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UNGULATES INCREASE FOREST PLANT SPECIES RICHNESS… TO THE BENEFIT OF NON-FOREST SPECIALISTS

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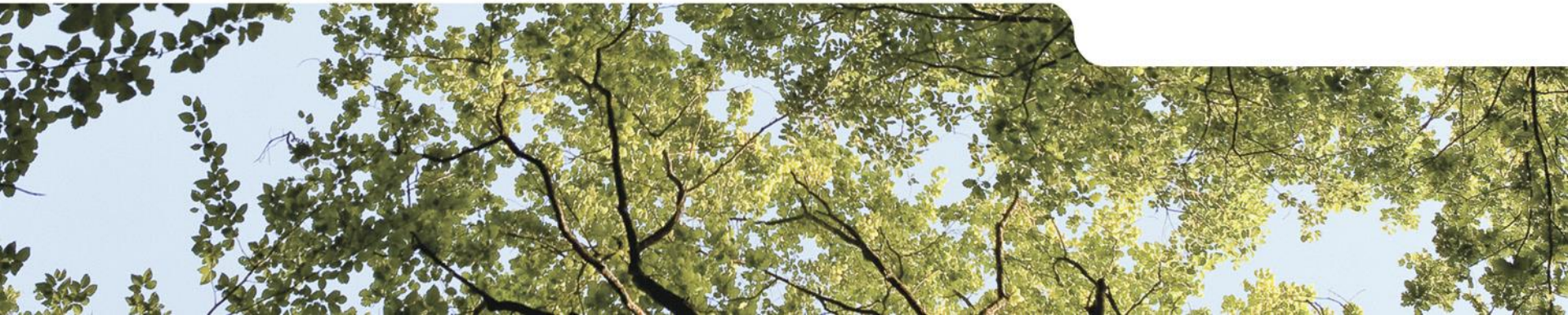


MONITORING ECOSYSTEM RESPONSES TO *VARIOUS* DRIVERS OF CHANGE

What are the drivers of changes ?

Some are global and diffuse : climate, pollution

Some other ones are local : forest stand management (logging, ageing), wild large mammal population dynamics

What are the ecosystem response variables ?

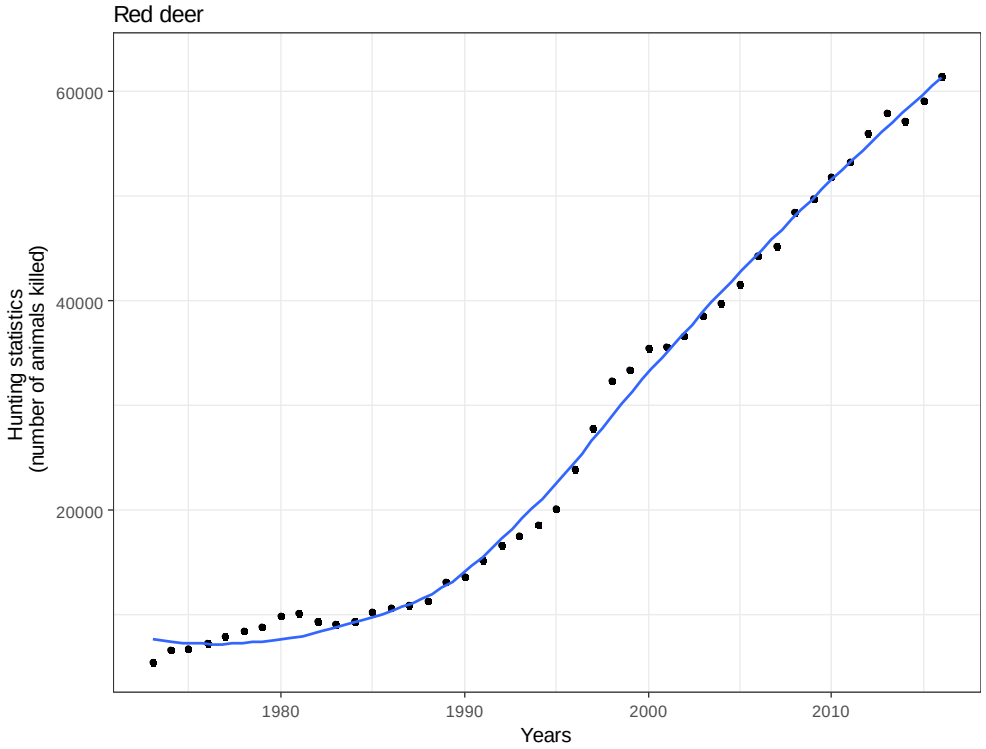
Tree/stand responses: growth, health, nutrition…

Soil properties

Biodiversity dynamics

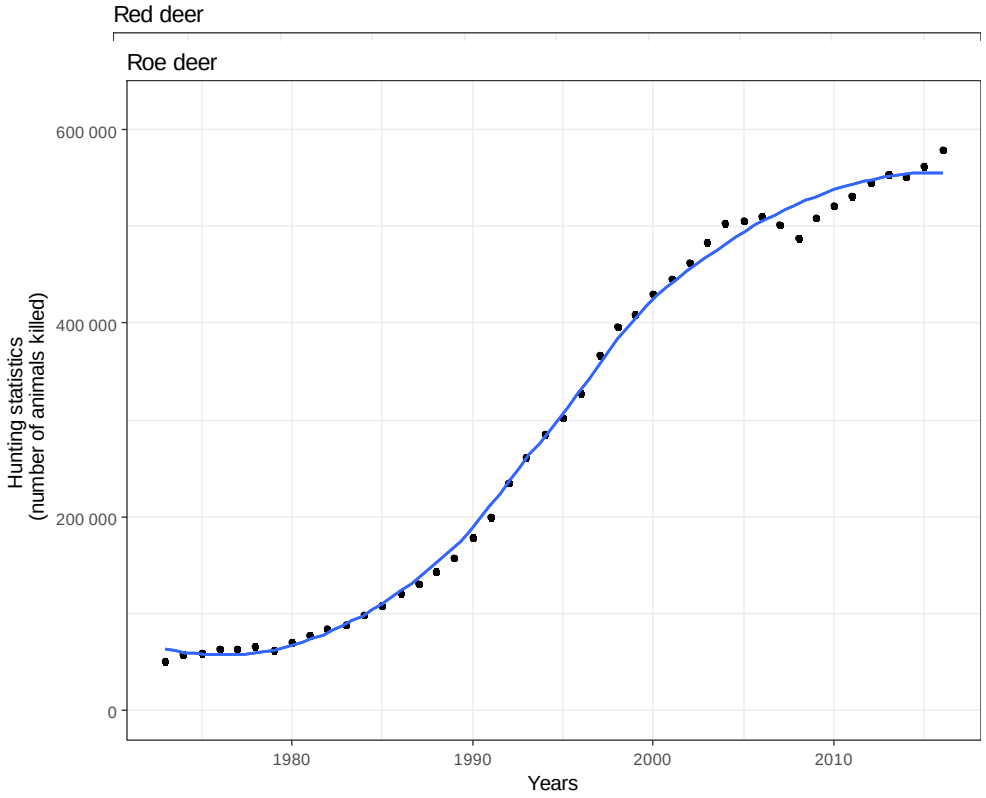
→ vegetation, as primary producers, is a relevant indicator of environmental changes

