Effects of forestry treatments on forest site conditions and on the biodiversity of different organism groups

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PILISI PARKERDŐ ZRT.

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Motivation

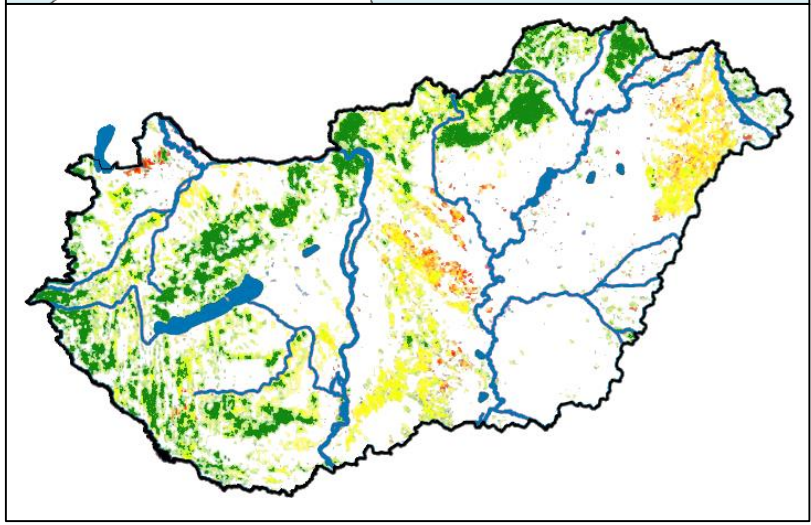
Necessity of the harmonization between timber production and conservation purposes

Forest cover in Hungary: ~20%

- Managed forests: 96%
- Protected (management restrictions): 21%

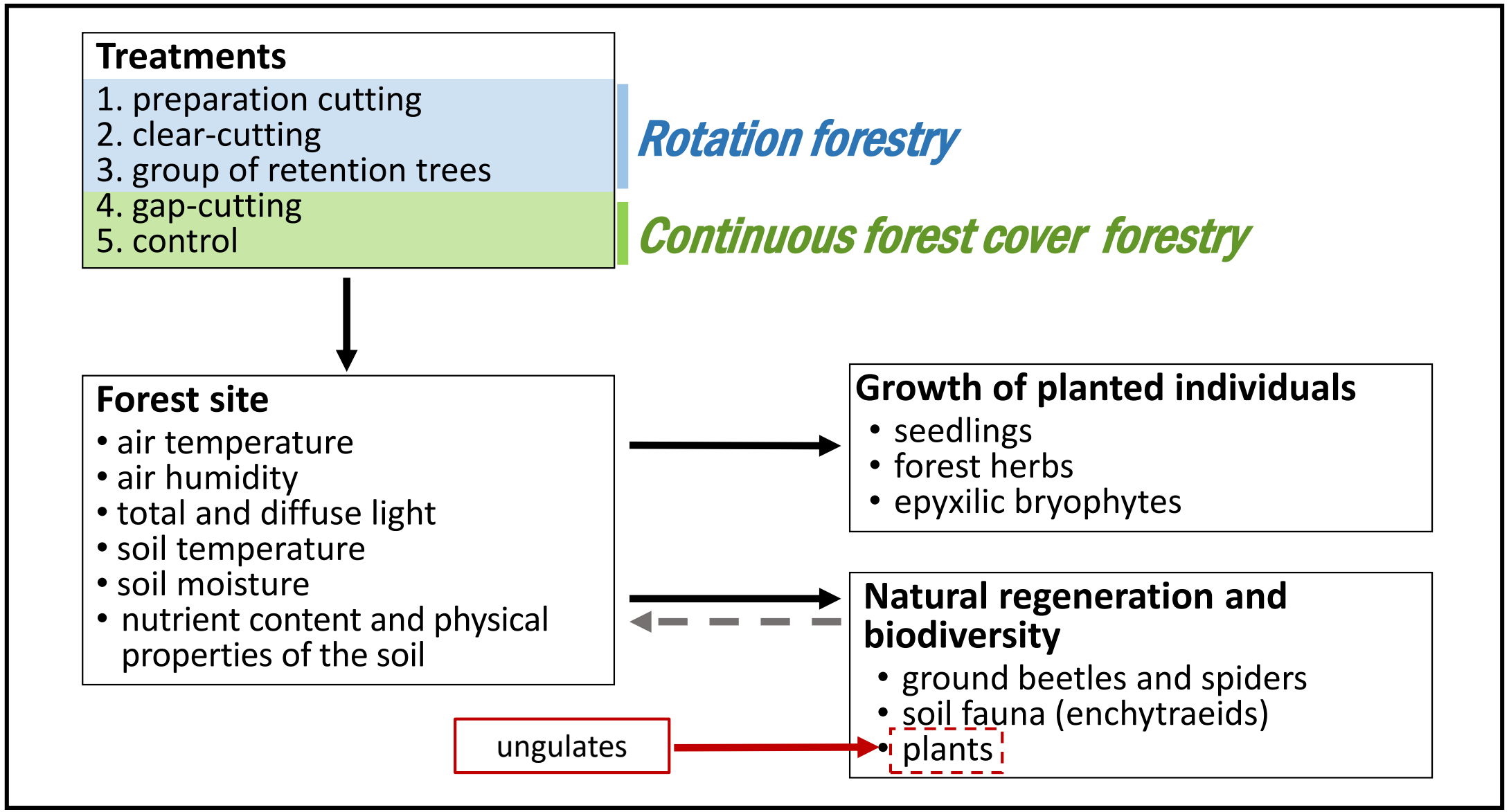
Applied silvicultural systems:

