Some calcareous grasslands plant species harbor higher reproductive performances in restored habitats compared to reference habitats

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Context
Global context

Biodiversity threats
Global context

- Changes in land use:
  - Habitats destruction
  - Fragmentation
- Response = Ecological restoration
- Restoration projects

Project cycle:
- Preparation
- Implementation
- Identification of goals
- Evaluation

Global context

• Goals of restoration projects and evaluation criteria are numerous
  – Species diversity
  – Vegetation structure
  – Ecosystem resilience
  – Ecosystem integration in the landscape
  – Sustainability of reproductive populations
Global context

→ Sustainability of reproductive populations

→ Successful restoration if populations are able to persist over the long term

Restored populations possess **attributes** necessary for:

• Reproduction
• Migration
• Growth
• Adaptive evolutionary changes

Indicators: Species performances
Objectives
Objectives

• To evaluate the success of restoration
• Population indicators
  – (Re)Colonization
  – Reproductive success
  – Final fitness
• Comparaison between reference and restored parcels
Methods
Focused habitat

Calcareous grasslands
Study area

Belgium

Viroin Valley
Study sites

The Viroin Valley
Study parcels

Legend
- Red: Reference
- Green: Recent restoration (>2000)
- White: Selected parcels
Study species

**Hippocrepis comosa**
Fabaceae

**Sanguisorba minor**
Rosaceae

**Potentilla neumanniana**
Rosaceae

Specialists and abundant
Recording method
Recording method

• Species recolonisation
  → occurrence (%)
Recording method

- **Species recolonisation**
  → occurrence (%)
### Recording method

- **Species recolonisation** → occurrence (%)

<table>
<thead>
<tr>
<th>Site</th>
<th>Parcel</th>
<th>Nb of plots (1m²)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Abannets</td>
<td>Reference</td>
<td>400</td>
</tr>
<tr>
<td></td>
<td>1990-2000</td>
<td>225</td>
</tr>
<tr>
<td></td>
<td>&gt;2000</td>
<td>504</td>
</tr>
<tr>
<td>Montagne-aux-buis</td>
<td>Reference</td>
<td>334</td>
</tr>
<tr>
<td></td>
<td>1990-2000</td>
<td>178</td>
</tr>
<tr>
<td></td>
<td>&gt;2000</td>
<td>208</td>
</tr>
<tr>
<td>Rivelottes</td>
<td>Reference</td>
<td>125</td>
</tr>
<tr>
<td></td>
<td>1990-2000</td>
<td>206</td>
</tr>
<tr>
<td></td>
<td>&gt;2000</td>
<td>123</td>
</tr>
</tbody>
</table>
Recording method

- **Species recolonisation** → occurrence (%)
- **Reproductive success**

Parcel
Recording method

- **Species recolonisation**
  → occurrence (%)

- **Reproductive success**
  
  20 plots randomly selected
  On 2 sites (6 parcels) / species
  One individual selected /plot
Recording method

- **Species recolonisation**
  → occurrence (%)

- **Reproductive success**
  20 plots randomly selected
  On 2 sites (6 parcels) / species
  One individual selected /plot
  → Number of flowers (or inflorescences) / indiv.
  → Number of seeds / fruit (or inflorescences)
Recording method

- **Species recolonisation**
  - occurrence (%)

- **Reproductive success**
  - 20 plots randomly selected
  - On 2 sites (6 parcels) / species
  - One individual selected / plot
  - Number of flowers (or inflorescences) / indiv.
  - Number of seeds / fruit (or inflorescences)

- **Final fitness**
  - Number of seeds / indiv.
Main results
Main results

- Species occurrence (%)

**Sanguisorba minor**

- Reference
- Old restoration (1990-2000)
- Recent restoration (2004-2006)

**Potentilla neumanniana**

- Reference
- Old restoration (1990-2000)
- Recent restoration (2004-2006)

**Hippocrepis comosa**

- Reference
- Old restoration (1990-2000)
- Recent restoration (2004-2006)

Legend:
- Abannets
- Montagne-aux-buis
- Rivelottes
Main results

• Reproductive success
  → Number of flowers/indiv

**Sanguisorba minor**

<table>
<thead>
<tr>
<th>Number of inflorescences/indiv</th>
<th>Reference</th>
<th>Old rest.</th>
<th>Recent rest.</th>
</tr>
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<tbody>
<tr>
<td></td>
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</table>

**Potentilla neumanniana**

<table>
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<tr>
<th>Number of flowers/indiv</th>
<th>Reference</th>
<th>Old rest.</th>
<th>Recent rest.</th>
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**Hippocrepis comosa**

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<th>Recent rest.</th>
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Main results

• Reproductive success
  → Number of seeds/fruit

**Sanguisorba minor**

<table>
<thead>
<tr>
<th>Reference</th>
<th>Old rest.</th>
<th>Recent rest.</th>
</tr>
</thead>
<tbody>
<tr>
<td>26</td>
<td>22</td>
<td>20</td>
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</table>

**Potentilla neumanniana**

<table>
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<th>Reference</th>
<th>Old rest.</th>
<th>Recent rest.</th>
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<tbody>
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<td>15</td>
<td>14</td>
<td>13</td>
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</tbody>
</table>

**Hippocrepis comosa**

<table>
<thead>
<tr>
<th>Reference</th>
<th>Old rest.</th>
<th>Recent rest.</th>
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</thead>
<tbody>
<tr>
<td>3</td>
<td>2.5</td>
<td>2</td>
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</tbody>
</table>

Key:
- Abannets
- Montagne-aux-buis
- Rivelottes
- All sites
Main results

• Final fitness

**Sanguisorba minor**

**Potentilla neumanniana**

**Hippocrepis comosa**

<table>
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<th>Montagne-aux-buis</th>
<th>Rivelottes</th>
<th>All sites</th>
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<td>Recent rest.</td>
<td></td>
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Discussion

• Restoration success:

→ (Re)colonisation success

– Colonisation of restored parcels

– Species occurrence reference >> restoration

*S. minor and P. neumanniana*  

<table>
<thead>
<tr>
<th></th>
<th><em>H. comosa</em></th>
</tr>
</thead>
<tbody>
<tr>
<td>- Soil seed bank</td>
<td>- Soil seed bank</td>
</tr>
<tr>
<td>- Dispersion by wind</td>
<td>- Dispersion by wind</td>
</tr>
<tr>
<td>- Dispersion by sheep and goats</td>
<td>- Dispersion by goats</td>
</tr>
</tbody>
</table>

NB : Study species = abundant
Discussion

• Restoration success:

→ Reproductive success and fitness

– Flowers and seeds production in recently restored grasslands >>>> reference

→ Hopefull concerning species persistence as higher fitness populations dynamic extinction risks

– Seeds/fruit : no clear differences

→ No lack of pollination
Conclusion
Conclusion

• Recently restored populations:
  – play an important role in supporting species persistence in fragmented grasslands
  – have a favorable effect on the dynamic of species evolving in manmade landscape

• Species occurrence: Reference >> Restoration
• Reproductive performance: Reference << Restoration

→ Importance of considering more than one attribute when evaluating restoration success
Thank you for your attention