

Modeling the reduction in sapling growth, density and diversity along a gradient of wild ungulate density

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(1 : Uliège ; 2 : DEMNA)

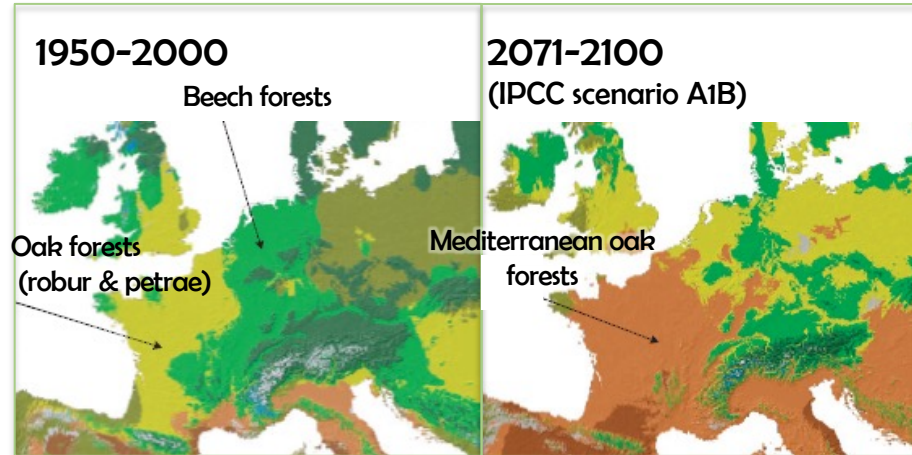
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New challenges for forest management

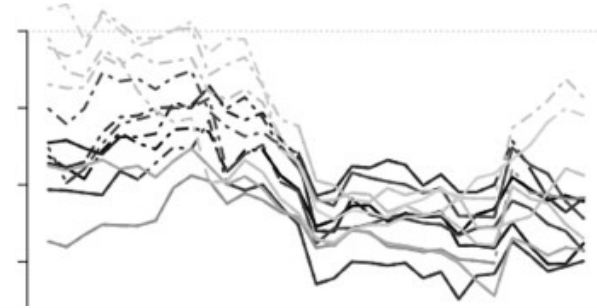
Predicted changes
(less than a tree lifetime)

Potential ranges

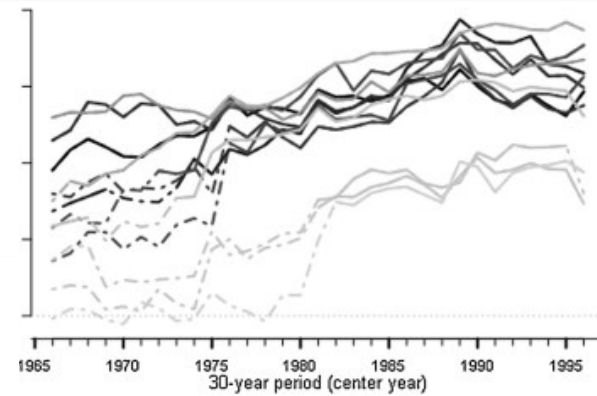


Hanewinkel et al. (2013)

Recent response of beech,



Annual tree rings



Sensitivity to hydric stress

STA FLO ENG TER LES TIH HES POR REC MAR SAI ROC
67m.....increasing altitude.....590m

Source : Latte N et al. (2015)



Effect of heat and drought on
walloon forests (august 2018)

Strategies to maintain ecosystem services :

Anticipate threats :

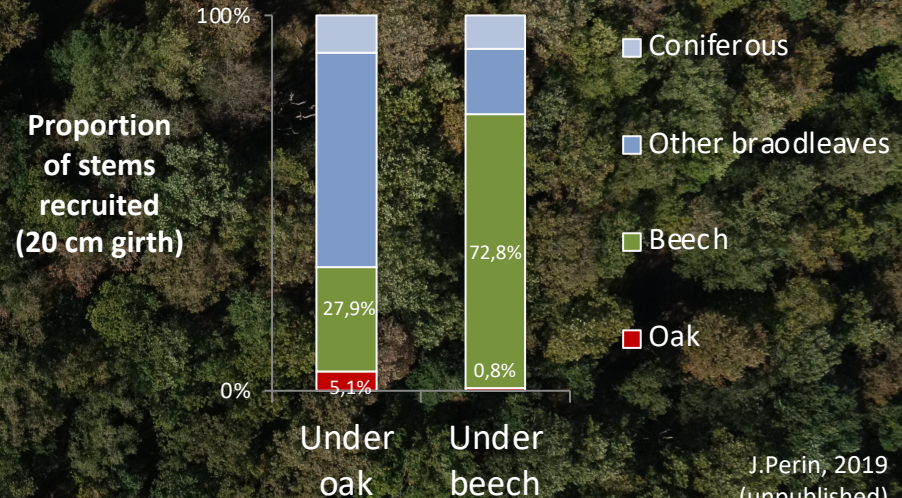
- Species adapted to local conditions
- Species diversity
- Use of natural regeneration