DEER-FOREST INTERACTIONS



- In France : a spectacular increase in populations
- So as in most of the countries in the Northern hemisphere

DEER-FOREST INTERACTIONS



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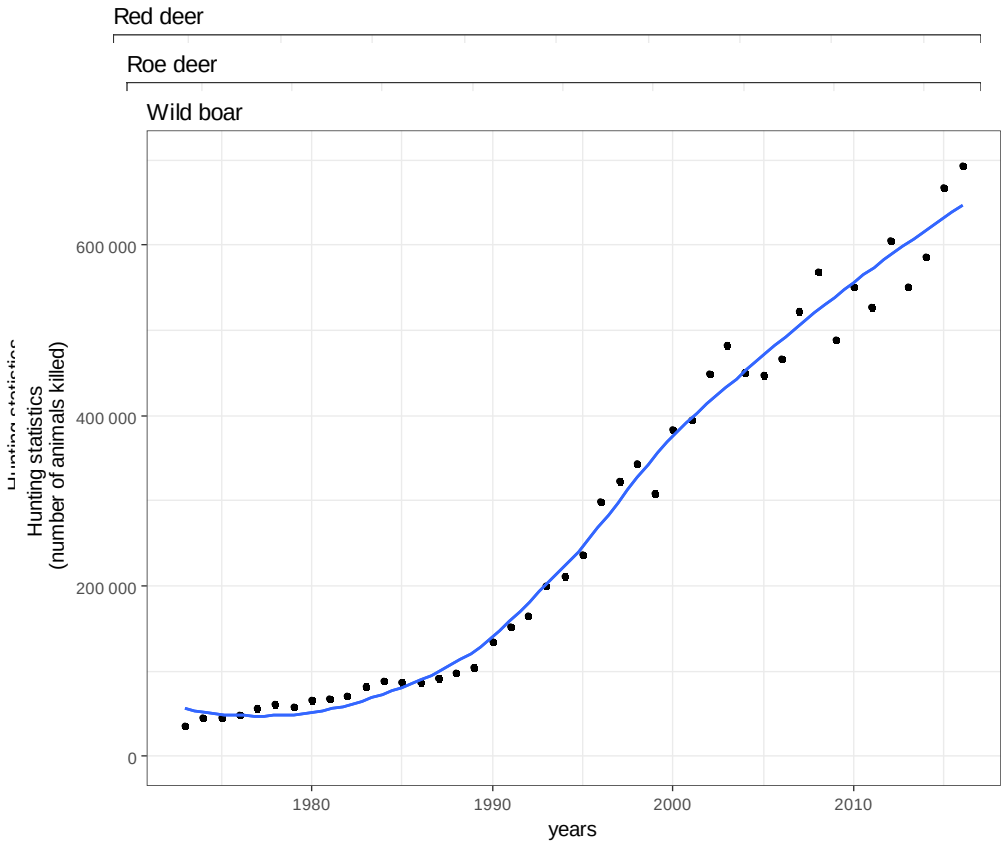
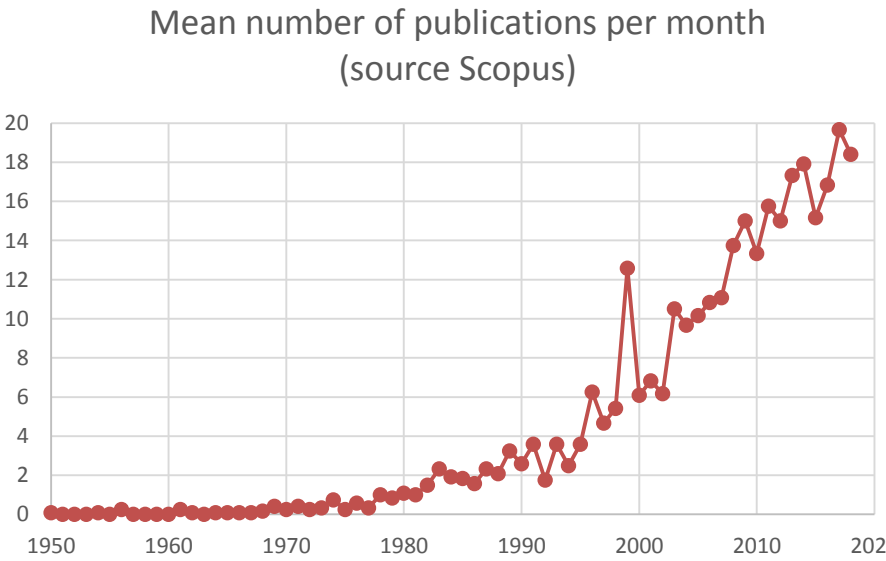


- A growing interest in science

- In France : a spectacular increase in populations
- So as in most of the countries in the Northern hemisphere



