EVO experiment

Our playground-Evo experimental area
Major changes – need for restoration?

- Intensive forestry
- Suppression of natural disturbances and dynamics (e.g. forest fires)
  - Changes in forest structure, stand size, fragmentation
  - Tree species proportions
  - Lack of coarse woody debris (CWD)
  - Lack of burned areas and charred wood
  - Insufficient amount of conservation areas
Forest restoration

Finnish definition:
Restore natural dynamics, processes and elements to (boreal) forests in all landscape levels
Long-term goal

To promote natural processes which lead to pristine forests (all successional stages, not just old growth – as currently)
Short-term goal

Re-introduce missing elements to forest landscape with a special target of supporting endangered species
Acts

-starting natural succession by burning
Objective

- Rehabilitating boreal forest structure and species composition in Finland through logging, dead wood creation and fire.
Aims of the project

✓ To conduct forest fire research and applied development to incorporate knowledge of fire effects and their ecosystem response to forest ecosystem management.

✓ Focuse on ecological and forest management questions whether habitats can be created by use of prescribed fire for maintenance of biodiversity and endangered species in managed forest areas.
Aims of the project

✓ Get information of the effects of restoration fellings and burning on the structure of the forest stands, and on the characters of the humus layer, soil and different species groups (bottom and field layer vegetation, tree species regeneration, epiphytic lichens and bryophytes, polypores)

✓ Specifically, developing burning methods, guidelines and instructions for burns to promote biodiversity.
General hypotheses:

- The short-term effects of especially fire will be negative to many species, depending on fire severity

- Both restoration felling and burning will increase species diversity in the long run by creating more substrate for the species, important for many fire dependent species

- Forest structures (tree species composition, higher amount of CWD) will develop more uneven-aged, resembling better natural conditions
## Restoration experiment, design

Located in Norway spruce-dominated mature managed forest stands on mesic-site type, DR= Down retention, SR= Standing retention.

<table>
<thead>
<tr>
<th>Burn</th>
<th>Replicates</th>
<th>Unburned</th>
<th>Replicates</th>
</tr>
</thead>
<tbody>
<tr>
<td>Treatment 1.</td>
<td>5m³/ha DR</td>
<td>3</td>
<td>5m³/ha DR</td>
</tr>
<tr>
<td></td>
<td>50m³/ha SR</td>
<td></td>
<td>50m³/ha SR</td>
</tr>
<tr>
<td>Treatment 2.</td>
<td>30m³/ha DR</td>
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<td>30m³/ha DR</td>
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<tr>
<td></td>
<td>50m³/ha SR</td>
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<td>50m³/ha SR</td>
</tr>
<tr>
<td>Treatment 3.</td>
<td>60m³/ha DR</td>
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<td>60m³/ha DR</td>
</tr>
<tr>
<td></td>
<td>50m³/ha SR</td>
<td></td>
<td>50m³/ha SR</td>
</tr>
<tr>
<td>Control</td>
<td>No cuttings</td>
<td>3</td>
<td>No cuttings</td>
</tr>
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</table>

Total 24 forest stands
- **Selection of the plots.** The land areas were provided by UPM-Kymmene (United Paper Mill), City of Hämeenlinna, Forest and Park Service, Häme Polytechnic and Finnish Forest Research Institute.

- **Felling operations** done by land-owners.

- **Pre- and post-fire sampling** (stand structure, regeneration of the tree stand, CWD, composition and spatial structure of understorey vegetation, epixylic mosses and lichens, depth of the burn and soil samples, polypores)

- **Burnings** done by the Ministry of interior in co-operation with polytechnic schools and FFRI.
Restoration treatment: 50 m³/ha standing and 30 m³/ha downed
Burning method

- 12 stands were burned

Forest stand (2ha)

Direction of ignition

Clearcut buffer zone (20m) includes mineral soil safety zone

Ignition point

Direction of ignition

Wet biotope

Dry biotope

30 X 50m

Wind direction

30 X 50m

Saara Lilja
A restoration treatment burn - forming the horse shoe
Restoration burning in a Norway spruce forest
Restoration burnings were mainly ground fires
Follow-up studies in following subjects:

1) Stand structure and tree mortality
2) Regeneration of the tree stand
3) CWD dynamics
4) Ground- and fieldlayer vegetation
5) Humus and soil
6) Epixylic lichens and bryophytes
7) Polypores
Estimation of species coverages by using the metal net

Spore trapping →
Results

Fire increases
--> heterogeneity of the sites

Fire enhances
--> species diversity

Fire develops forest structure more natural
--> dead wood continuum in control burning
--> volume of dead wood
Changes in the tree diameter distribution - in logging and burning restoration

Diameter class (DBH) cm

Pre-treatment

Cutting

Cutting and burning

Control burning

Number of trees/ha

Upland biotope Paludified biotope

Control burning

Diameter class (DBH) cm
Volume of dead wood after restoration burning
(before n=24, after n=3)

**Total dead wood**

- Pretreat.
- Control
- 5m3
- 30m3
- 60m3

- Upland biotope
- Paludified biotope

**Standing dead wood**

- Pretreat.
- Control
- 5m3
- 30m3
- 60m3
Aspen regeneration after burning

![Graph showing regeneration over time]
Results (2a): The effects of restoration treatments on the coverages of the epixylic (growing on dead wood) bryophytes

Restoration treatments

- **treatment 1 (5m³, no burning), spruce**
- **treatment 2 (30m³, no burning), spruce**
- **treatment 4 (5m³, burning), spruce**
- **treatment 5 (30m³, burning), spruce**
Results (2b)

treatment 3 (60m³, no burning), spruce

<table>
<thead>
<tr>
<th>Year</th>
<th>Hepatics</th>
<th>Mosses</th>
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Mean %

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treatment 6 (60m³, burning), spruce

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Mean %

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<tr>
<td>3</td>
<td>10</td>
<td>20</td>
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treatment 7 (burning), spruce

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Mean %

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treatment 8 (control), spruce

<table>
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</tr>
<tr>
<td>3</td>
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<td>20</td>
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</table>

Mean %
Changes of pH in the humus layer

### Treatments
- 5 m3 DR
- 30 m3 DR
- 60 m3 DR
- control

### pH
- Before burning
- After burning

10.6.2010
The thinning of humus layer (mm) in vegetation quadrates with different cover percentage (%) of moss species

(A) *Dicranum* sp.

(B) *Hylocomium splendens*

(C) *Pleurozium schreberi*
Conclusions

- Different restorative treatments give different immediate results
- Standing tree mortality is related to the amount of down wood retention immediately after burning
- Paludified biotopes increase variability of stand structure in *Picea* restoration areas
- Diversity is generally increased with restoration treatments – long-term monitoring
Tools for managers

- amount of wood can be used to regulate fire severity, fire effects and amount of charred wood
- small-scale within-stand site type variation is important in creating heterogeneity after restoration
- fire and amount of dead wood are important factors in maintaining biodiversity in the boreal - substrates for threatened species
Publications

Related publications

Acknowledgements

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