Mitigate risks

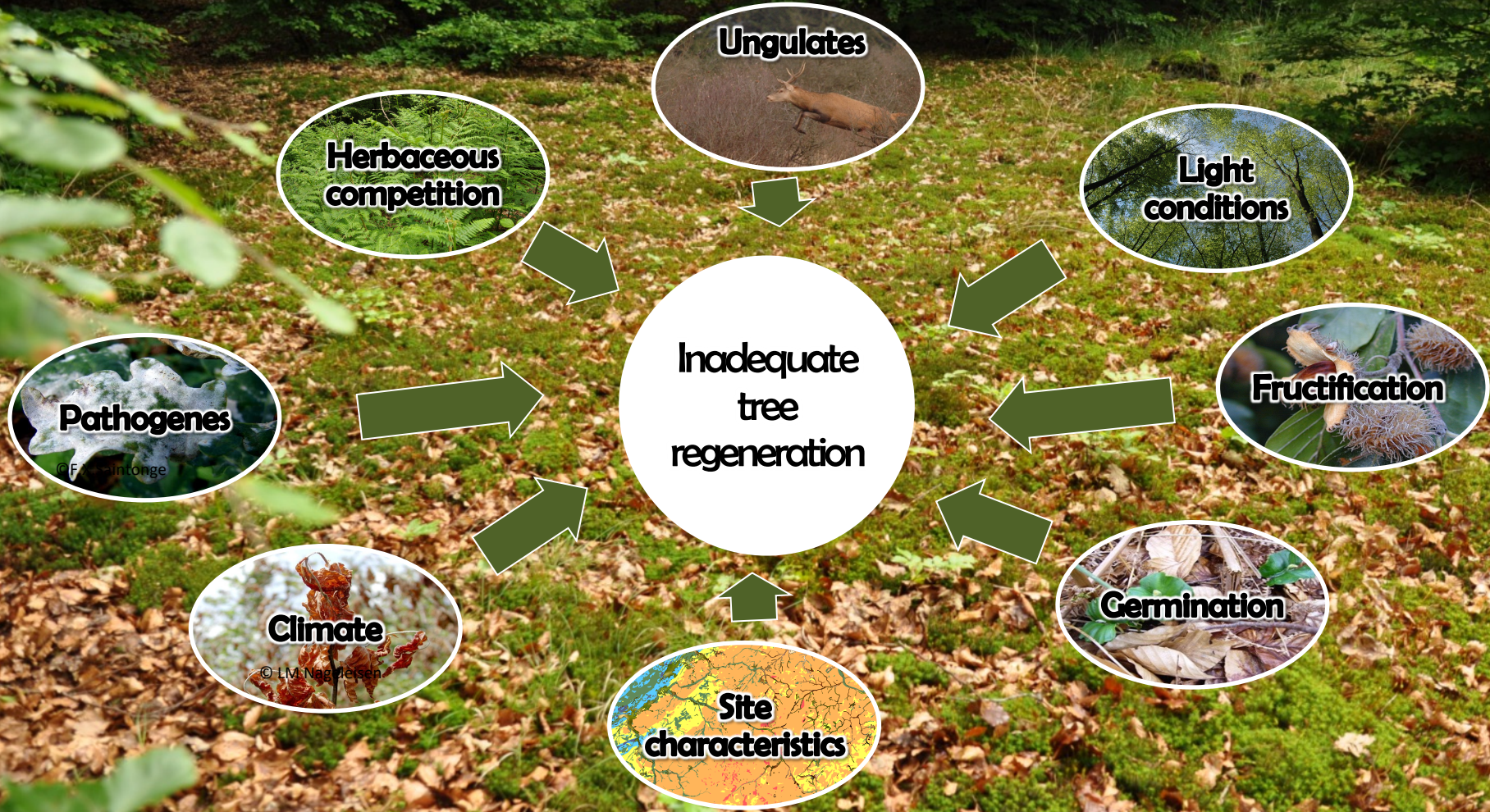
Positive interactions

First priority in forestry code of Wallonia (art. 1) . . .