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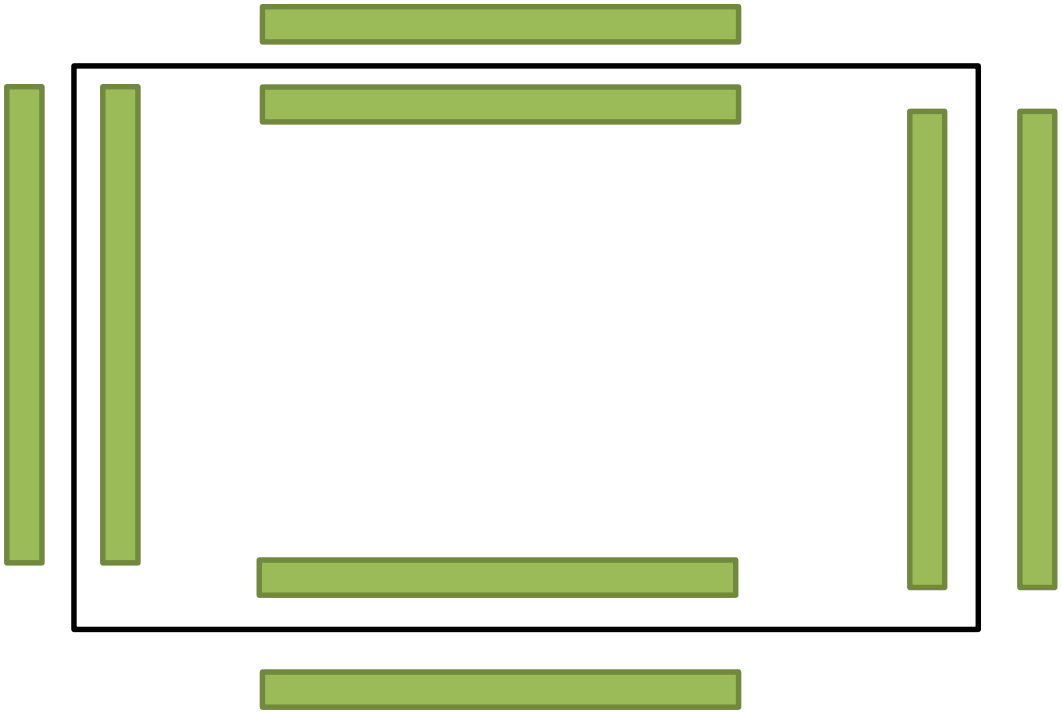
INCREASING EVIDENCES ABOUT DEER IMPACTS ON FOREST ECOSYSTEMS

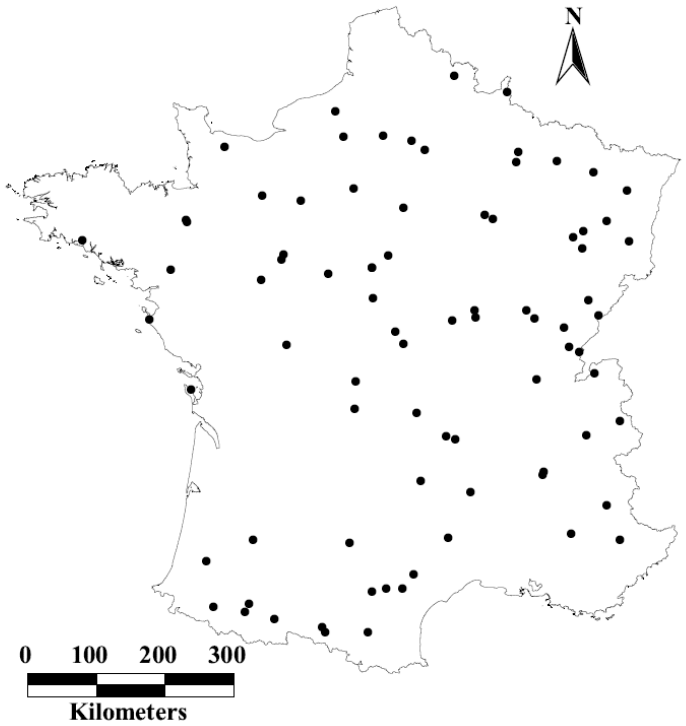
- Effects on trees and stands:
  - Browsing on twigs and bark stripping: increase stem mortality, decrease growth and alter the shape of the trees.
  - Can induce changes in stand composition: less prefered species are favoured, to the detriment of more palatable ones.
  - → A major concern for forest managers
- And more broadly on forest biodiversity
  - Direct and indirect effects on vegetation composition (browsing, dispersal, soil trampling) then on insects, birds…
  - But most studies focused on contexts of over-abundance.
- How do ungulates determine vegetation composition and dynamics in normally managed forest plots ?

FENCING EXPERIMENT IN A MONITORING PROGRAM



8 subplots : 50m x 2m

- 4 inside
- 4 outiside



82 plots analysed / 102

20 excluded :

17 plots impacted by 1999 storms

3 with domestic cattle or pigs

VEGETATION SURVEY METHOD

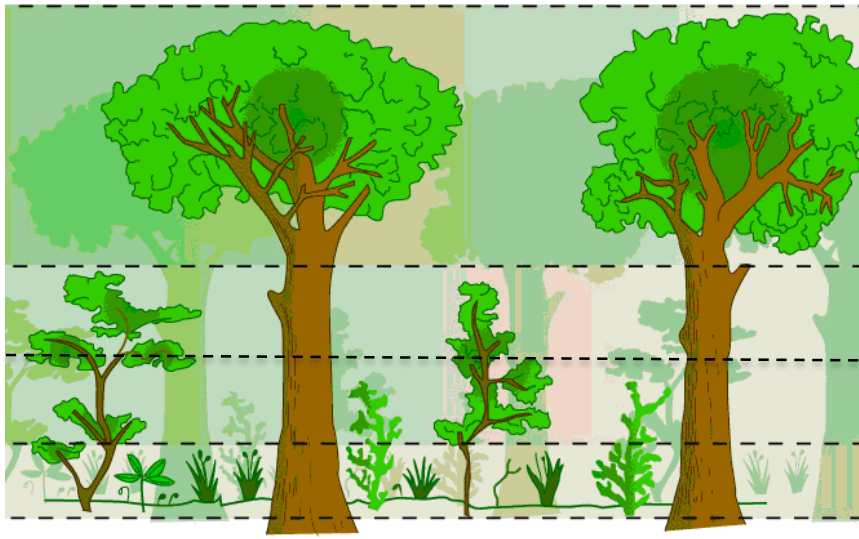
- Surveys in 1995, 2000 then 2005
- Repeated in spring and summer
  - Experienced botanists
  - Following a training program
- Species abundance record