- Rotation forestry, shelterwood system (natural regeneration) → *native submontane forests*
- Rotation forestry, clear-cutting system (artificial regeneration) → *lowland forests and plantations*
- Continuous cover forestry, selection system → new!, ~4%, more open stands with continuous forest cover



Important to study the relationships between forest management and biodiversity

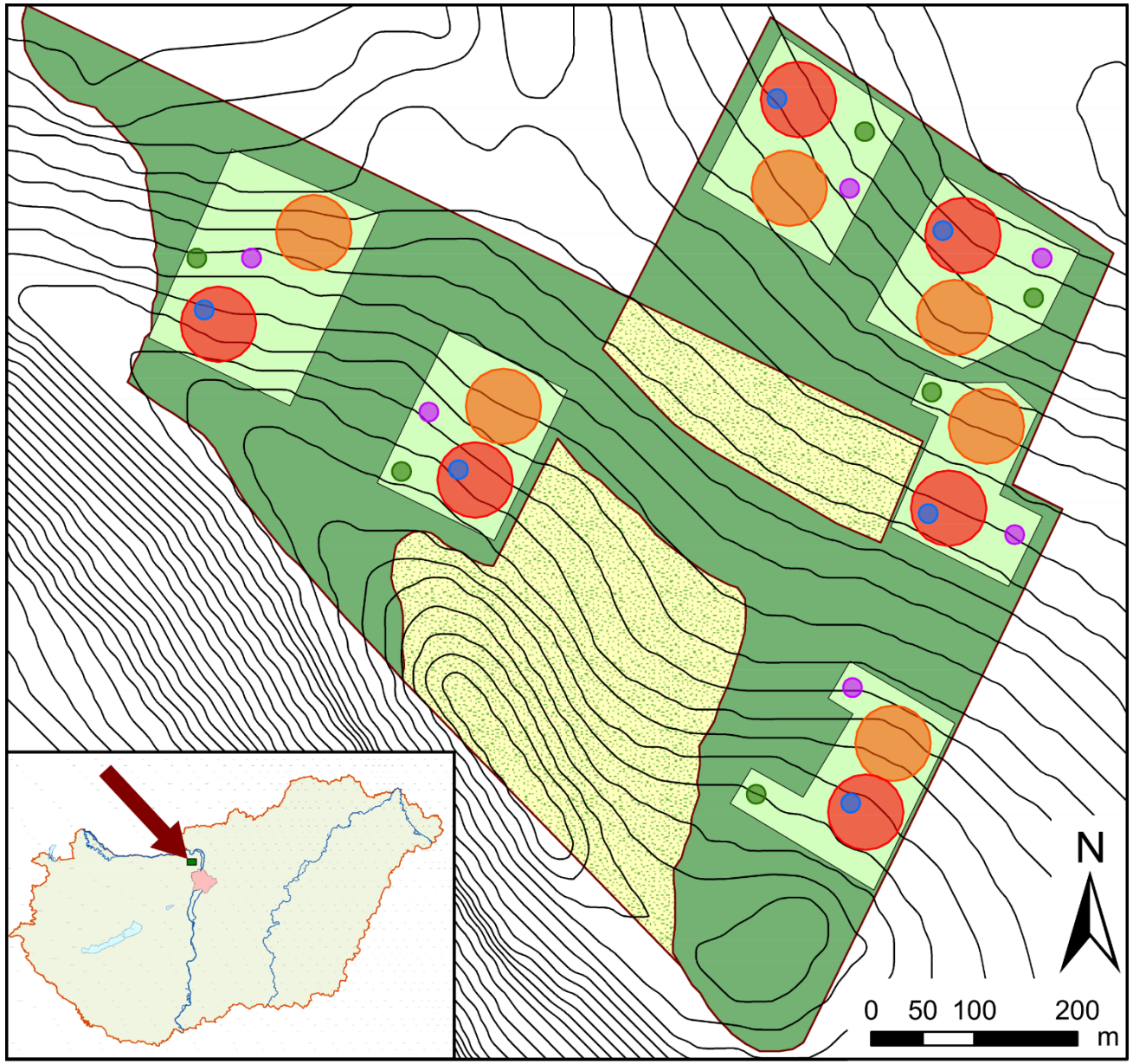
Pilis Project (2014-), forestry experiment