. . . Difficult to meet in the regeneration



© Forest is life



Ungulates



Light conditions



Fructification



Germination



Site characteristics



Climate



Pathogenes



Herbaceous competition



Ungulates has potentially
undesirable effects on the
regeneration



Reduction of growth and quality,
tree species substitution.

Long-lasting consequences

Ungulates impact on the regeneration : a recurring issue



© SPW, DEMNA

Ungulates has become a determinant issue

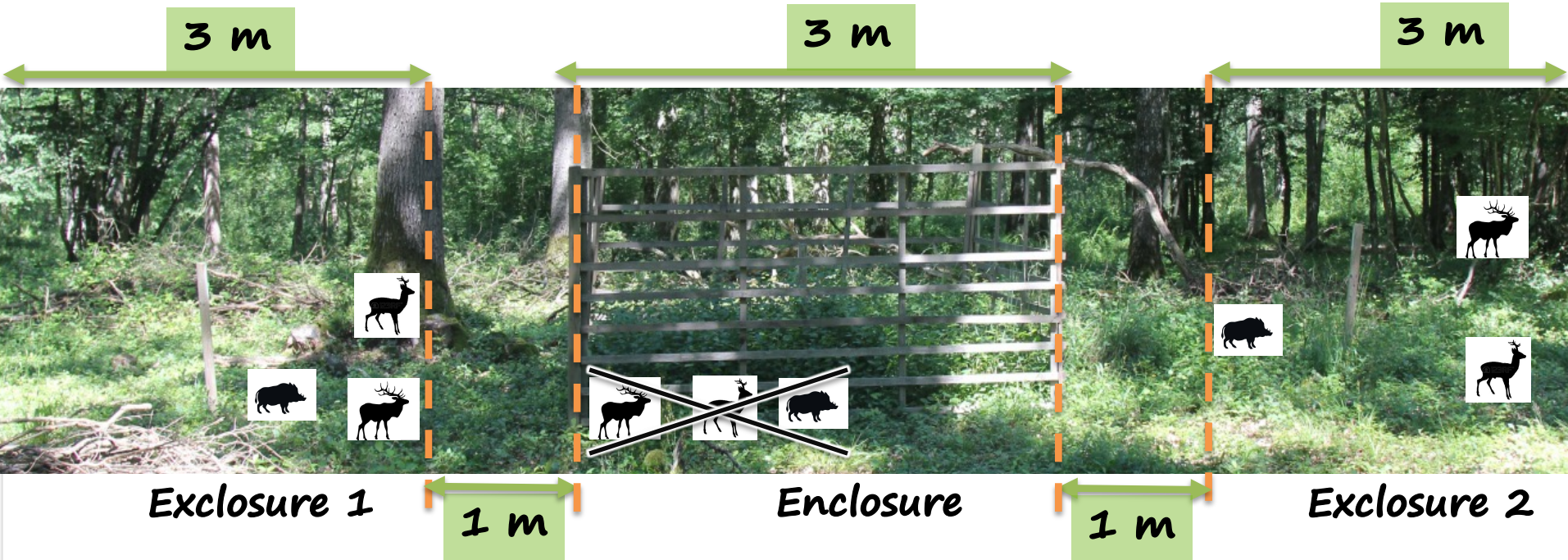
Aim of the study

Characterisation of the ungulate impact on the forest regeneration in Wallonia (in varying ungulate abundances)

- Are ungulates a determinant factor for the forest regeneration?
- Does ungulates modify species composition of the forests?
- (What is the relation between ungulate abundance and regeneration succes?)

Material

An enclosure – exclosure experiment.
One Sampling Unit (UE) = 3 sub units (SUE).



