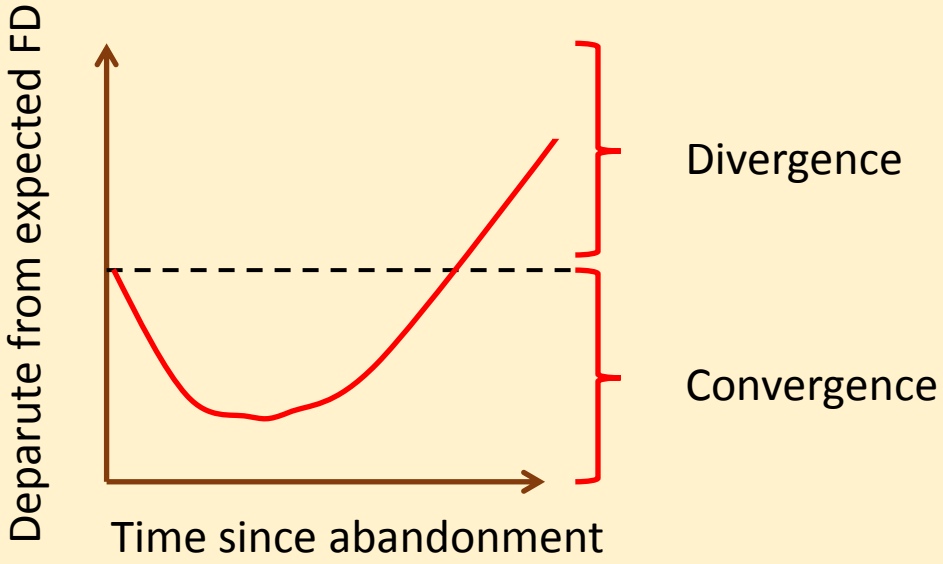
Convergence in trait distribution→
Environmental filter is present

Less productive end, ~dry grassland

More productive end, ~wetland

New: Succession can be also an environmental gradient

- Hypothesis: Community composition assembling during the succession are also partly non-random, there are assembly rules forming the new community and these change with time
- After crossing the dispersal limitation, environmental filtering will be dominant at the beginning of succession
- Biotic interactions will be important later in the succession
- Use of traits help in generalization



Our aims

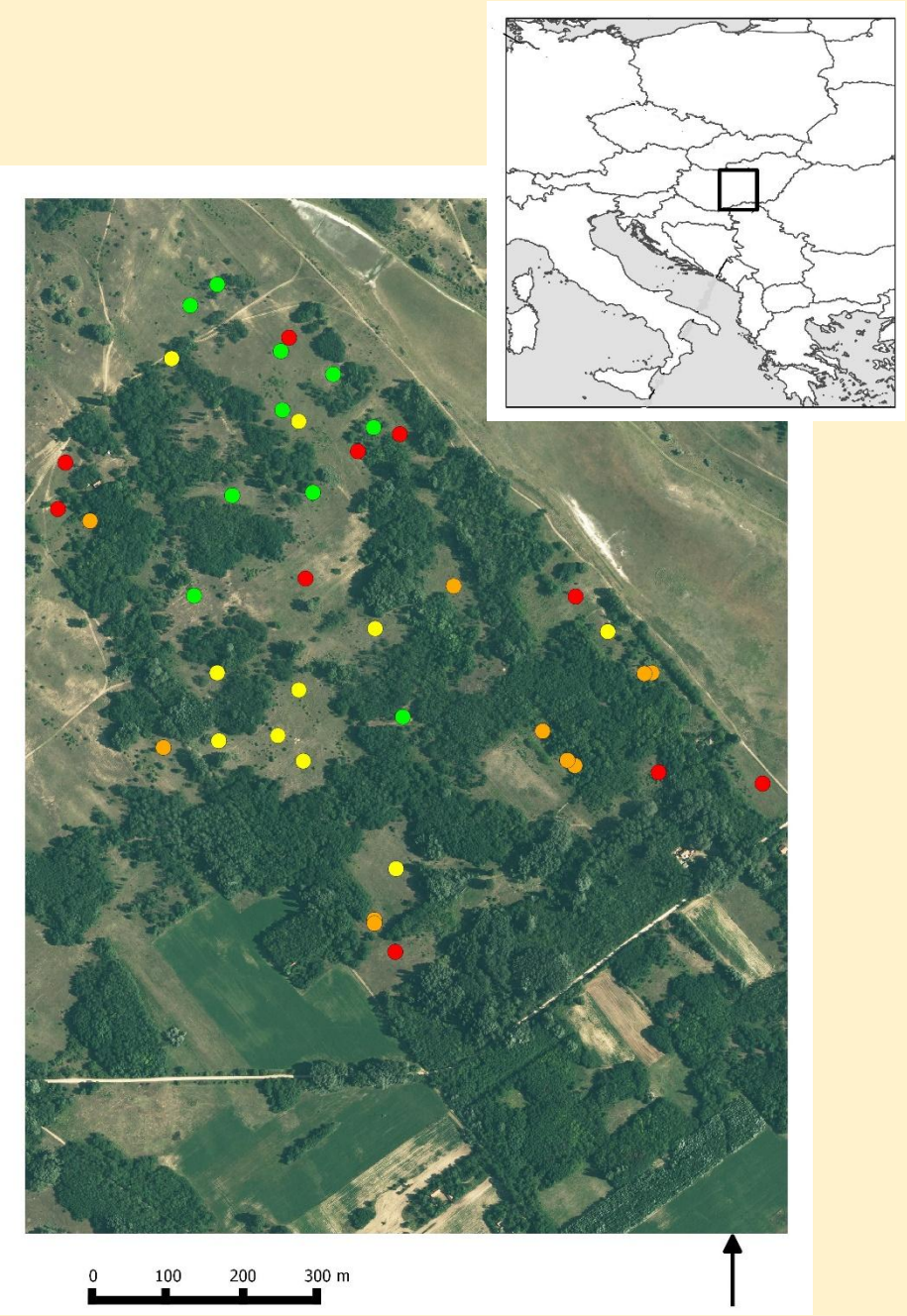
- Describe the pattern of changes of functional traits during old-field succesion