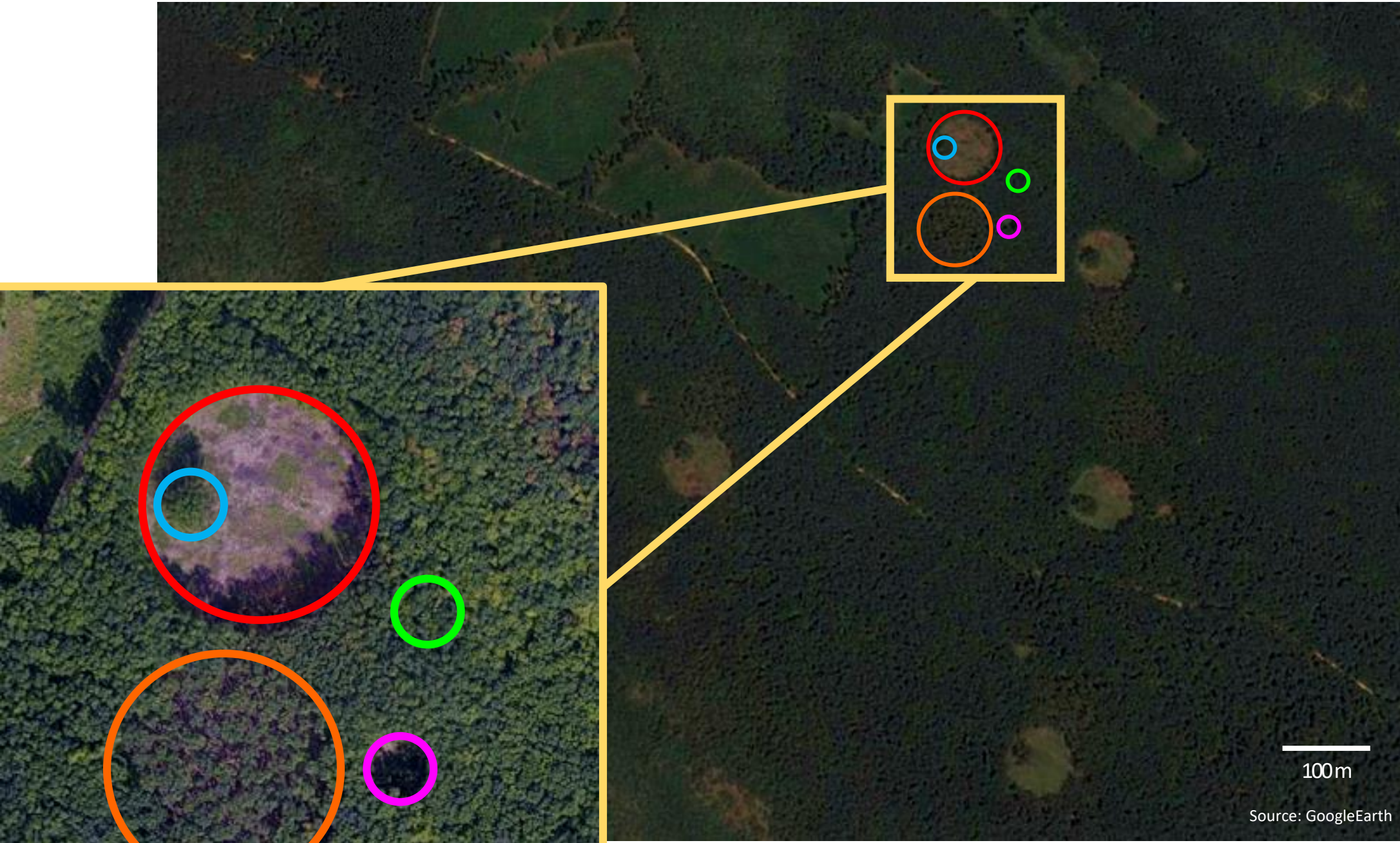


Experimental design

- 75 yr old *Quercus petraea – Carpinus betulus* stand
- 5 treatments:
  - preparation cutting (d=80 m)
  - gap cutting (d=20 m)
  - clear-cutting (d=80 m)
  - retention tree group (d=20 m)
  - control

- 6 replicates – complete block design
- BACI (Before-After-Control-Impact): all measurements started in 2014
- Data analysis in 2016 (2 years after the treatments)





Drone photo: Viktor TÓTH

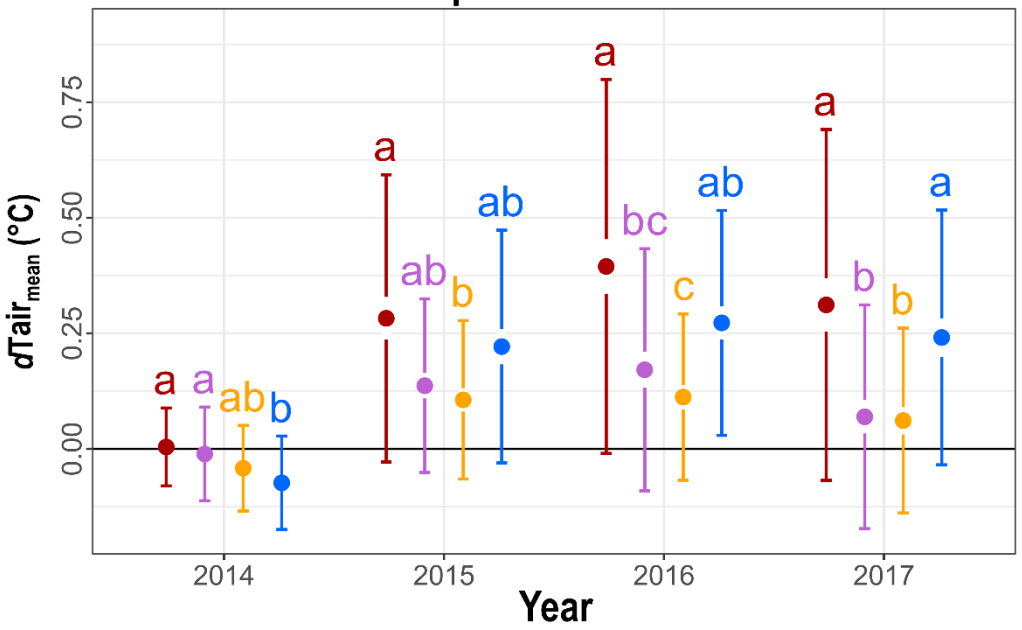
Relative Diffuse Light (2016)

