Why a dominant native tree species cannot regenerate in natural(-like) conditions?

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Introduction

- New forestry law in Hungary 2009
- Continuous forest cover (CFC)
- Based on natural regeneration - gaps
- It works in beech forests
- But it does not seem to work in alluvial forests
- Why?

Alluvial forests

- Strongly modified floodplains in whole Europe
- Willow-poplar forests we have: quick regeneration – e.g. restoration projects
- Almost no near-natural alluvial hardwood (oak-ash-elm and oak-horneam) forests
- Old-growth: regrowth on pastures
- Commercial stands: even-aged, often monocultures

Regeneration of alluvial oak (*Quercus robur*) forests

- Commercial regeneration of oak forests:
  - Clear-cutting of (5)-10-30 hectares
  - The bigger the clearing, the better is for the oak
- Why cannot be it done on a more natural way?
- With smaller gaps (CFC) – like beech forests?
- **Oak forests are native here!**

Why alluvial oak forests cannot regenerate „naturally"?

- Some possible explanations:
  - Native oak-ash-elm forests had lesser proportion of *Q.robur*
  - → today's *Q.robur* forests are far from natural
  - It had regenerated via shelterwood (*Populus alba*)
  - Water control – site dry-out (practically irreversible): competition of more dry-tolerant species
  - Excessive game damage

Study aims

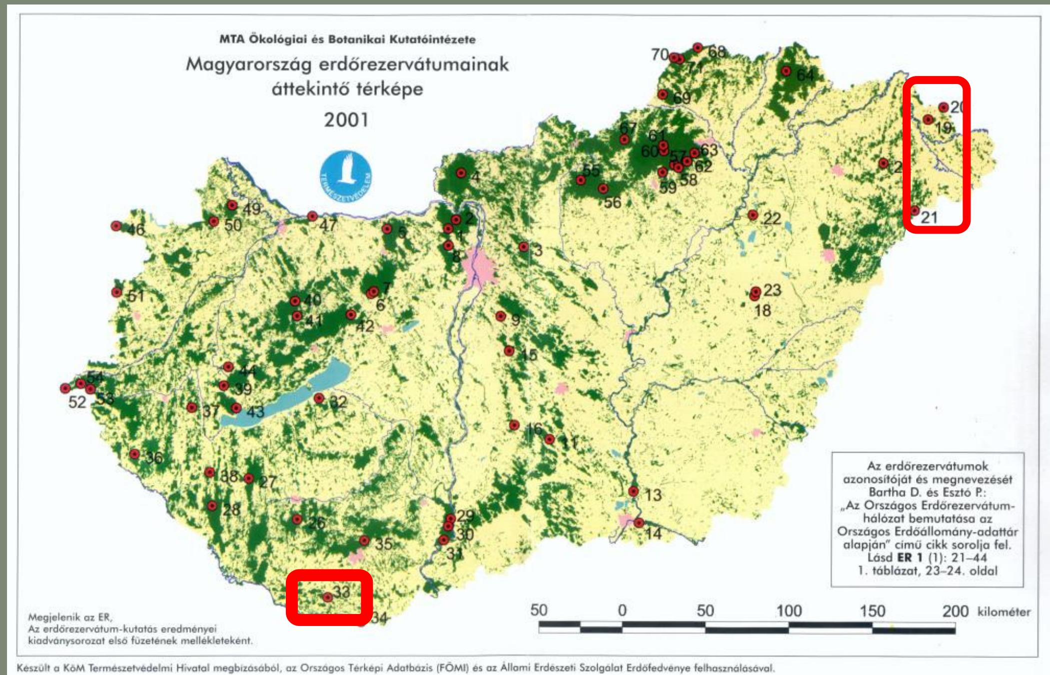
„The easy part of any research project is
to test the hypothesis which has been formulated.
It is far more difficult
to formulate the hypothesis correctly"

(Hüttl et al. 2000)

- To collect base overview data for more exact hypothesis formulation
- What patterns of natural regeneration can be observed?
- In what extent it depends on current tree stand („trees of the present")?
- Other factors?
  - Abiotic conditions (water, light)
  - Site heterogenity (macro and micro scale)
  - Biotic interactions (competition)

Forest reserves in Hungary

- 63 forest reserves in Hungary
- 4 alluvial oak forests
- Bükkhát Forest Reserve