- Determine the presence and changes of assembly rules during the succession on basis of selected traits

- Comparing the assembly rules on old-fields assumed on the basis of space-for-time substitution and on long-term observation.

Methods

- Kiskun-LTER field site network
- 40 permanent vegetation plot, 4x4 m
- 4 age – group (10 plot/AG),
  - abandoned between 1994-1999
  - abandoned between 1994-1989
  - abandoned between 1988-1975
  - abandoned between 1965-1974
- Sampling: 2000, 2008, 2010, (2015, 2017)
- Traits of vascular plant species
- Functional diversity (Rao's quadratic entropy) of plots compared to random
- Effect sizes from the comparision for every plot
- Changes of CWM and effect sizes were checked by linear mixed effect modell



Pictures from old-fields

Studied plant traits

Connected to regeneration:

- Seed weight
- Clonality
- Flowering start, end, long, (in months)

Connectet to vegetative growth:

- SLA (specific leaf area, mm^2/mg)
- LDMC (leaf dry matter content, mg/g)
- Leaf size, mm^2
- Generative maximum height
- Life span
- Lateral spread

Data source:

- LEDA, Hungarian Flora,
- Török et al. 2014, 2016 – for seed weight,
- own measurements for ~ 150 species - SLA, LDMC, height, partly in: Lhotsky et al. 2016