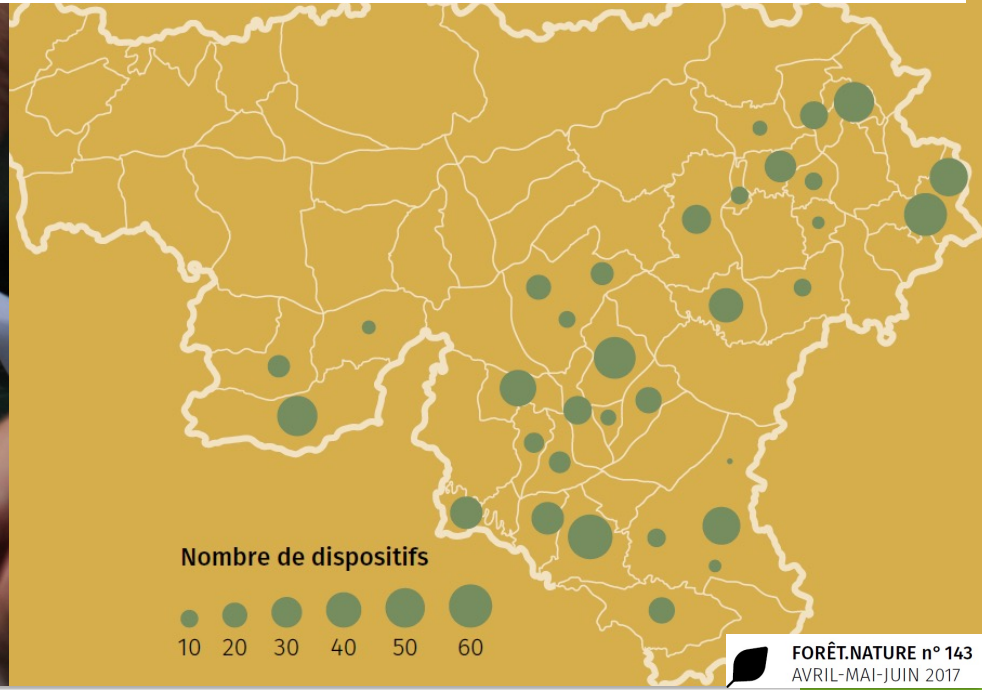
970 EE in varying ungulate abundance

3 000 km² of forest

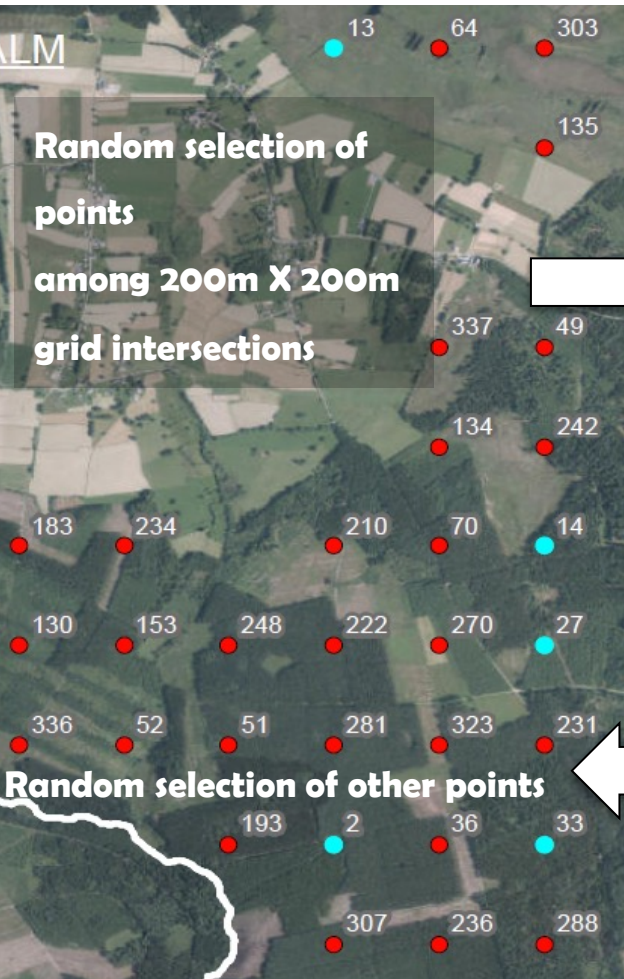
At least 1,5 red deer harvested / km² of forest in the management area (in 2013)

At least 0,6 Enclosures-Exclosures / km²

Mainly in broadleaves forest gaps (indigenous species)



Installation of the EN-EX network



Yearly survey by forest officers and trained volunteers

Measured variables :

- Height of highest seedlings
- Number of seedlings / species
- Cover (herbaceous and ligneous ; shrub species ; bryophytes)



Early results

2016 : installation and first measures
970 U.E.