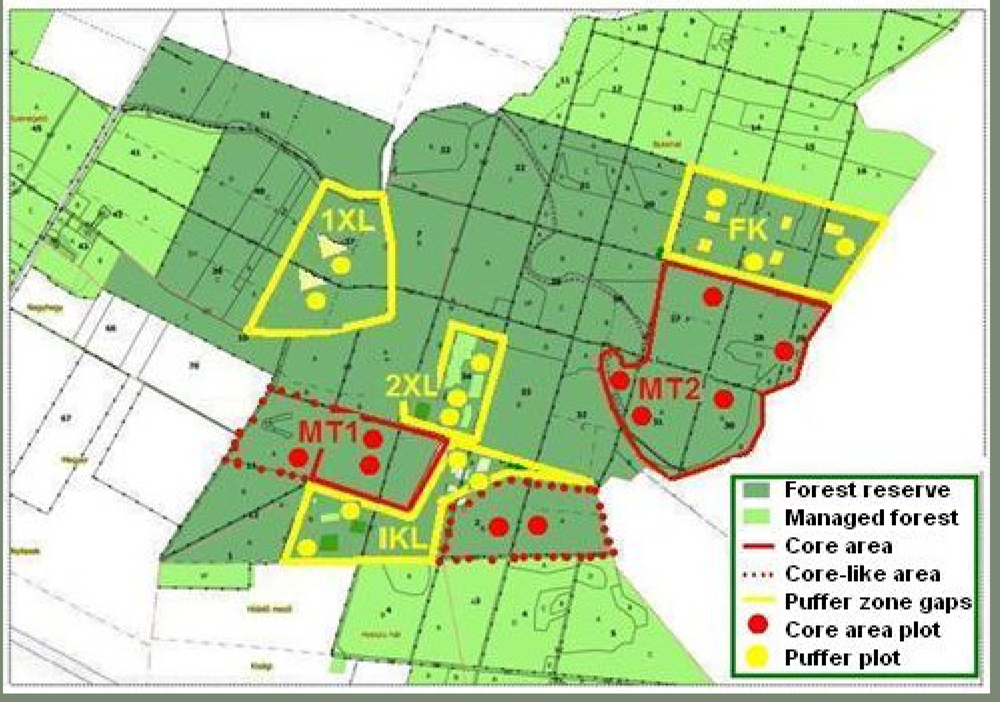


Study area

- Bükkhát Forest Reserve
- Floodplain of Drava
- 452 ha
- Core area: 58 ha
- 70 – 120 years
- Alluvial hornbeam-oak forests (*Circaeo-Carpinetum)*
- Oak-ash-elm forests (*Carici brizoidis-Ulmetum*)
- Small wetland habitats
- Gap experiments in the puffer zone:
  - Gaps of 0.2 – 0.6 ha
  - Instead of 5-10 ha clear-cuttings

Data collection

- 22 sites
- 10 core/12 puffer
- Summer 2011
- Tree stand
- Herb layer



Tree stand:

- Circle of Ø 30 m (tree height)
- Woody plants > 5m
- Species
- Number of trees in 4 DBH categories:
- <10 cm <20 cm<40 cm<

Herb layer:

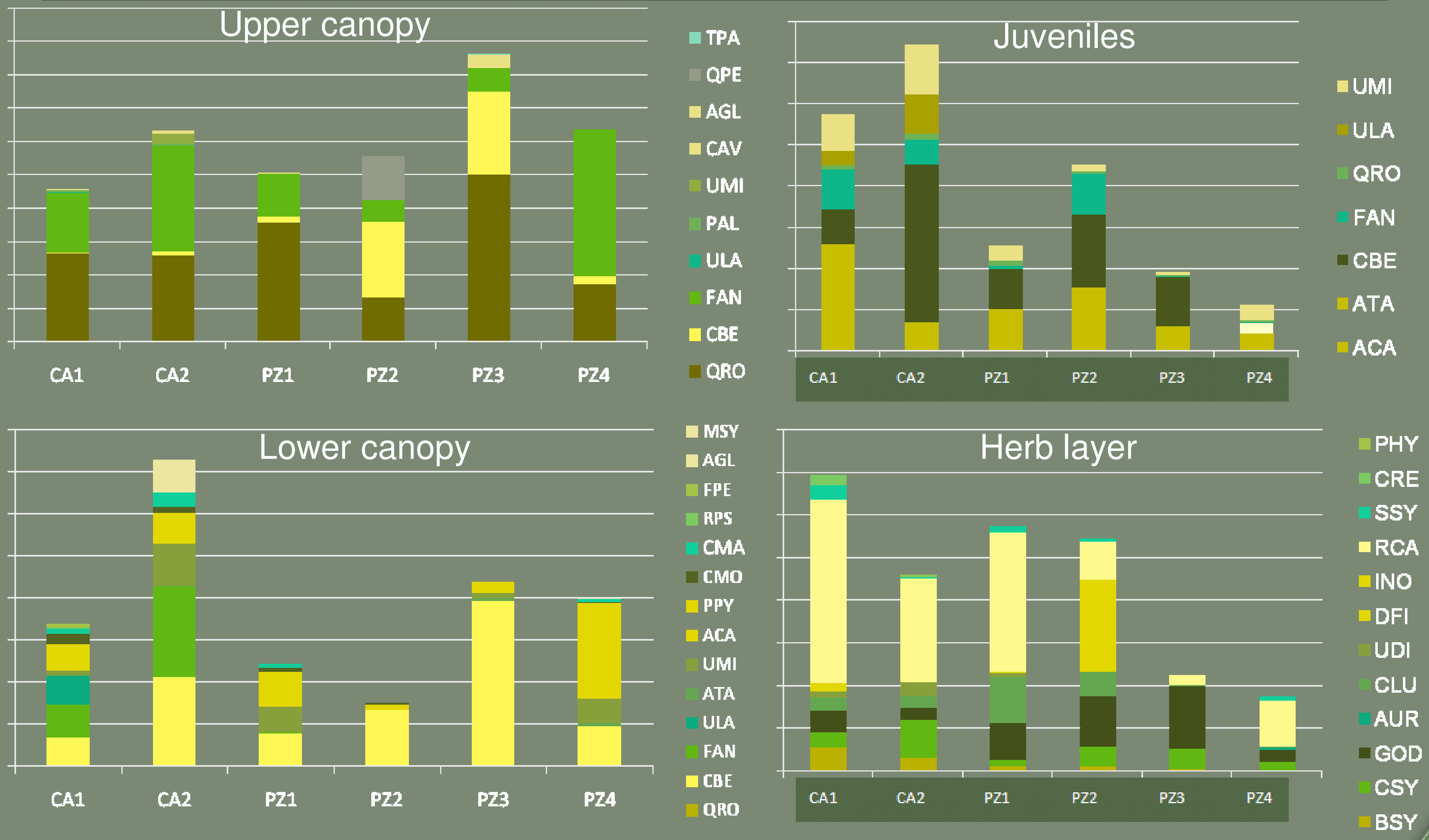
- Quadrants of 30x30 m
- 50 x 0.5 m^2 small circles
- Cover of herb species (Braun-Blanquet scale)