F=55.843***

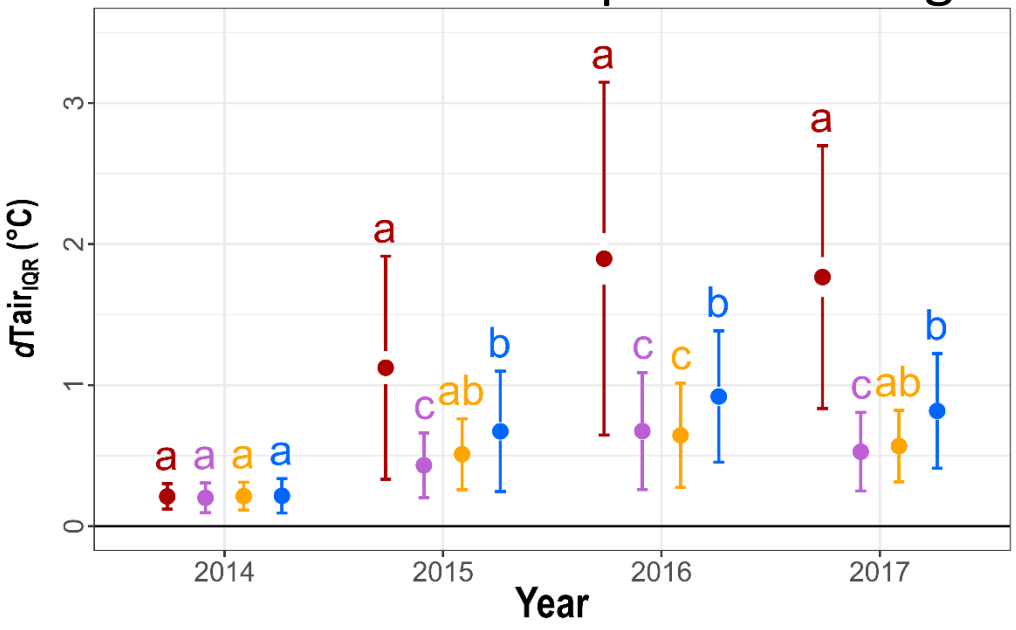
2%[a]	81%[b]	35%[c]	20%[d]	17%[d]
				