2017 : 1st growth year



2018 : 2nd growth year
877 U.E.

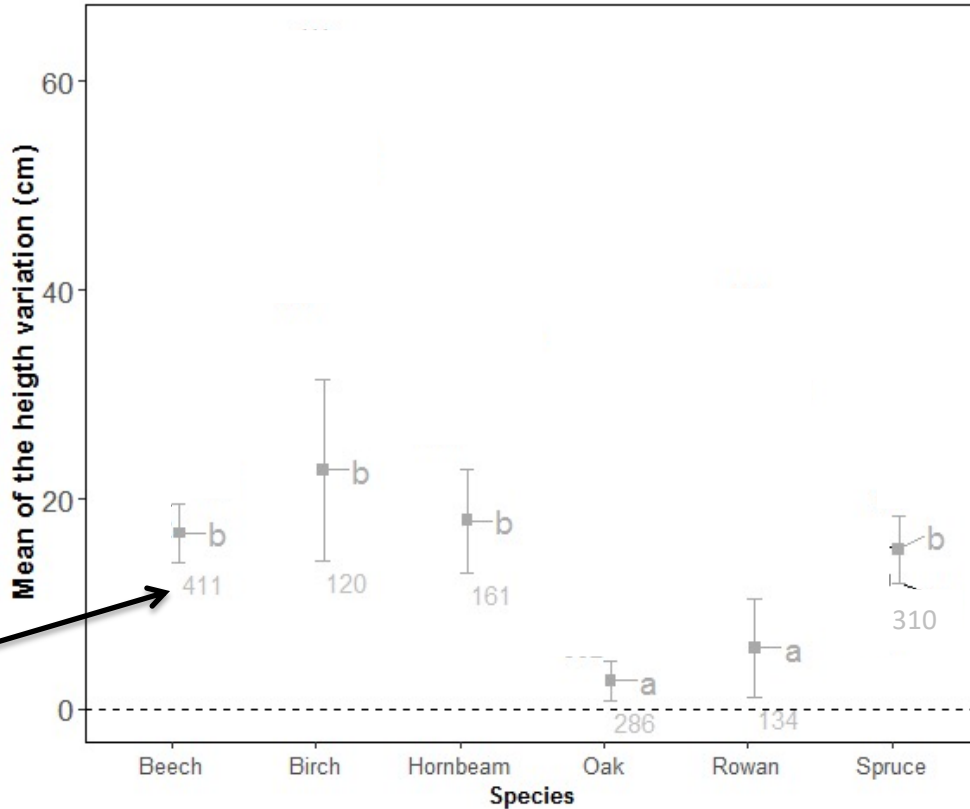


(2019 : 3rd growth year, in a limited area
due to a.s.f.)

Changes in the height of seedlings

Species comparison
(inside SUE type):
Anova and Kurskall -
Wallis and poshoc
test: No common
letters means
significant differences

Total : 877 U.E.