Results

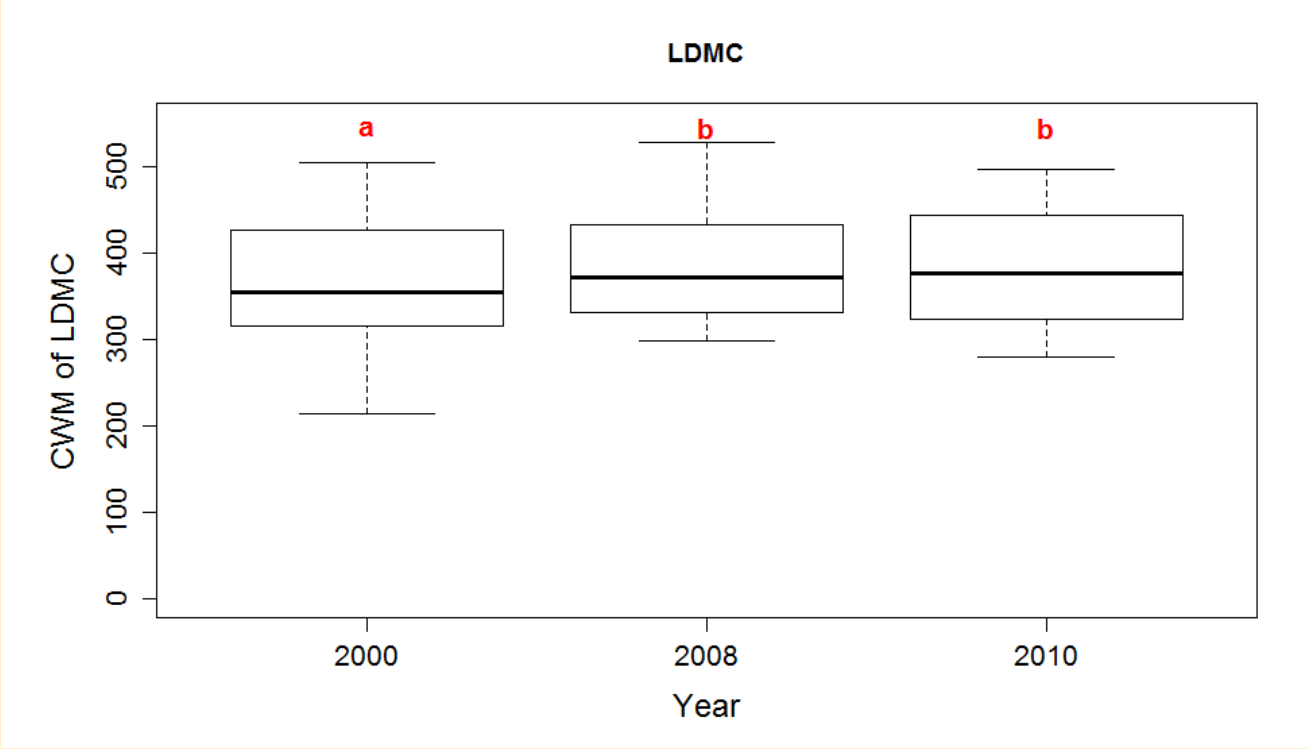
1. Changes of community weighted mean (CWM) of traits between 2000-2010

Life span: annuals ↓, perennials ↑

SLA ↓,

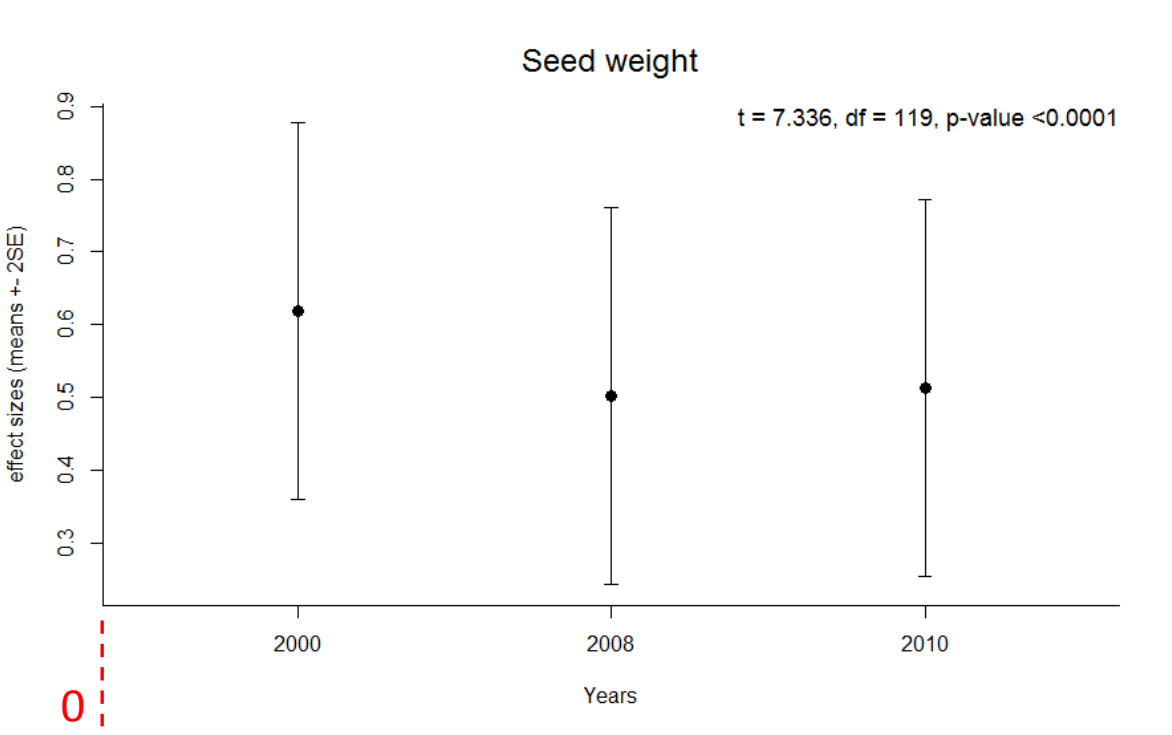
LDMC ↑, start, end and lenght of flowering time ↑, generative height ↑, leaf size ↑