Data analysis

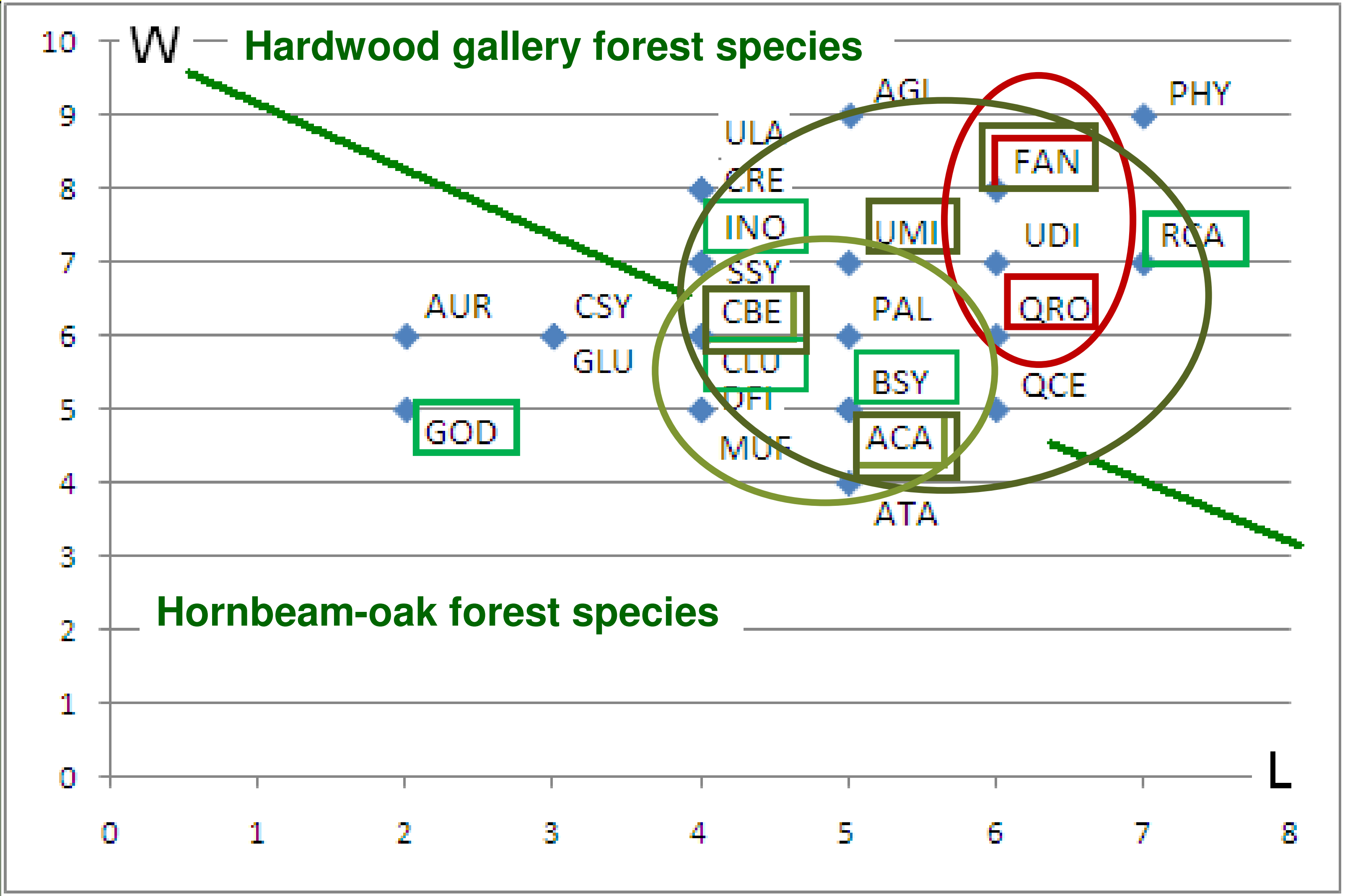
- Linear correlation based on cover data
- Tree stand and herb layer
- Macro and micro scale:
  - Macro (22 site): forest structure and herb layer summerized for sites
  - Micro: herb species in 0.5 m^2 circles, which contained juveniles of at least one selected tree species (550 of 1100)
- Selected tree species: juveniles occurring in at least 30 small circles
- Forest-type indicator herb species

Results

Species composition by layers



Dominant species by Ellenberg indicators



Correlations between:

- Macro scale (22 sites)
  - Trees of present – type-indicator herbs
  - Trees of present – juvenile trees („trees of future”)
  - Juvenile tree species with each other
  - Juvenile trees – type-indicator herbs

