Effect of forestry treatments on microclimate, regeneration and biodiversity. An experimental study

Péter Ódor<sup>1</sup>, Gergely Boros<sup>1</sup>, Zoltán Elek<sup>1</sup>, Ferenc Samu<sup>2</sup>, Flóra Tinya<sup>1</sup>, Réka Aszalós<sup>1</sup>, András Bidló<sup>3</sup>, Péter Csépányi<sup>4</sup>, Bence Kovács<sup>1</sup>

<sup>1</sup>MTA Centre for Ecological Research <sup>2</sup>MTA Centre for Agricultural Research <sup>3</sup>University of West Hungary <sup>4</sup>Pilisi Parkerdő Ltd.









IUFRO Regional Congress for Asia and Oceania Beijing, China, 24-27 October 2016

## Motivation

# Necessity of the harmonization between timber production and conservation purposes

Forest cover in Hungary: ~ 20% Native: 63% No management: 4% Protected (management restrictions ): 24%

Silvicultural systems

- Rotation forestry, shelterwood system (natural regeneration): dominant in native submontane forests
- rotation forestry, clear-cutting system (artificial regeneration): mainly lowland forests and plantations
- continuous forest cover forestry, selection system (new!, ~4%)

Important to study the relationships between forest management and biodiversity



## Pilis project -2014. Forestry experiment



## **Experimental design**

- 70 yrs old *Quercus petraea, Carpinus betulus* stand
- 5 treatments

preparation cutting (d=80 m) gap cutting (d=20 m) micro-clearcut (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





## Design of a sampling unit



## Forest Site

- Microclimate measurements for 72 hours in every month (March-November)
- 30 plots (5 Treatment, 6 Blocks)
- Indirect light measurements
- Soil Water Content pattern
- Soil variables (pH, C, N)





#### Air temperature

Air temperature difference

Air temperature range difference



#### Soil conditions



#### Response of organism groups: Spiders





#### Response of organism groups: Carabids



Species richness

non significant F= 4.62\*\* а 600 0 а 500 45 ab а Abundance 400 Species richness 40 300b 35 0 200 30 100 Thinning Control Gap-felling Clear-cuts Retention tree Control Clear-cuts Thinning Gap-felling Retention tree

Response of organism groups.

Abundance

#### Response of organism groups: Plants



Cover

Species richness



#### Response of organism groups: Enchytraeid worms

Abundance

Species richness

F= 13.00\*\*\*







Response of saplings Height increment 2014-2016



## Summary

Forest site:

- Temperature increment: clear-cut, retention tree group
- Daily temperature range increment: clear-cut
- Soil water content increment: Gap

Organism groups:

- Spiders: Low response
- Carabids: Intermediate response, abundance decrease in clearcut (temperature effect)
- Plants: Intermediate response, cover increased in clear-cut, thinning and gap, species richness in clear-cut (light effect)
- Enchythraeid worms: Strong response, abundance and species richness decresead in clear-cut and retention tree group (temperature effect)
- Saplings: Increased increment in gap and clear-cut

Conclusions for management

- Continuous forest cover forestry is more favorable for conservation purposes than rotation (shelterwood) forestry system
- Consequences of this management are gaps and canopy openings
- Gaps provides favorable light conditions for regeneration, temperate microclimate, increased soil water content
- In gaps, biodiversity changes were lower than in clear-cuts and retention tree groups
- In clear-cuts the retention tree group can compensate light effect and temperature range increment, but it can not buffer the increased temperature.
- Sessile soil organisms are very sensitive to microclimatic changes resulted by forest management.



## Thank you for your attention

The project is supported by the Hungarian Science Foundation (OTKA 111887), GINOP-2.3.2-15-2016-00019 and Hungarian Academy of Sciences