Tree layer : woody species h > 7m

High shrub layer : woody species 2m< h < 7m

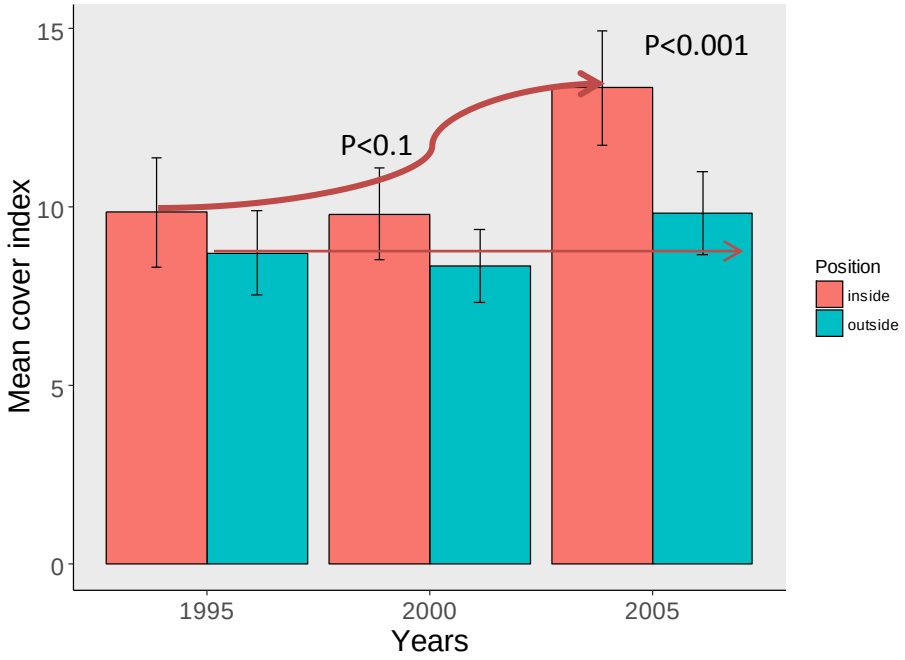
Low shrub layer : woody species 0,5m< h < 2m

