Short-term effects of white-tailed deer density reduction on insect communities

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Problematic

• Impacts of overabundant cervid populations
  • Modification of plant communities (Rooney et Waller 2003)
  • Can be detrimental to forest regeneration (Watson 1983, Tremblay et al. 2007)
  • Can have indirect effects on birds, small mammals and arthropods
Problematic

• About insects (and other arthropods)

  • Carabidae and spiders are the most studied

    • Web-spiders are negatively affect by high browsing (Miyashita et al. 2004, Baines et al. 1994)

    • Ground spiders are positively affected (Takada et al. 2008, Dennis et al. 2001)

    • Results are sometime contradictory for Carabidae (Melis et al. 2007, Gardner et al. 1997)
      • But they seem positively affected by high browsing
Other studied taxa

- *Hemiptera* (Morris 1973)
- *Curculionidae* (Suominen et al. 2003)
- *Lepidoptera* (Kruess et Tscharntke 2002)
- Bees and solitary wasps (Kruess et Tscharntke 2002)

In general:

- Taxa directly associated with plants are negatively affected by high browsing pressure
- Ground taxa are positively affected
Goal

To evaluate the short-term impact of deer density reduction on insects

1 – Carabidae
2 – Apoidea
3 – Syrphidae
4 – Macro Lepidoptera
Goal

**Carabidae** (Coleoptera)

- Epigeal predators (most of them)
- Often studied in relation to cervid browsing
  

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**Macro Lepidoptera**

- Herbivore at larval stade
- Often mono- or oligophagous
**Goal**

*Apoidea* (Hymenoptera)
- Most important pollinators
- Nesting (social or solitary)

*Syrphidae* (Diptera)
- Pollinators when adult
- Predators or saprophagous at larval stage
Goal

- "Gradient" of relationship with plants

Relationship with plants:

- Herbivores (Lepidoptera)
- Strict Pollinators (Apoidea)
- Non strict Pollinators (Syrphidae)
- Epigeal predators (Carabidae)
Study site

- Harvested (≈70%) in 2001
- Forest

- 0 deer/km² (10 ha)
- 7.5 deer/km² (3 deer in 40 ha)
- 15 deer/km² (3 deer in 20 ha)
- Uncontrolled density: >20 deer/km²
Materials and methods

- Pollinators sampling
  - Malaise trap
    - 1 per experimental unit
    - In harvested area: ~50 m from forest edge


Materials and methods

- Moths sampling
  - Luminoc traps
    - At 3 m above ground
    - 4 per experimental unit
    - 2 in harvested area
    - 2 in forested area

- Carabidae sampling
  - Pit-fall traps
Pollinators: results

• Apoidea
  • 1308 specimens
  • 35 species

• Syrphidae
  • 7481 specimens
  • 112 species
Apoidea: results

- Communities are separated in function of:
  - Block A vs. B and C
  - Uncontrolled densities vs. Reduced densities
RDA for Syrphidae

![Graph showing ordination analysis with species as Dryopteris disjuncta, Coptis groenlandica, and Melanostoma mellinum. The graph is labeled as RDA1 (λ = 0.12) on the y-axis and RDA1 (λ = 0.21) on the x-axis. Points represent different species with circles and squares indicating specific groups.]

• High similarity between communities at high densities
  • Diversification of communities at reduced densities

• Syrphid communities are strongly dominated by few species at high densities
  • As *M. mellinum* and *P. angustatus*
Macro Lepidoptera
Lepidoptera: results

- Macro Lepidoptera
  - 1505 specimens
  - 108 species
RDA for Lepidoptera in harvested areas

RDA1 (λ = 0.18)

Abies balsamea
Rubus idaeus
Rubus pubescens

RDA1 (λ = 0.15)
Lepidoptera: results

- Uncontrolled densities clearly separated from reduced densities

- Diversification of communities at reduced densities
Carabidae: results

- Carabidae
  - 1878 specimens
  - 30 species

- No significant RDA obtained
Cumulative abundance of all rare species of a taxon in each deer density and in harvested areas

<table>
<thead>
<tr>
<th>Taxon</th>
<th>Deer density</th>
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<tbody>
<tr>
<td></td>
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<td>Apoidea</td>
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<tr>
<td>Carabidae</td>
<td>10</td>
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<tr>
<td>Lepidoptera</td>
<td>43&lt;sup&gt;a&lt;/sup&gt;</td>
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<tr>
<td>Syrphidae</td>
<td>124</td>
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</tbody>
</table>
Conclusion
Conclusion

• The strength of the impact of deer density reduction on insects is a function of their degree of relationship with plants
  
  • No impact is observed for Carabidae while strong impacts are noticed for macro Lepidoptera
  
  • Fast return of rare Lepidoptera species

• Deer density reduction at 15 cerfs/km² is enough to permit a higher diversification of insect communities
  
  • The block effect is stronger at reduced deer densities
  
  • Increase in the number of ecological niche
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Questions ?