Seed weight: no changes in CMW (average)



Results

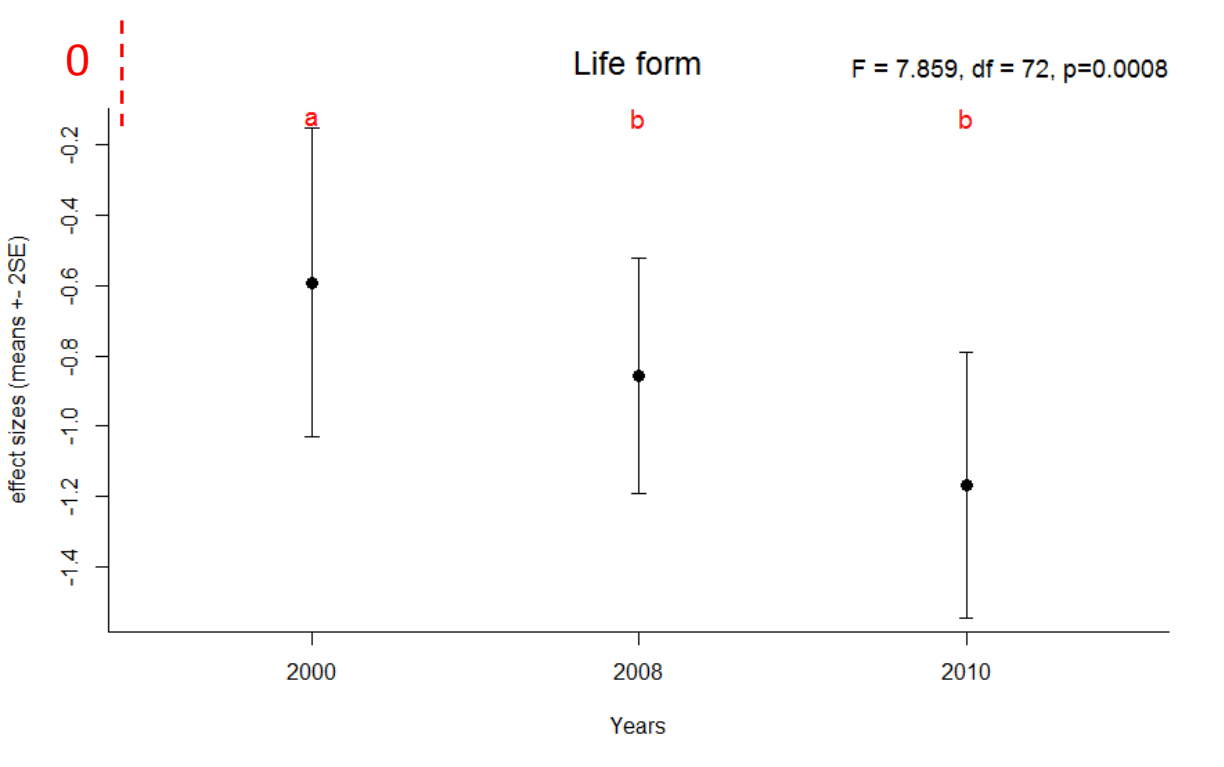
2. Detection of assembly rules:
a.) No changes during the succession in trait dispersion:
seed weight, lateral spread : divergent
leaf size : convergent