Herbaceous layer : all species h < 0,5m

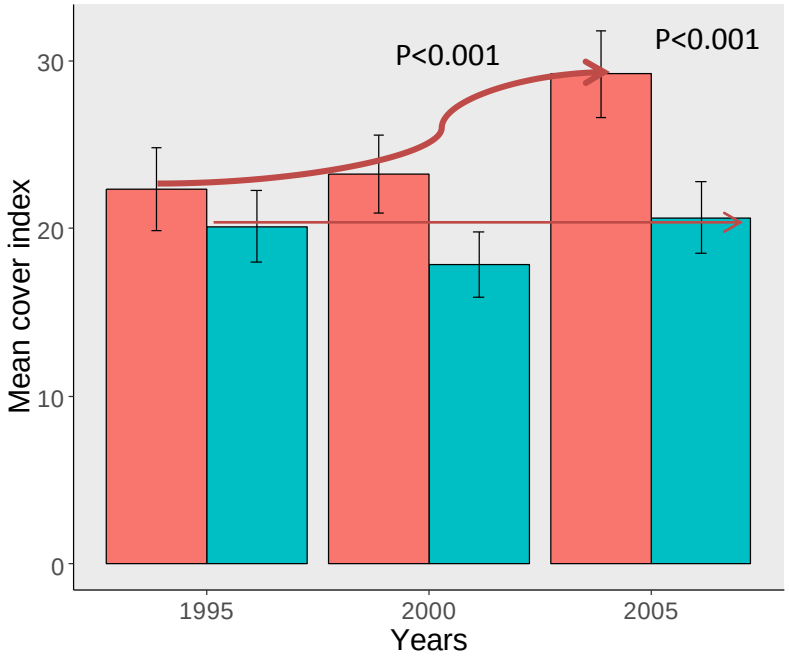


SHRUBS:
CHANGES IN OVERALL VEGETATION COVER

High shrub layer



Low shrub layer

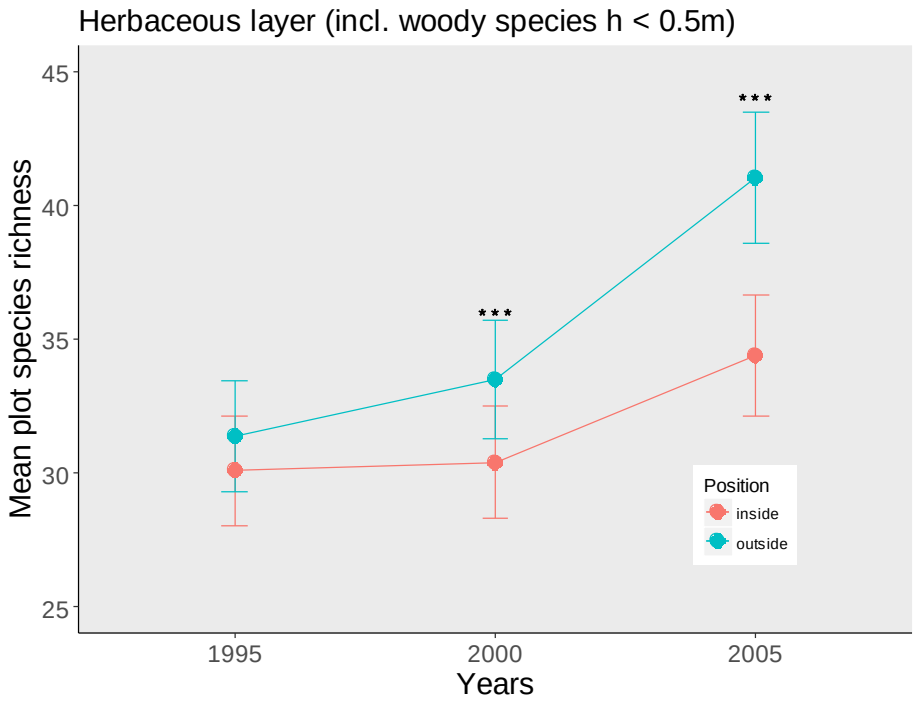


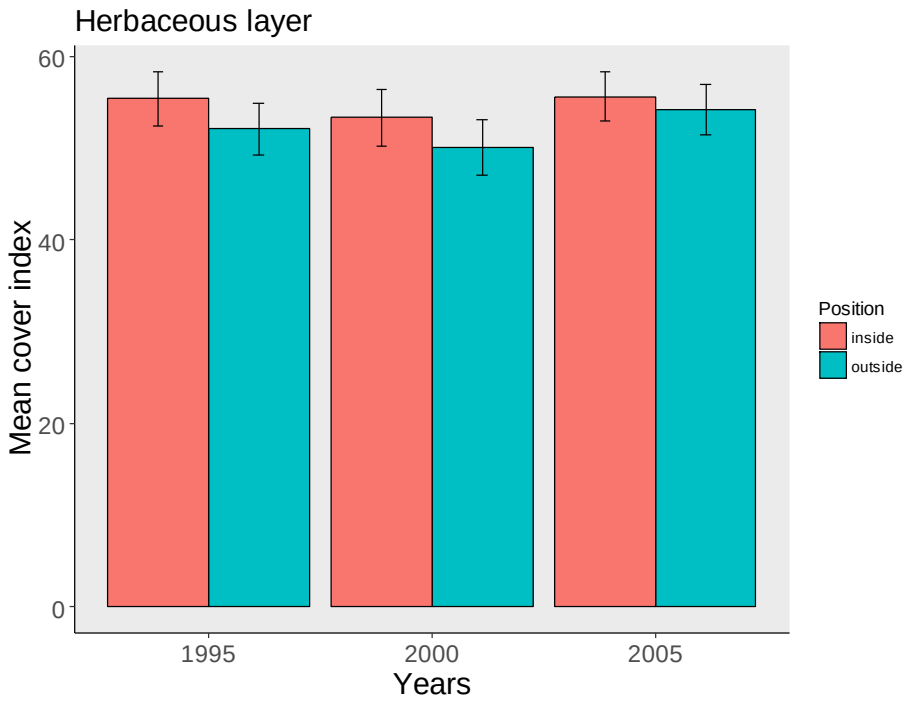
- Increasing cover of shrub layers inside exclosures
- Stable cover outside
- → Effect of browsing suppression

SHRUBS:
CHANGES IN SPECIES RICHNESS

- A global increase in species richness: training effect
- Higher increase in species richness *inside* exclosures
  - Less mortality and increasing recruitment when excluding deer

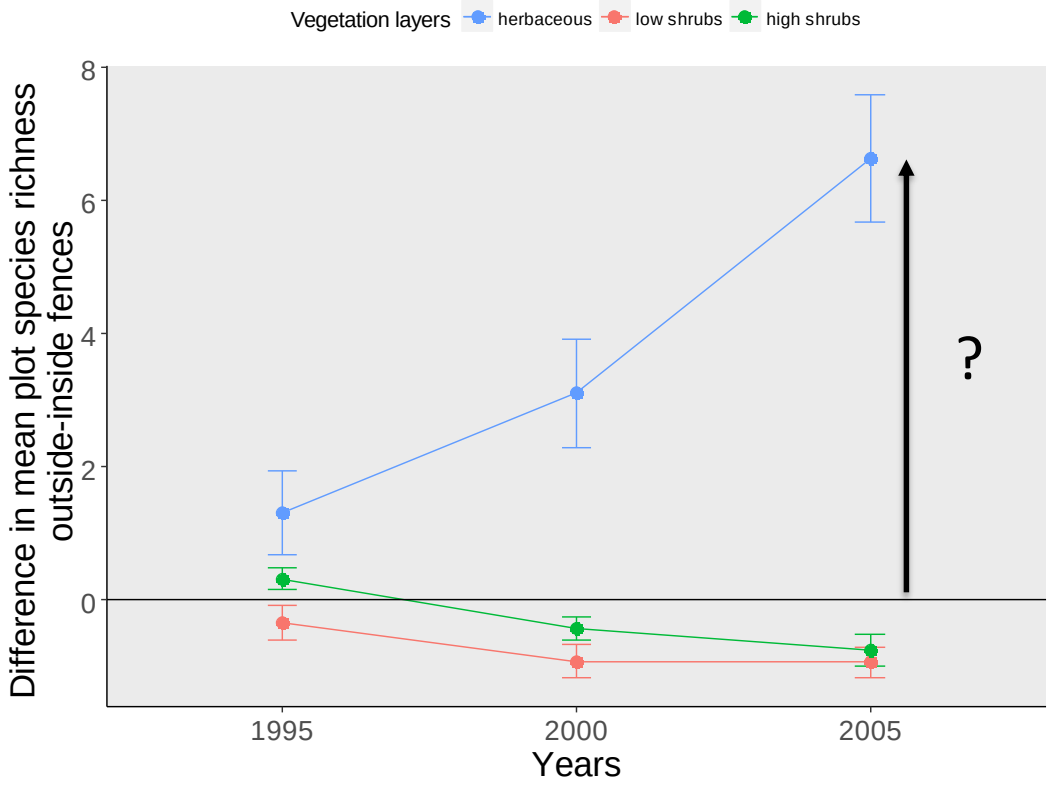
RESPONSE OF HERBACEOUS LAYER





- A global increase in species richness: training effect
- Higher increase in species richness *outside* exclosures
  - Wild ungulates increase species richness of the herbaceous layer