Control	Clear-cutting	Gap-cutting	Preparation cutting	Retention tree group

Microclimate

Air temperature mean

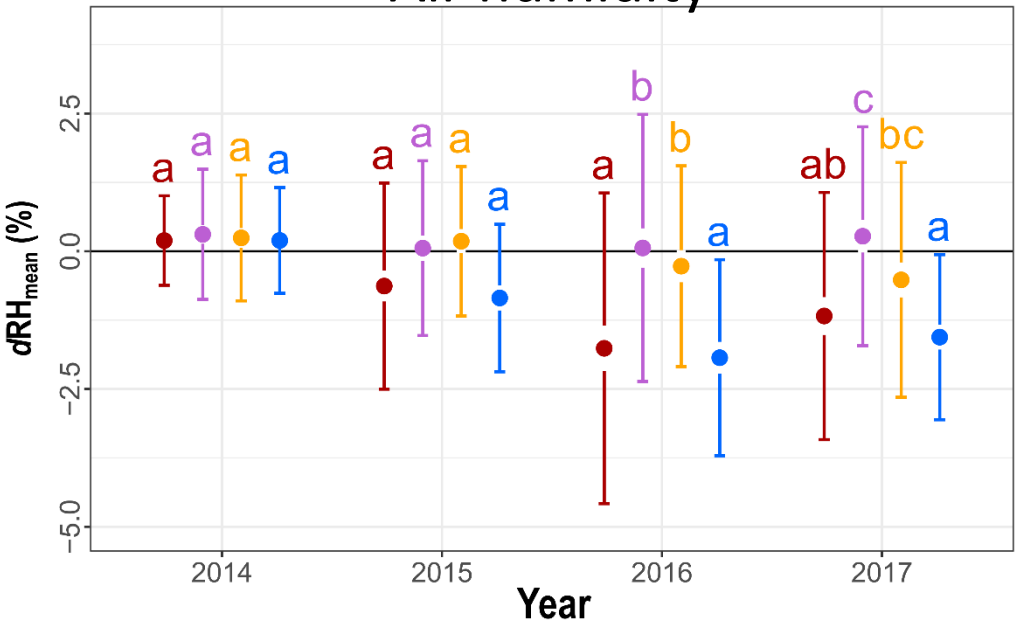


Air temperature range

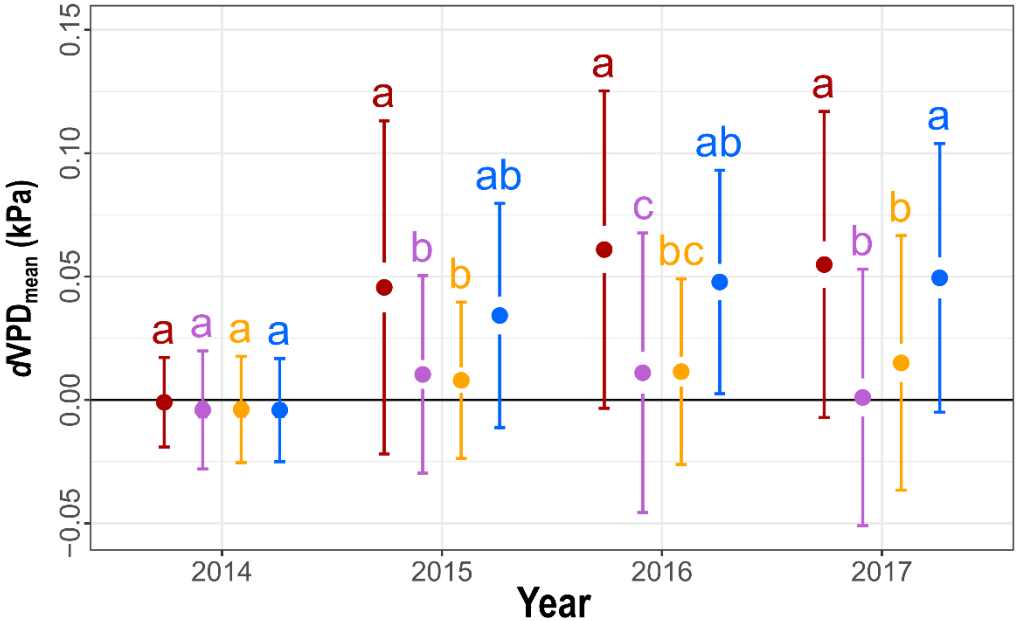


Treatment
- Clear-cutting
- Gap-cutting
- Preparation cutting
- Retention tree group

Air humidity

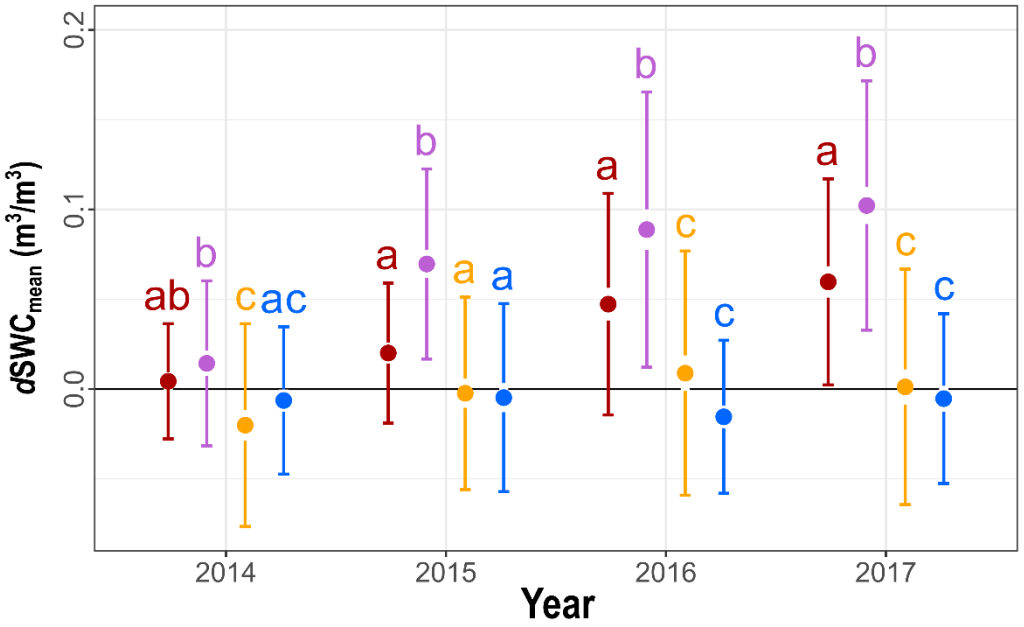


Vapour pressure deficit

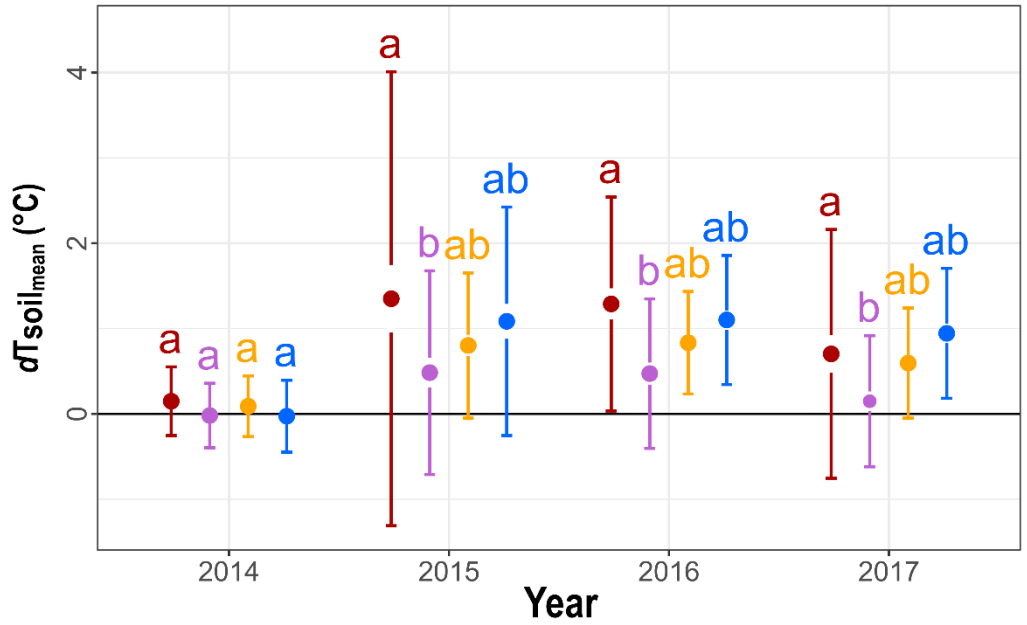


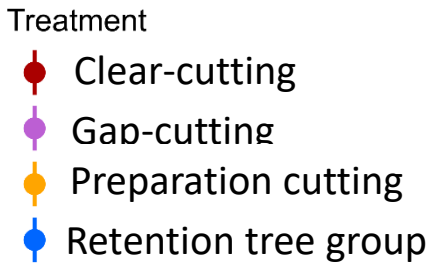
Microclimate

Soil water content



Soil temperature





Species richness difference (2016-2014)