- Micro scale (550 small circles)
  - Juvenile tree species with each other
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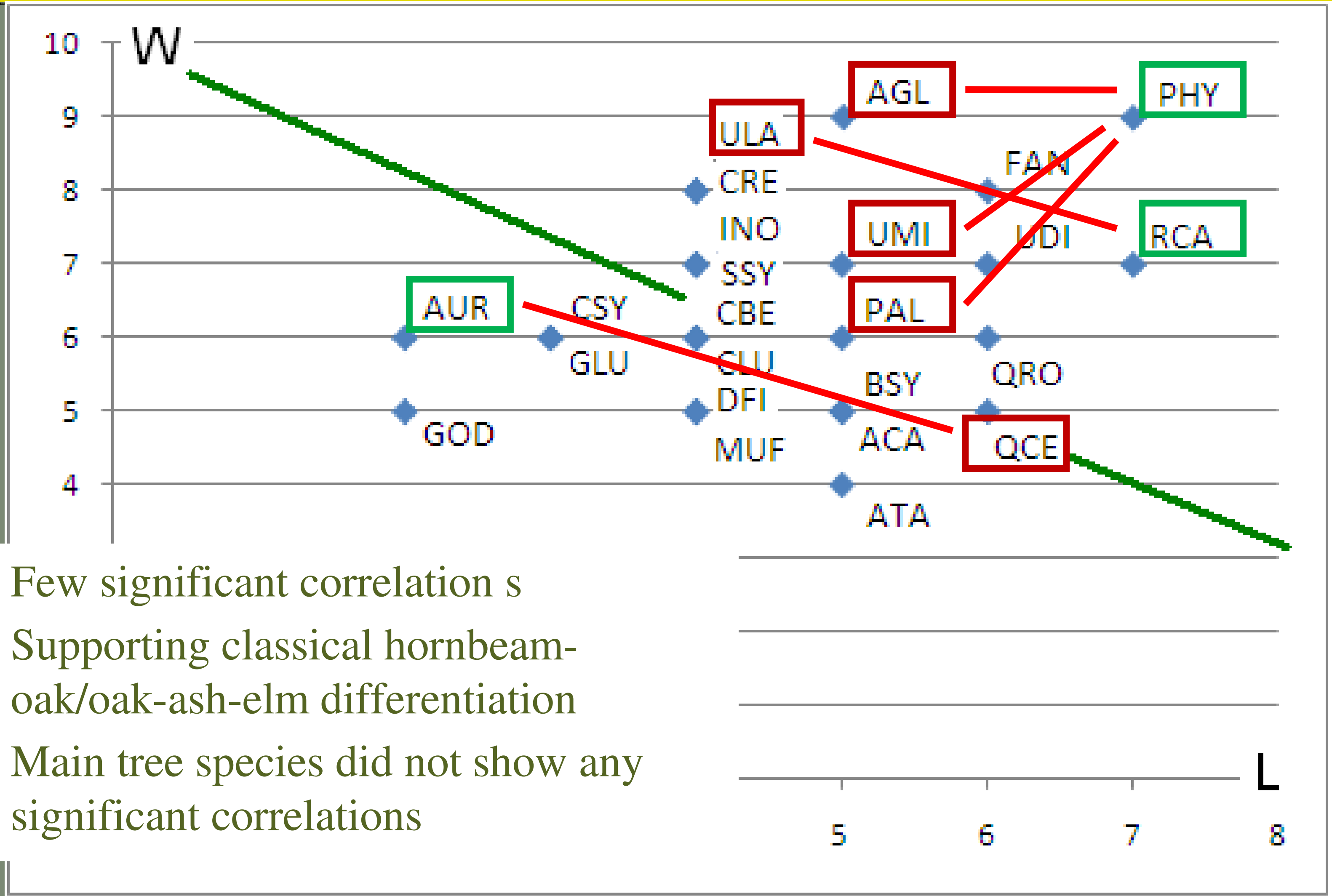
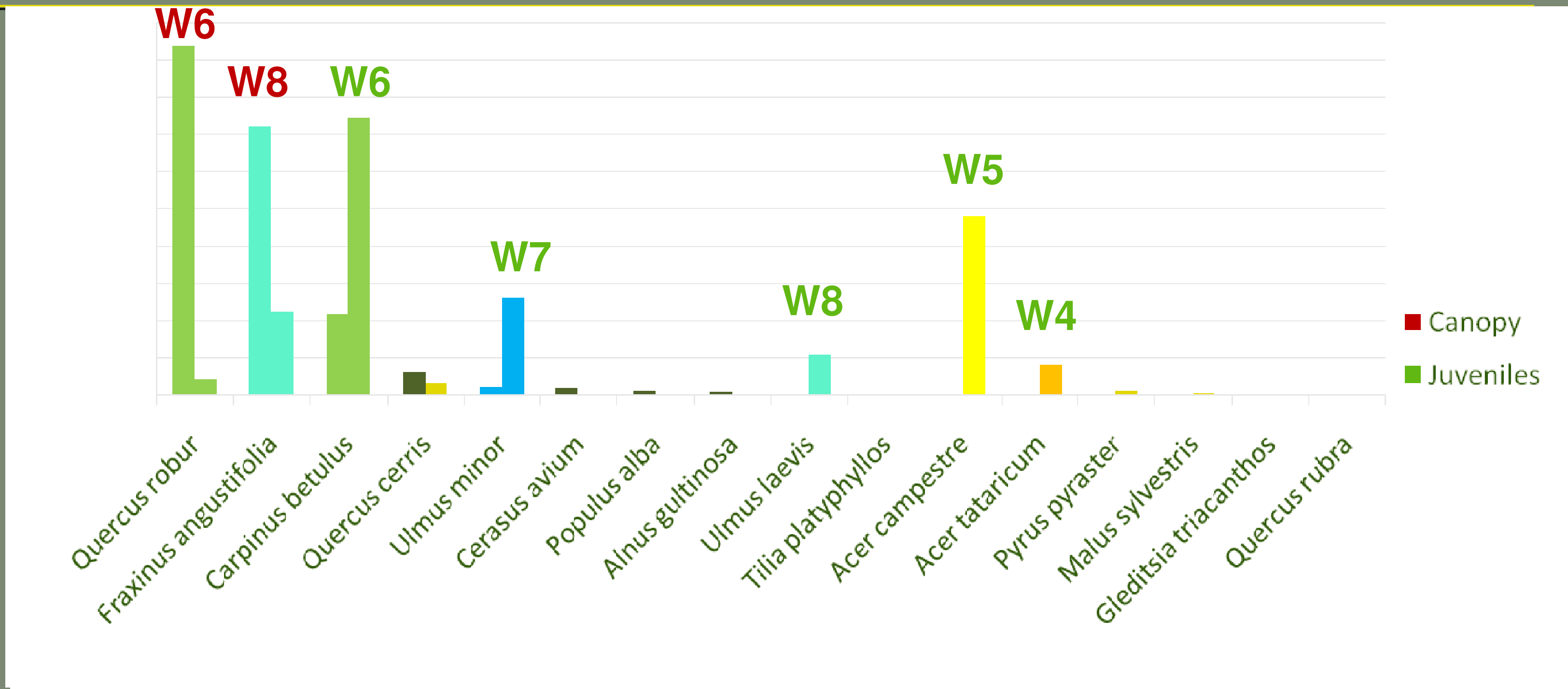
Macro I:
Trees of present – type indicator herbs