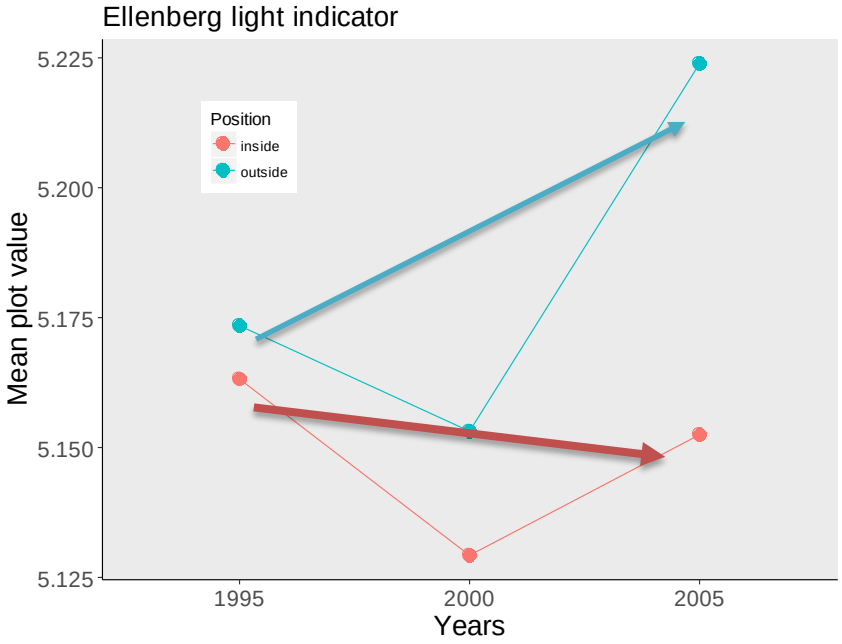
SYNTHESIS: DIFFERENCE OUTSIDE-INSIDE



- Ungulates :
  - Limit and alter shrub layers
  - Enchance richness of herbaceous layer
- Exclosure experiment :
  - A strong short term response of vegetation structure and composition

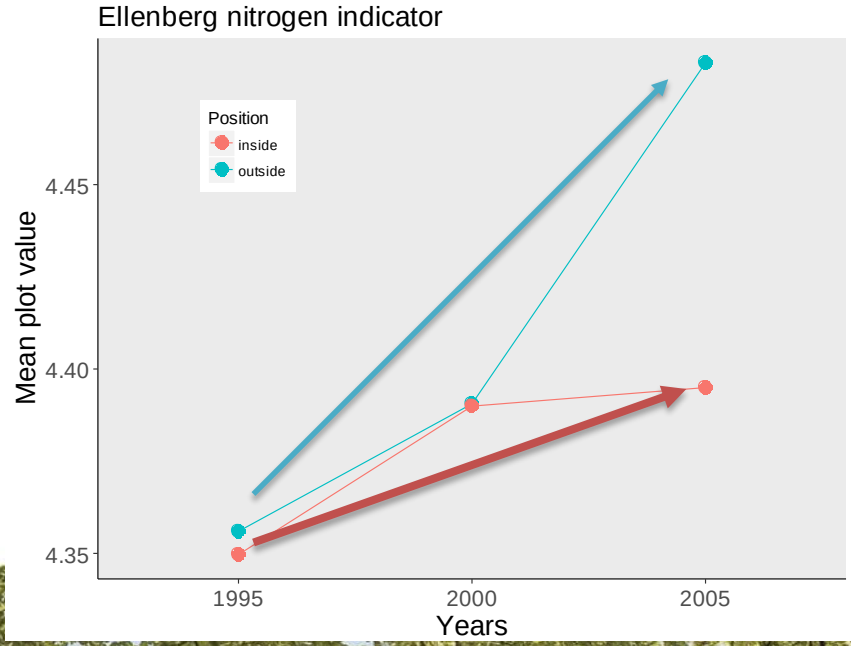
What were the changes in community composition ?
Which species benefited from ungulates ?