Results

2. Detection of assembly rules:
b.) Changes during the succession in trait dispersion:
SLA, LDMC, life forms, generative height, flowering start, end and lenght

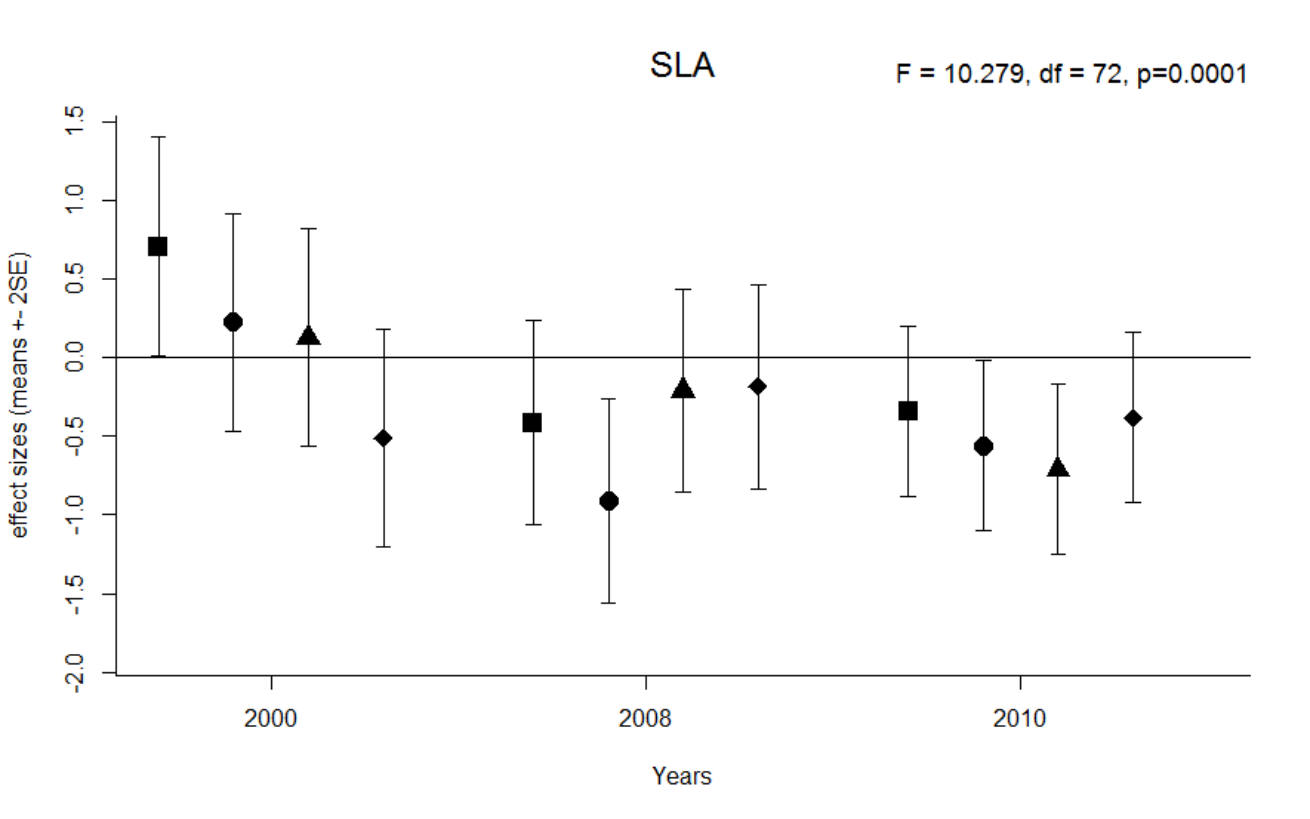
several patterns, e.g. life form: convergent