Chi²=17.4***

Plants

a b* b* a a

Chi²=33.6***

Enchytraeids

a* b b b* c*

Chi²=10.0*

Spiders

a* b b b b

Chi²=12.4*

Ground beetles

a a* a* a b

Control | Clear-cutting | Gap-cutting | Preparation cutting | Retention tree group

Abundance difference (2016-2014)

Chi²=42.8***

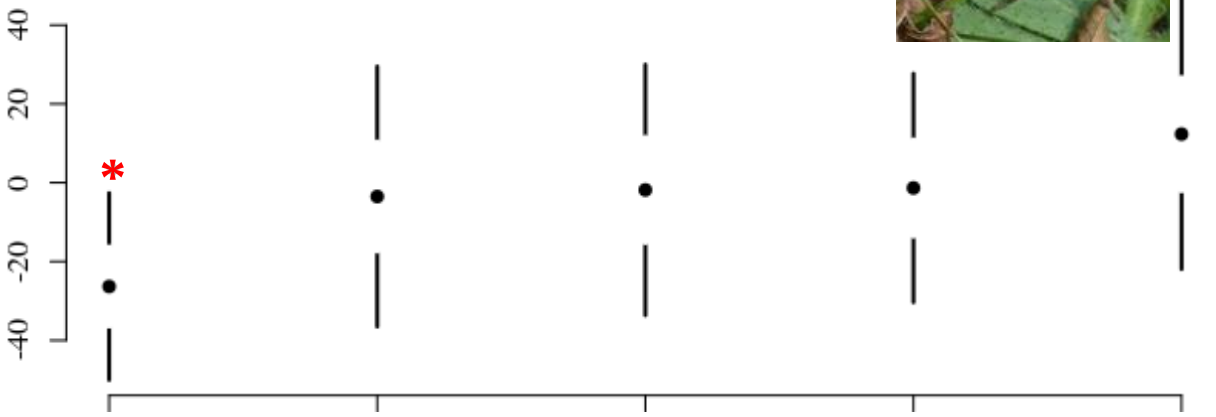
Plants

Chi²=74.5***

Enchytraeids

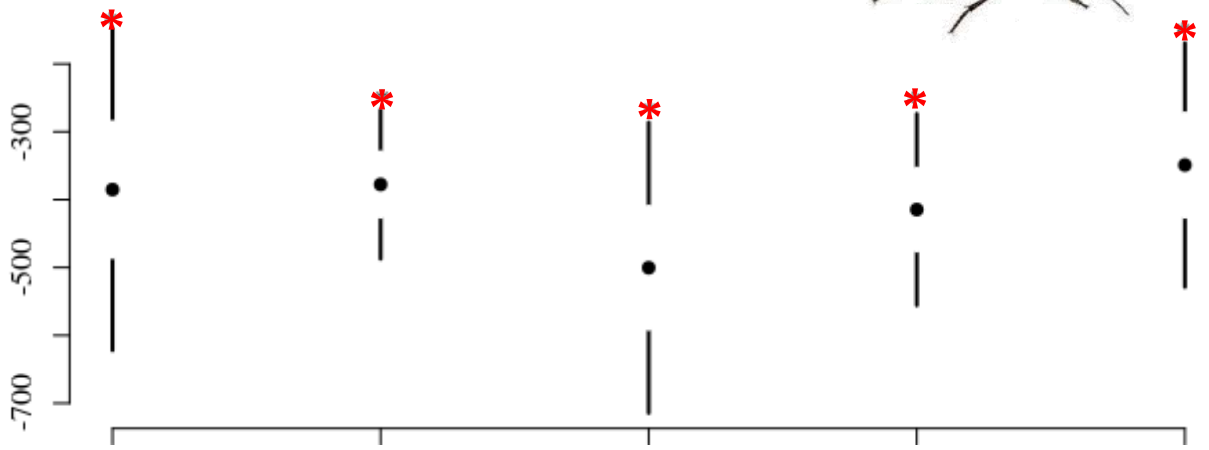
Chi²=5.0n.s.

Spiders



Chi²=2.9n.s.

Ground beetles



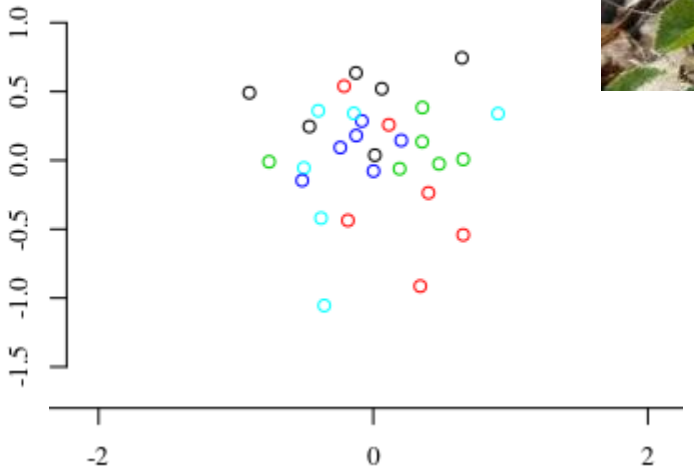
Control | Clear-cutting | Gap-cutting | Preparation cutting | Retention tree group

