Restoration of semi-natural meadows on a severely degraded fen

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Drained for agriculture,
Water fluctuations 1-1.5 m,
Soil structure changes,
N,P - eutrophication, K – impoverishment
Wind erosion, fires,
Carbon losses
Goal of restoration:
Sedge-moss vegetation,
Species-rich fen meadows,
Location: Całowanie Fen

- Location in Vistula River ice-marginal valley
- Seepage fed-fen
- Sedge-moss peat (3.5 m)
Hydrology

- Seepage still present
Water deficits:
- Drainage ditches
- Deepening of ditches
- ‘Fish ponds’
- Forestation of the infiltration area
- General lowering of groundwater levels
- Increased use of water

‘Fish ponds’ = illegal peat extraction!

Water flow map
- > 100 L/s
- 50 - 100 L/s
- 10 - 50 L/s
- 5 - 10 L/s
- < 5 L/s

[Map showing water flow data June 2005]
Fen meadows in peat cuts: *Carex diandra, C. rostrata, Eriophorum angustifolium*, *Menyanthes trifoliata*

*Calthion*, sedge-grass

Degraded meadows, species-poor: *Festuca rubra, Cardaminopsis arenosa, Urtica dioica, Potentilla anserina, Antoxantum odoratum*

Restoration by top soil removal and hay transfer
Pilot restoration 0.25 ha

- Top soil removal: 20 or 40 cm
- Hay transfer (2:1)
- Influence of large animals

Soil seed bank

<table>
<thead>
<tr>
<th>Depth Layer</th>
<th>Seeds/m²</th>
</tr>
</thead>
<tbody>
<tr>
<td>5-10 cm</td>
<td>28,964</td>
</tr>
<tr>
<td>20-25 cm</td>
<td>6,659</td>
</tr>
<tr>
<td>40-45 cm</td>
<td>82</td>
</tr>
</tbody>
</table>

Sagina procumbens,
Plantago intermedia,
Cardaminopsis arenosa,
Capsella bursa-pastoris,
Urtica dioica
Cerastium holosteoides
Juncus articulatus,
- no effect of small ditch blocking
- **removal of NO$_3$ and P**
- no pH drop
- further degradation of the top layer
- Hay treatment influence the development of community
- community composition closer to local target
- many ruderal, pioneer species, taking advantage from bare soil spots in first years
- *Salix cinerea* seedlings
• 40 cm and transfer
• transfer helps, but not all species are targets!
• Hay collected at the time when a lot of perennial grasses set seeds – helps strong competitors and fast growing spec.
• estimated seed transfer cs. $12 \times 10^3$ (viable seeds) (transfer repeated 2005)
• transfer rate 55% of species of donor vegetation present (2006)
- Restoring hydrology is not feasible, improving is limited
- Top soil removal - deeper, large scale? does not guarantee a success, but combined with hay transfer helps
- The best solution: to restore species-rich wet meadows (*Calthion*) and preserve existing peat-cuts

- Facilitative function of hay (higher humidity in upper layer)
- Facilitation of large seed species
- Limitation of the fast growing, competitive seedlings in 40 cm removal due to water-saturation, flooded conditions in the spring
- Small-scale soil disturbances
Supervision and help:

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