ELLENBERG ECOLOGICAL INDICATORS

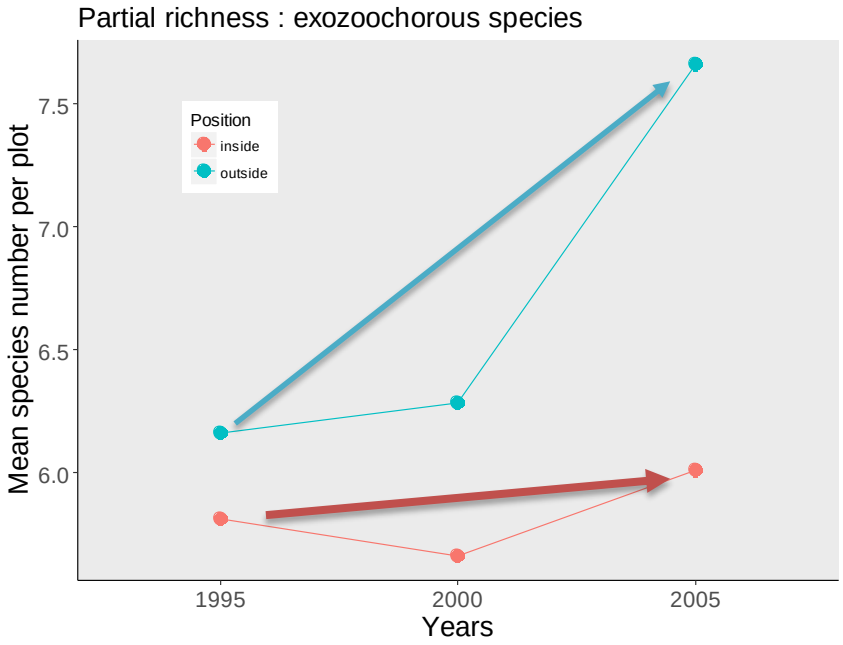


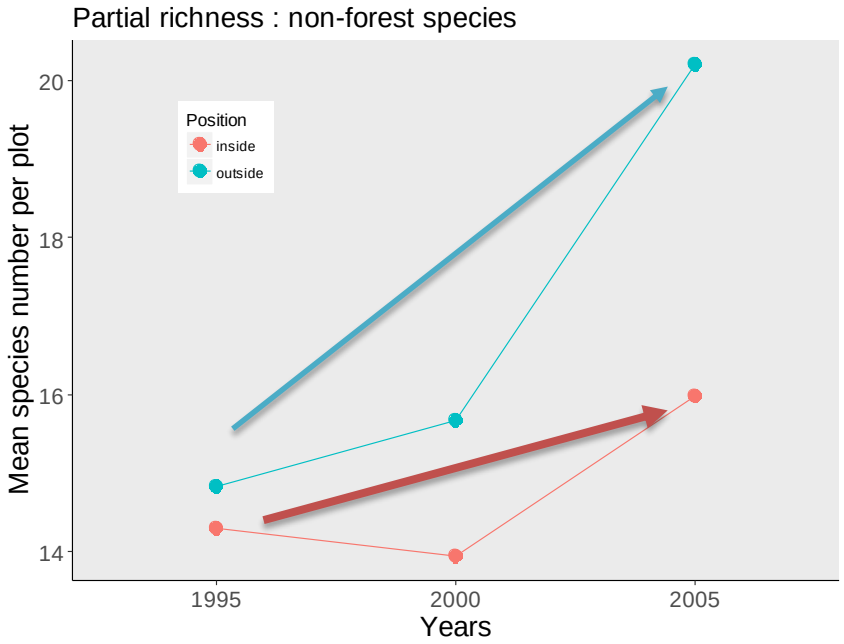
- More light demanding species outside

- Higher increase in nitrogen indicator



RICHNESS OF SPECIFIC GROUPS





- In average:
  - + 1,5 exozoochorous species outside (→ dispersal by ungulates)
  - + 5 non-forest specialist species
- Take home message:
  - Ungulates favour light demanding, nitrophilous and non-forest species within the herbaceous layer

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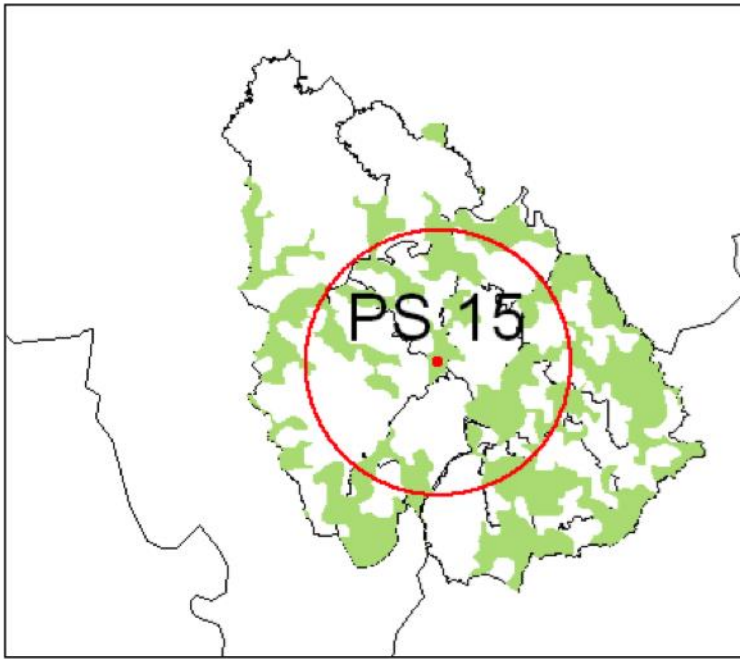
BEYOND EXCLOSURE EXPERIMENT: A GRADIENT OF UNGULATE SPECIES ABUNDANCE

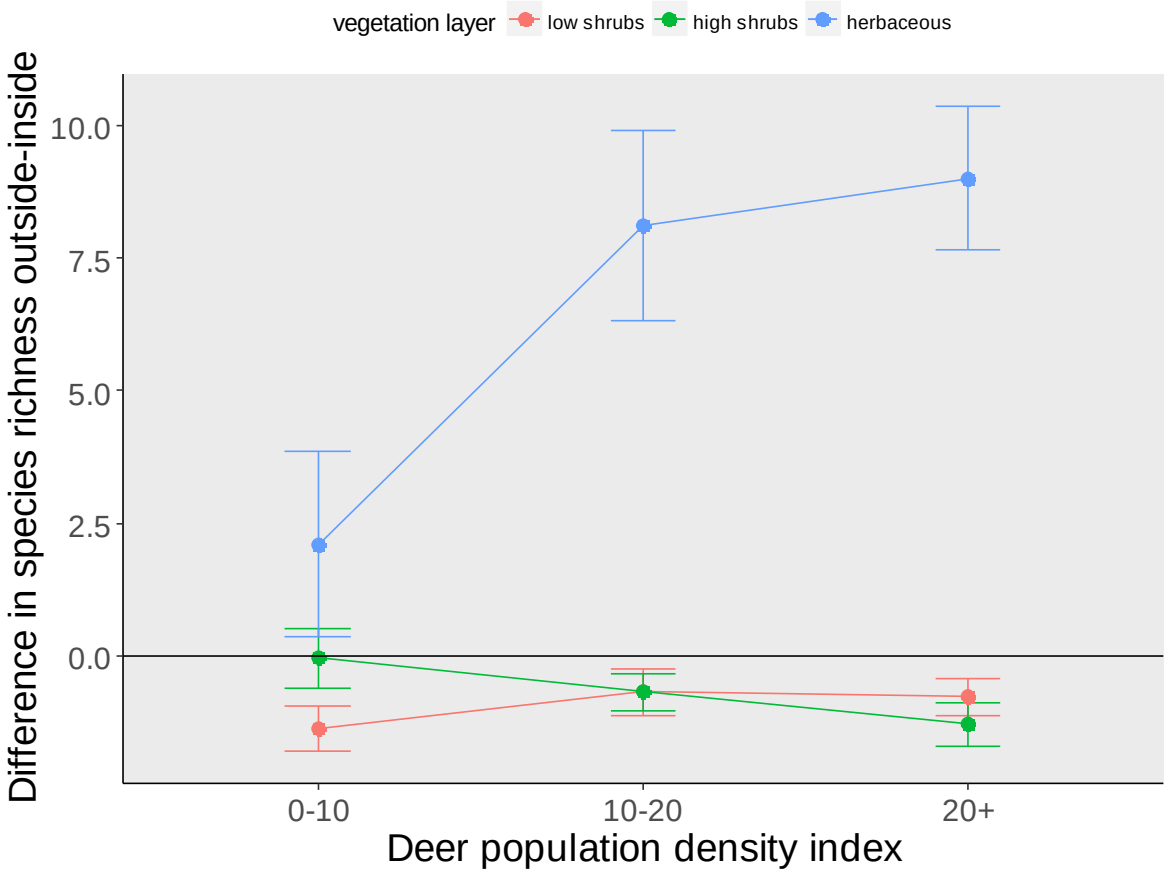
- Hunting bag statistics:
  - Wild boar: yearly, municipality scale
  - Roe deer: 3-year, municipality scale
  - Red deer: 5-year, management unit
- Collected in a buffer (6km radius)
  - Ratio killed animals/forested area
  - Transformed in Basal Metabolic Rate
- Coarse indirect indicator for ungulate population abundance
  - But homogeneous data available all over the network