Results

2. Detection of assembly rules:
b.) Changes during the succession in trait dispersion:

SLA: changes in AG1 2000 and 2008, 2010, and in AG2 2000 and 2008

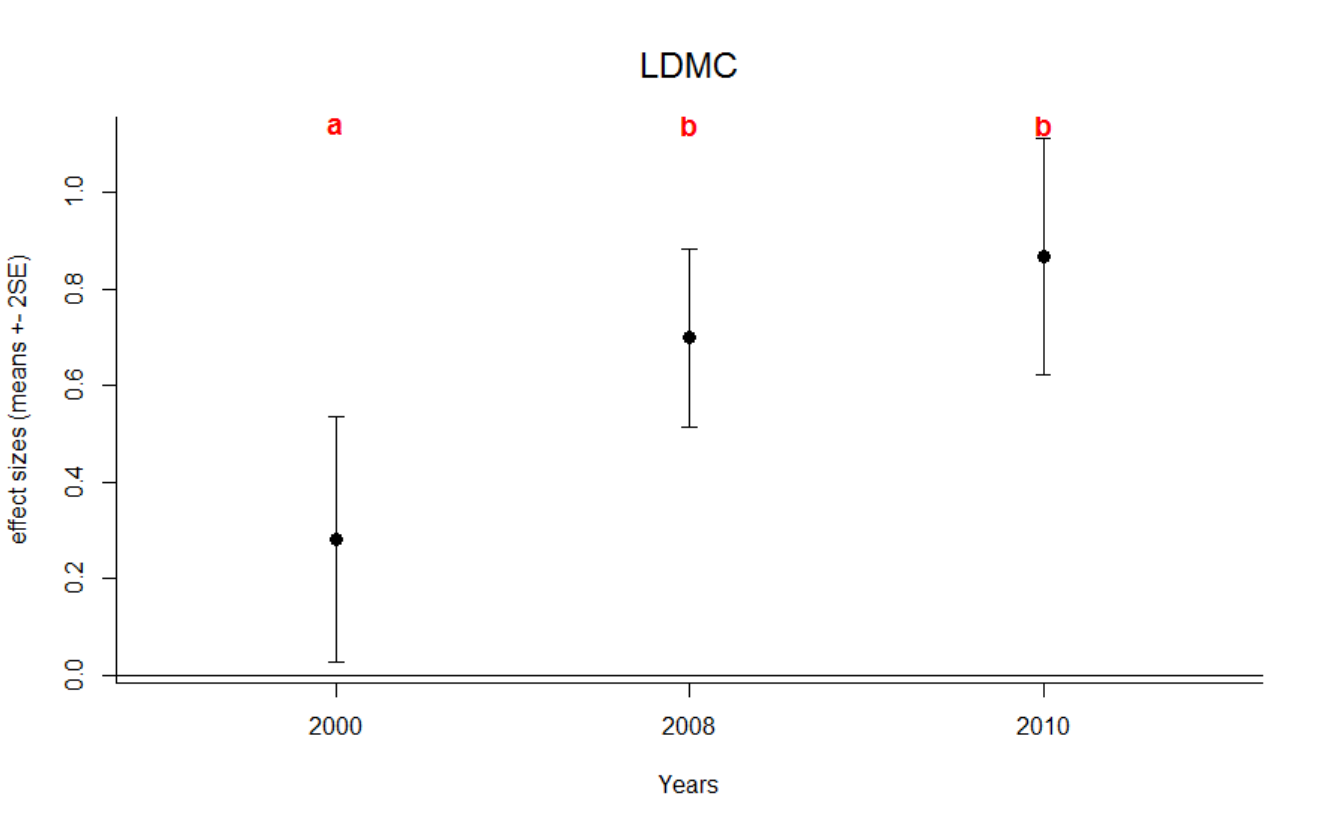


Results

2. Detection of assembly rules:

b.) Changes during the succession in trait dispersion:

LDMC: divergence



Results

3. Comparing space-for-time substitution and the long-term observation

SFT:
- CWM of traits change where already detetable
- Assembly rules: very few, only in SLA

short:
More detectable changes in long-term observation
Detectable slowing of changes

Conclusions

- CWM of traits changes similar to the expectation
- First long-term observation about the changes of several traits during succession
- Non-random trait distribution was detectable in this situation
- Distribution of 3 traits did not change (e.g.seed weight) with time = „constant assembly rules”
- Distribution of 7 traits show changes during succession, however many types of changes = „changing assembly rules”
- Only LDMC change according to the expectation
- Environmental filtering act through the life form and SLA distribution

Take home message

- There are assembly rules during succession → non-random process
- However every trait dispersion shows different pattern, no clear trends → different speed and direction of changes?

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Thank you for your attention!

Paldies!