- Few significant correlation s
- Supporting classical hornbeam-oak/oak-ash-elm differentiation
- Main tree species did not show any significant correlations

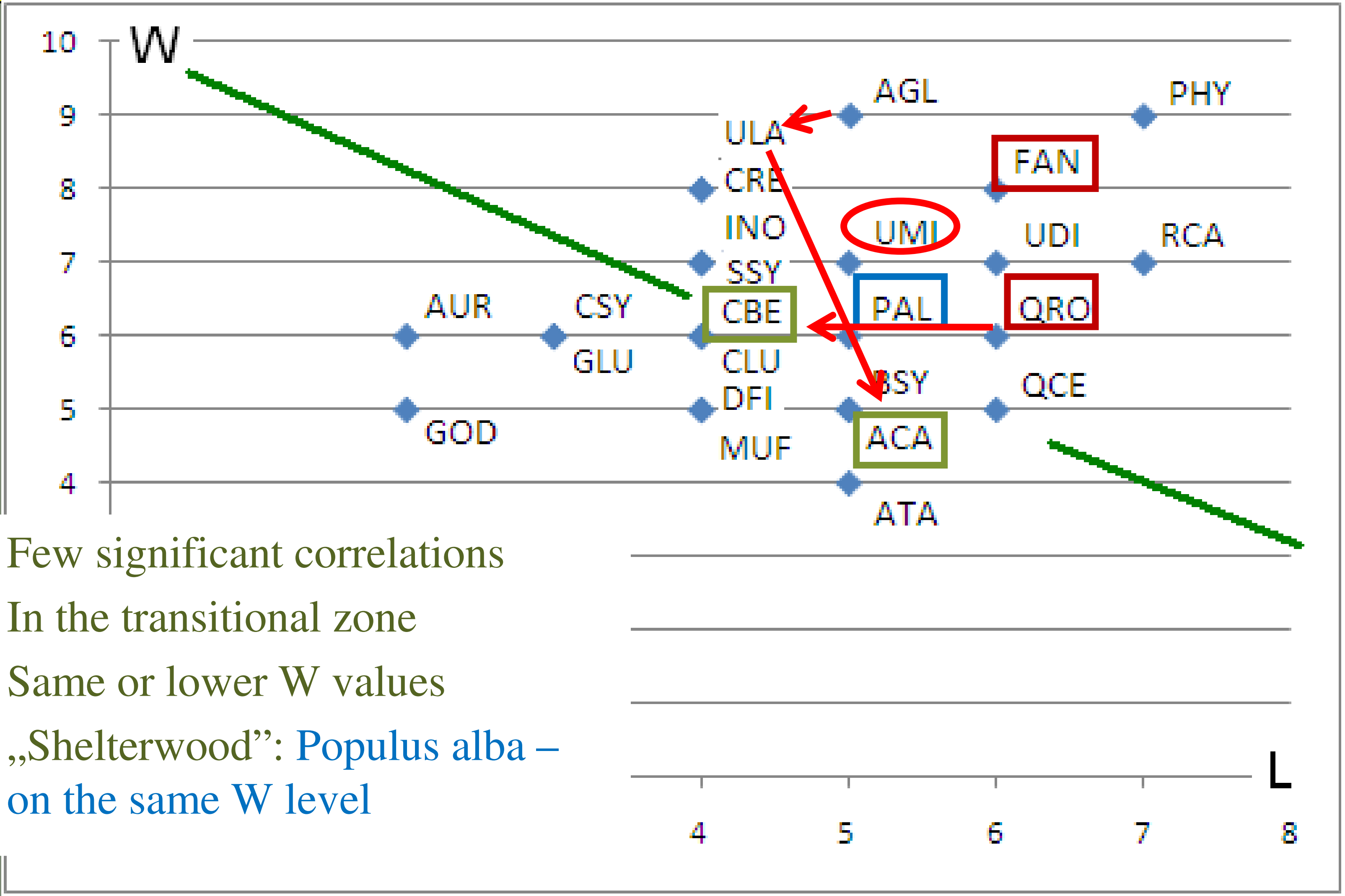
Macro II:
Trees of present – juvenile trees („trees of future”)



- Big difference -- no natural regeneration of the same forest (at least not in the next tree generation)