Source: ONCFS

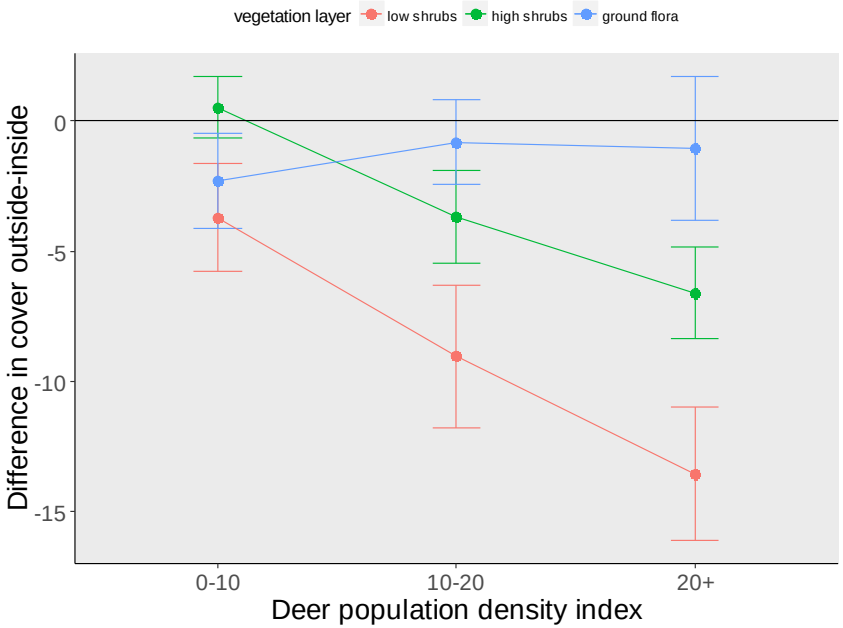
ONGULÉS SAUVAGES le réseau

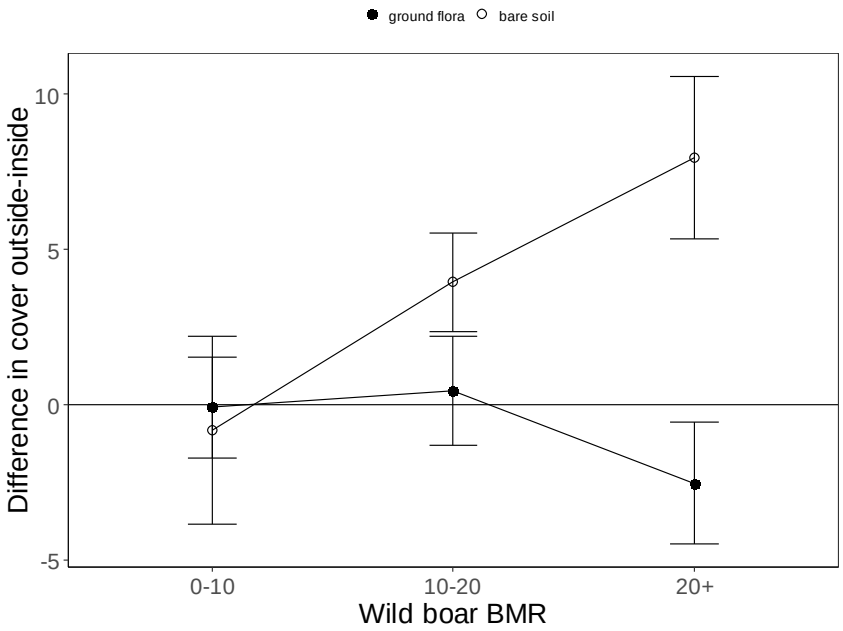
IN 2005: CORRELATIONS WITH SPECIES RICHNESS



- Magnitude of the differences in species after 10 years of fencing
  - Weak correlations with deer abundance for shrub layers
  - Strong and positive correlation for the herbaceous layer

IN 2005: CORRELATIONS WITH VEGETATION COVER





- Difference in shrub layer cover increases with deer abundance
- Wild boar abundance increases the proportion of bare soil but doesn’t impact herbaceous richness or abundance.

TAKE HOME MESSAGES

VEGETATION MONITORING

- Inside/outside comparison is the major contrast that appears after 10 years of vegetation monitoring
- A global increase in species richness probably due to a training effect within botanists
  - Coupled comparison inside/outside overcome this trend.

UNGULATES IN FOREST

- Identification of general effects across a wide variety of forest ecosystems
- Impacts on shrub abundance and richness (browsing effect)
  - Due to (red and roe) deer
  - Reverberates on herbaceous layer → more light demanding species
- Favour non-forest species
  - Increase the colonization rate of species coming from neighbouring communities
  - Consequence of dispersal processes (deer and wild boar) and increased disturbances (wild boar)

Received: 14 March 2017 | Accepted: 16 August 2017

DOI: 10.1111/gcb.13899

PRIMARY RESEARCH ARTICLE

WILEY Global Change Biology

Ungulates increase forest plant species richness to the benefit of non-forest specialists

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