Control | Clear-cutting | Gap-cutting | Preparation cutting | Retention tree group

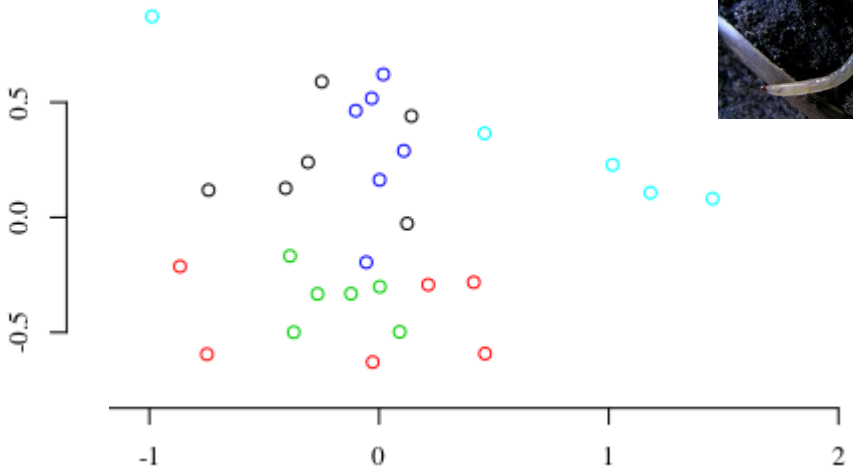
Species composition 2016 (NMDS)

- Control
- Clear-cutting
- Gap-cutting
- Preparation cutting
- Retention tree group