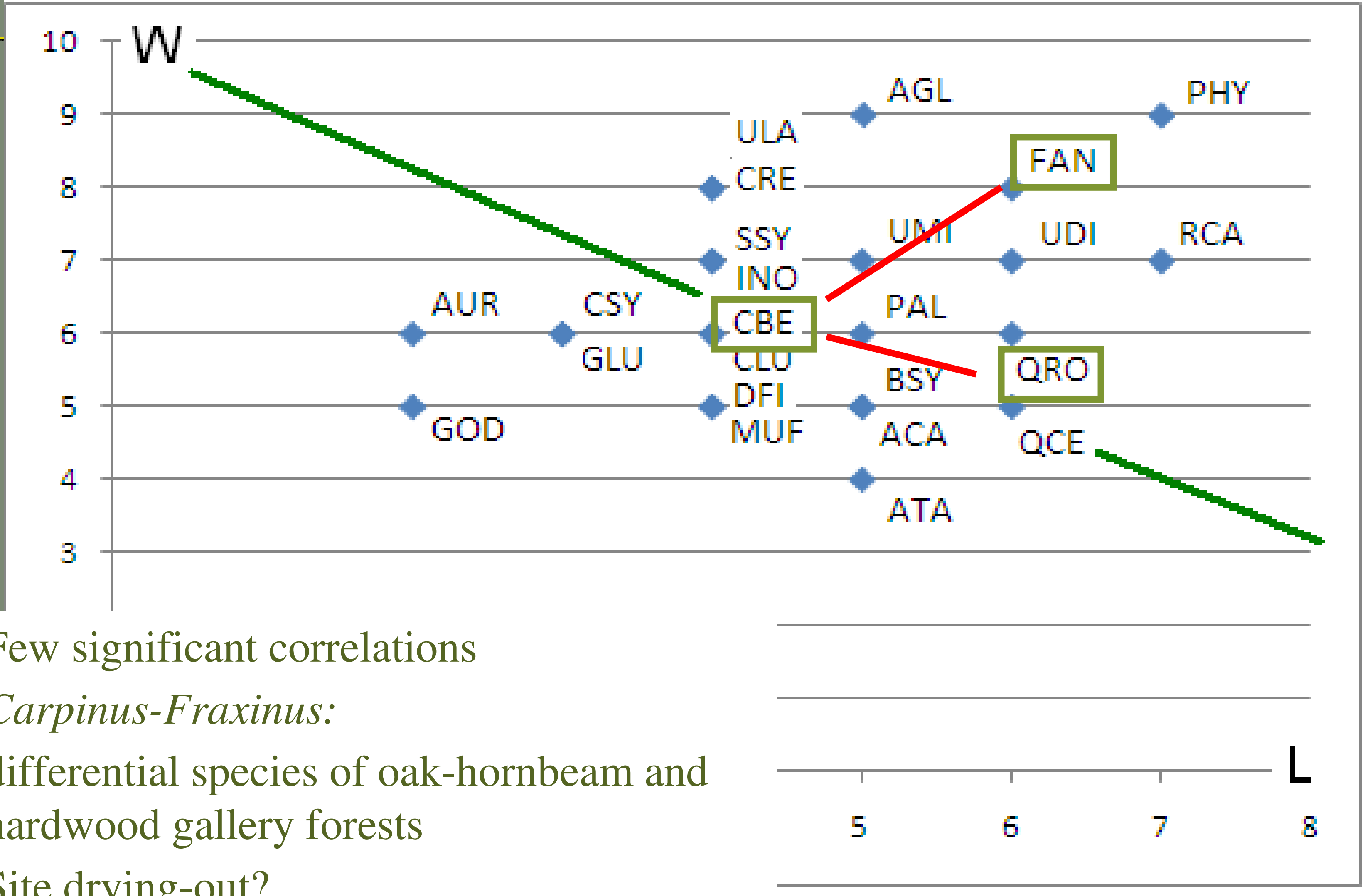
- Shift towards lower W values:
- *Quercus* (W6), *Fraxinus* (W8) → *Carpinus* (W6), *Acer campestre* (W5)

Macro II:
Trees of present – juvenile trees („trees of future”)



- Few significant correlations
- In the transitional zone
- Same or lower W values
- „Shelterwood”: Populus alba – on the same W level

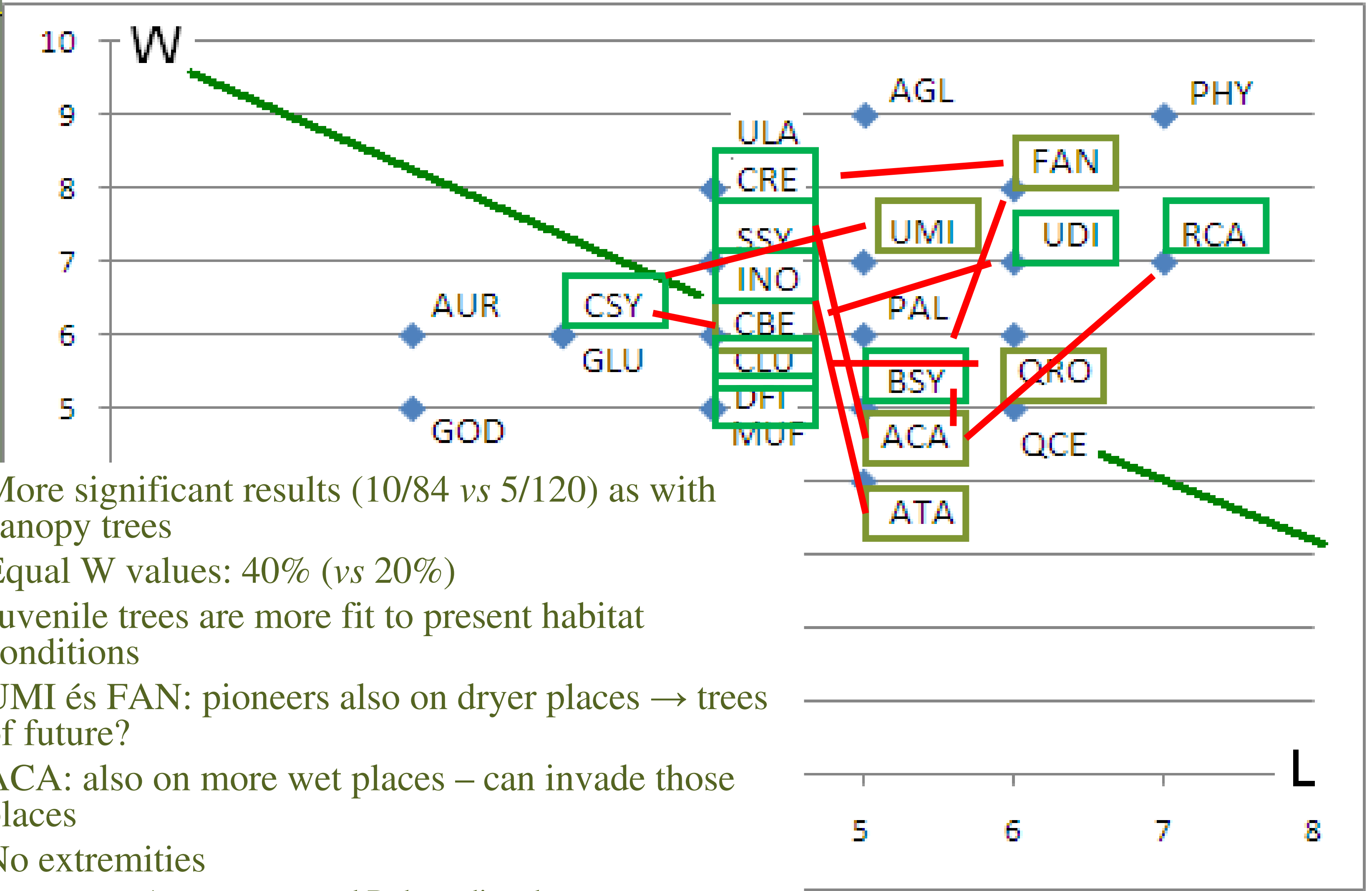
Macro III: Juvenile trees with each other