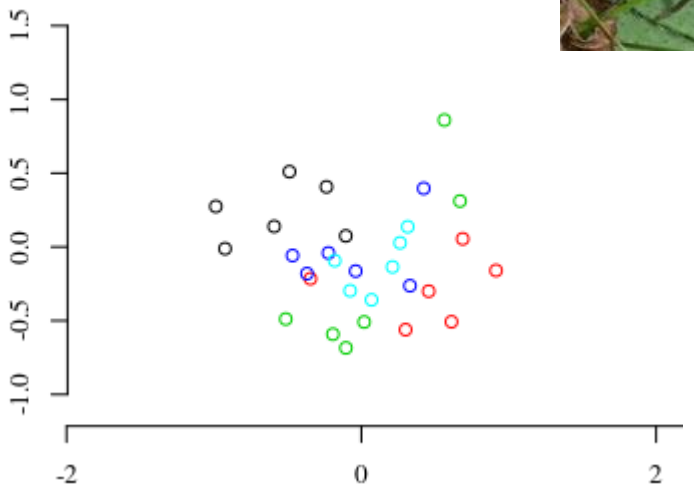
F=2.1** **Plants**



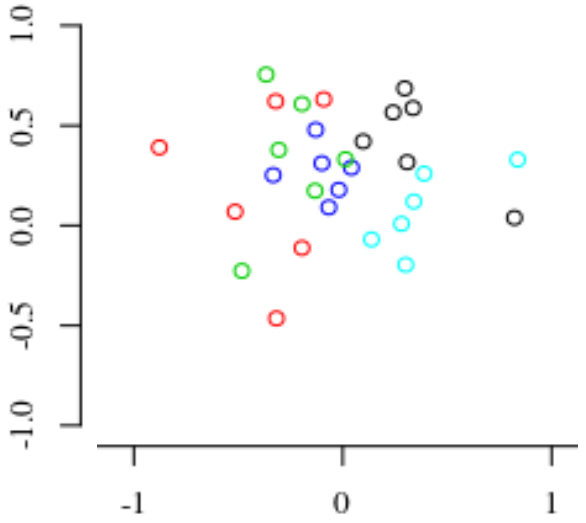
F=4.6*** **Enchytraeids**



F=6.1*** **Spiders**

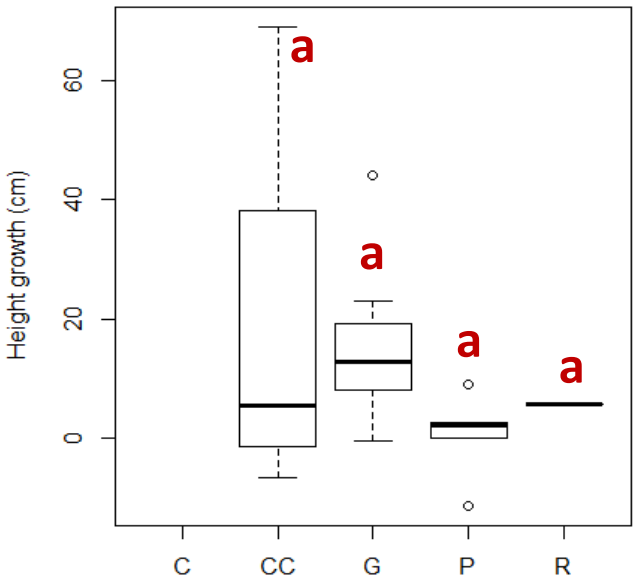


F=2.9*** **Ground beetles**

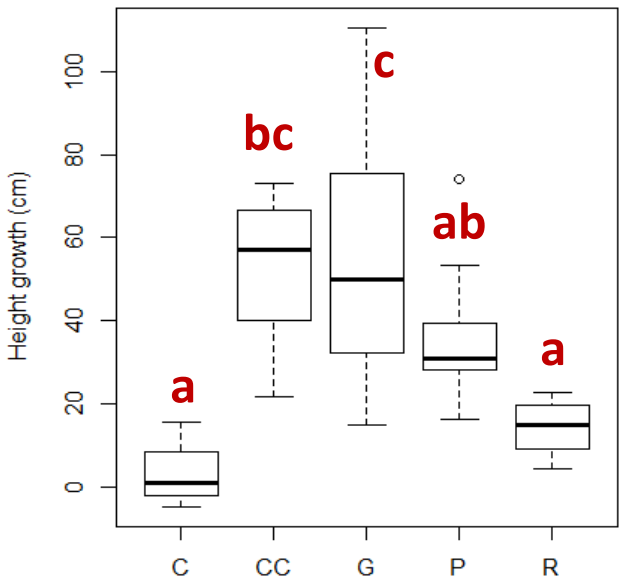


Planted saplings – Height growth between 2014-2017 (cm)

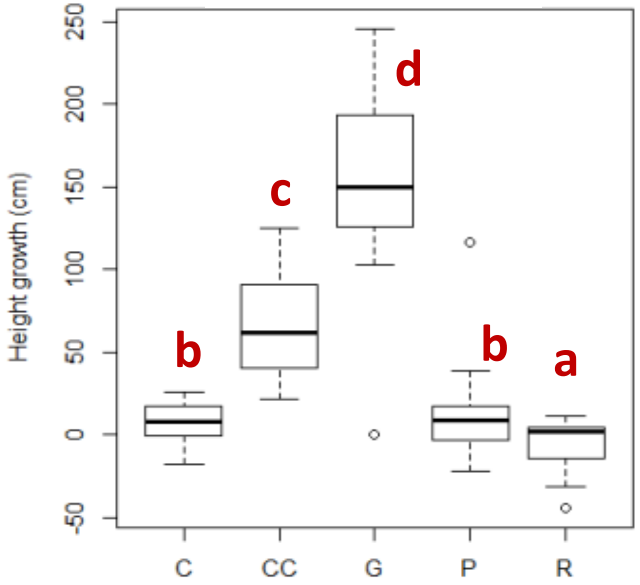
Sessile oak



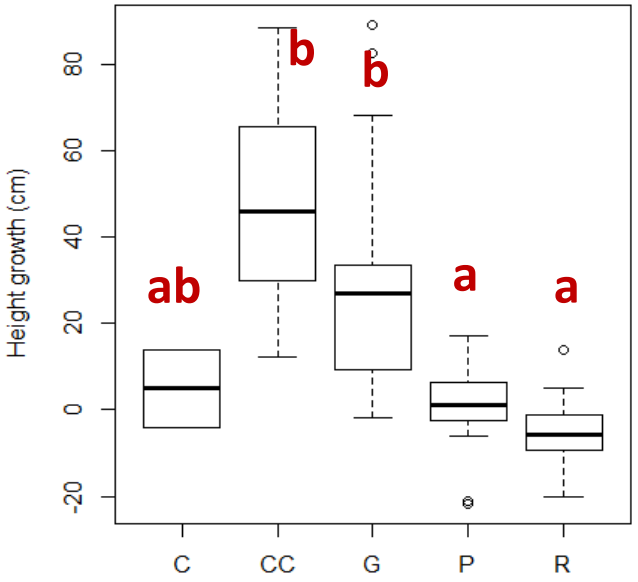
Beech



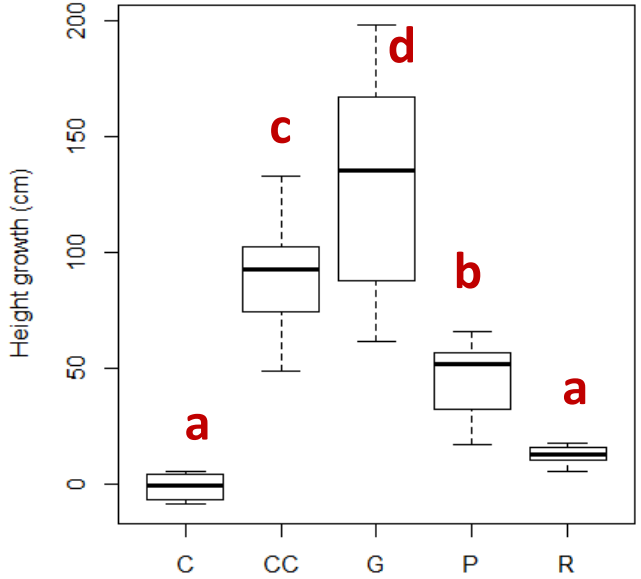
European ash



Turkey oak



Hornbeam



C – Control
CC – Clear cutting
G – Gap cutting
P – Preparation cutting
R – Retention tree group

Conclusions for management

- Gaps provide favorable light conditions for regeneration, temperate microclimate, increased soil water content
- Preparation cutting has the most similar conditions to control
- Clear-cutting has drastic effects on organism groups
- Retention tree group can compensate light effect and temperature range increment, but it can not compensate the increased temperature
- Sessile soil organisms are very sensitive to microclimatic changes resulted by forest management; for plant communities it is buffered by the survival of the perennials; for spiders and ground beetles by the mobility of individuals
- Continuous forest cover forestry is more favorable for conservation purposes than rotation (shelterwood) forestry system






Thank you for your attention!

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