- Few significant correlations
- *Carpinus-Fraxinus:*

  differential species of oak-hornbeam and hardwood gallery forests
- Site drying-out?

Macro IV: Juvenile trees – type-indicator herbs



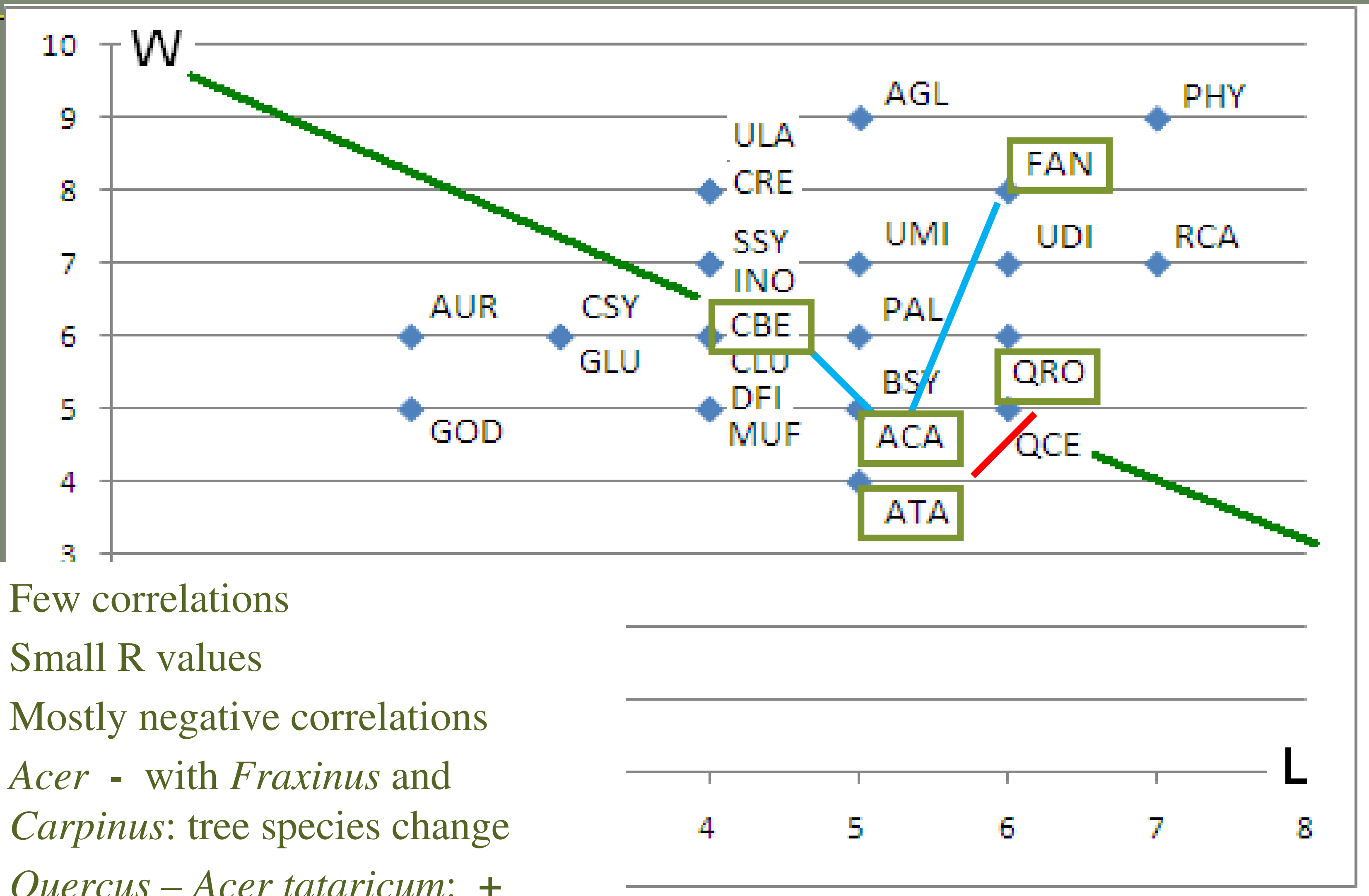
- More significant results (10/84 *vs* 5/120) as with canopy trees
- Equal W values: 40% (*vs* 20%)
- Juvenile trees are more fit to present habitat conditions
- UMI és FAN: pioneers also on dryer places → trees of future?
- ACA: also on more wet places – can invade those places
- No extremities
  - except A. campestre and Rubus: disturbance

Correlations between:

- Macro scale (22 sites)
  - Trees of present – type-indicator herbs
  - Trees of present – juvenile trees
  - Juvenile tree species with each other
  - Juvenile trees – type-indicator herbs

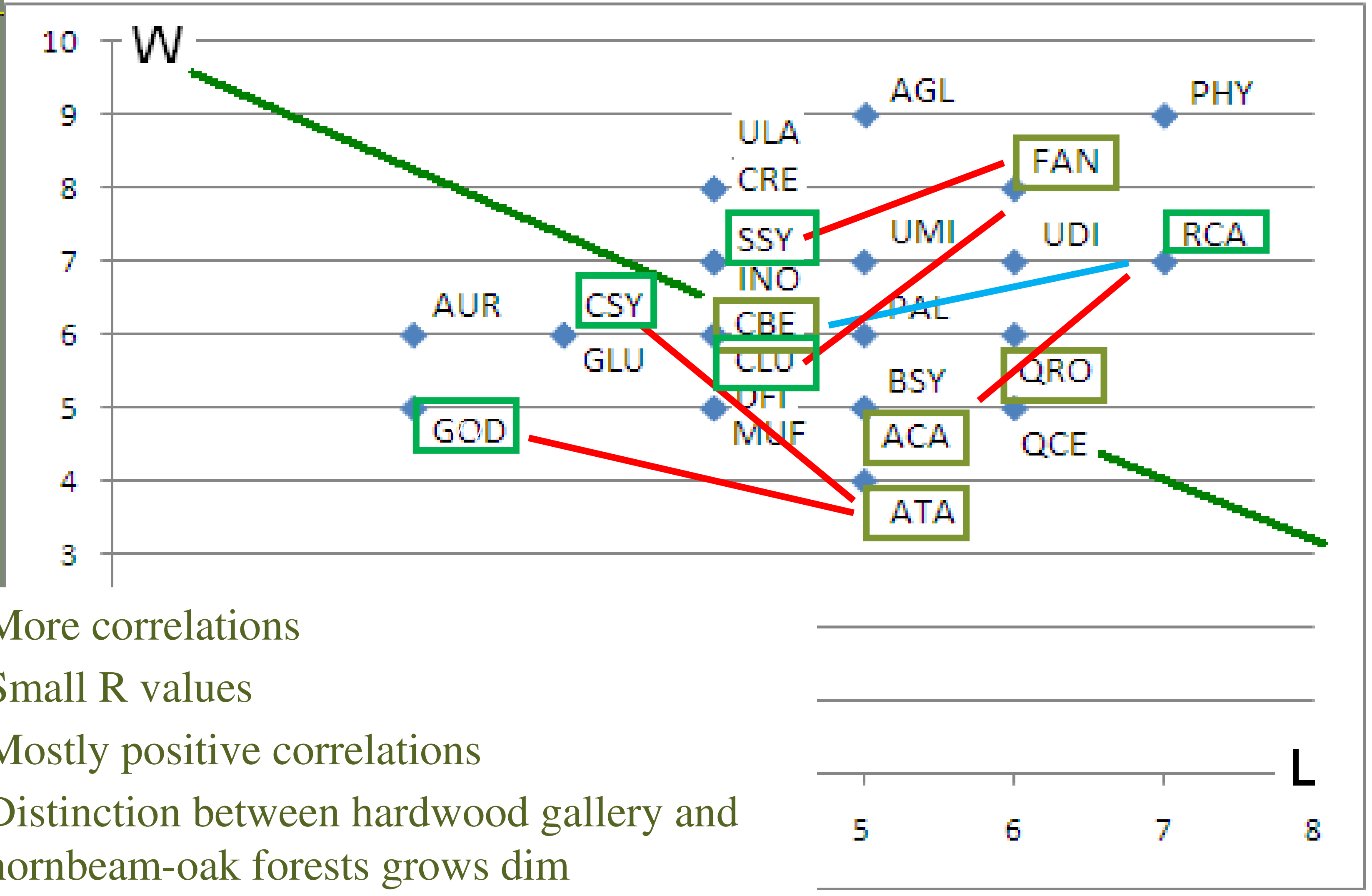
- Micro scale (550 small circles)
  - Juvenile tree species with each other
  - Juvenile trees – type-indicator herbs

Micro I: juveniles with each other



- Few correlations
- Small R values
- Mostly negative correlations
- *Acer* **-** with *Fraxinus* and *Carpinus*: tree species change
- *Quercus – Acer tataricum*: **+**

Micro II: juveniles – type indicator herbs



- More correlations
- Small R values
- Mostly positive correlations
- Distinction between hardwood gallery and hornbeam-oak forests grows dim

Discussion

- There is a big difference between trees of present – trees of future
- *Q. robur* do not regenerate
- **No self-sustaining forests**

- **Site drying out/homogenization seems to be important:**
  - Tree species shift towards more dry-tolerant species, mostly *A. campestre*
  - *Carpinus* and *Fraxinus* (regarded as differential species) regenerates besides each other
  - Tree – herb layer correlations are more numerous in case of juvenile trees
    - indication of **current** site characteristics – not the same as 100 years before

→ **One hypothesis for the future**

Further research plans/possibilities

- Detailed study of the core areas (50x50 m grid, Hungarian forest reserve protocol)
- Repeating 20x20 m coenological releves of 1995-96
- Study of regeneration in artificial/natural and fenced/not fenced gaps
- Study of individually protected oak saplings
- Looking for old-growth alluvial oak forest …
- … and for partners working on similar issues from Europe

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Thank you for your attention!