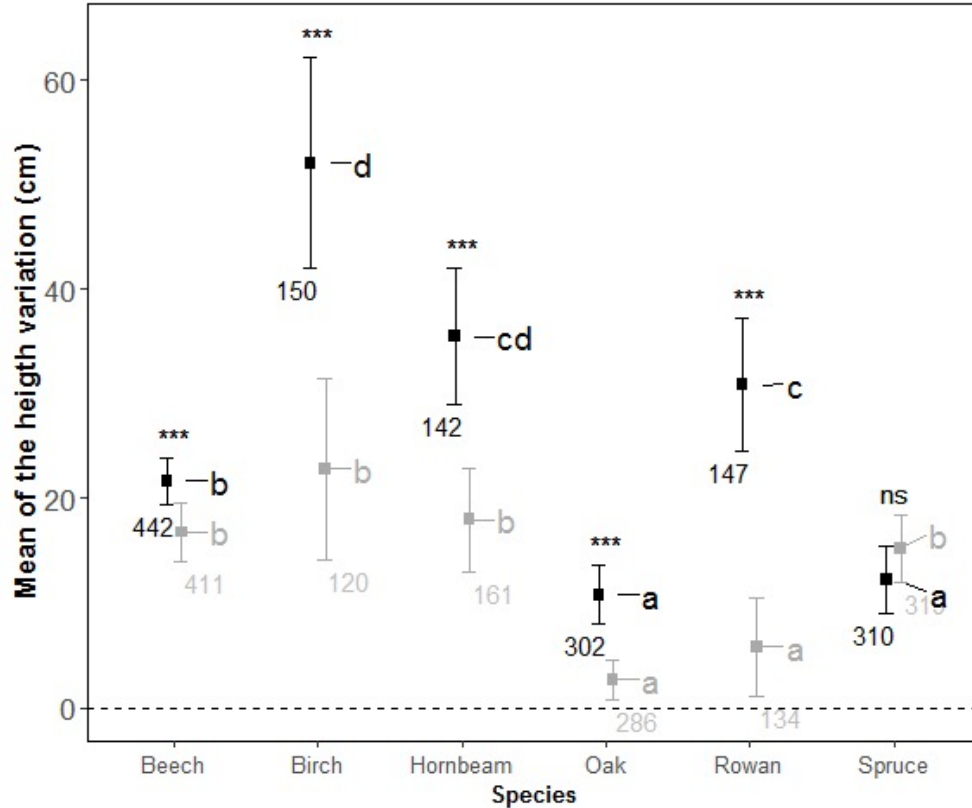
Nr. of UE with presence of the species

Changes in the height of seedlings

Species comparison
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EN VS EX :
student t.test of
the differences for
one specie

ns : not significant
* : p value < 0,05
** : p value < 0,01
*** : p value < 0,001



Total : 877 U.E.

sue
 enclos
 exclos

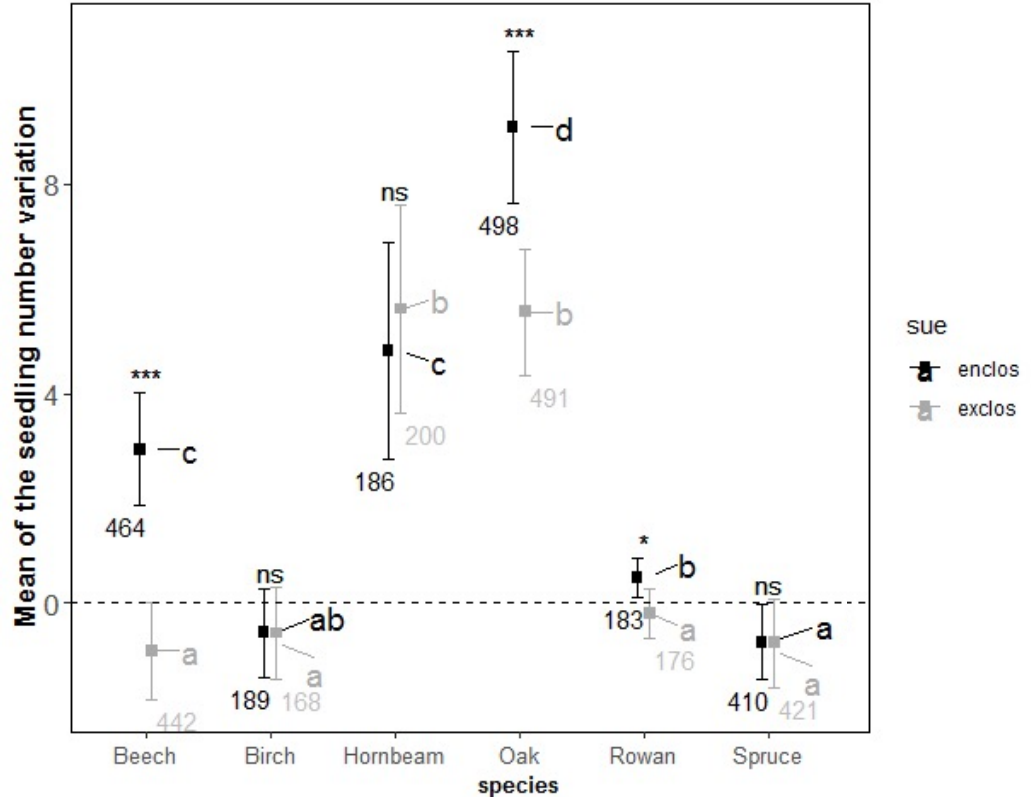
Change in the number of seedlings

Species comparison
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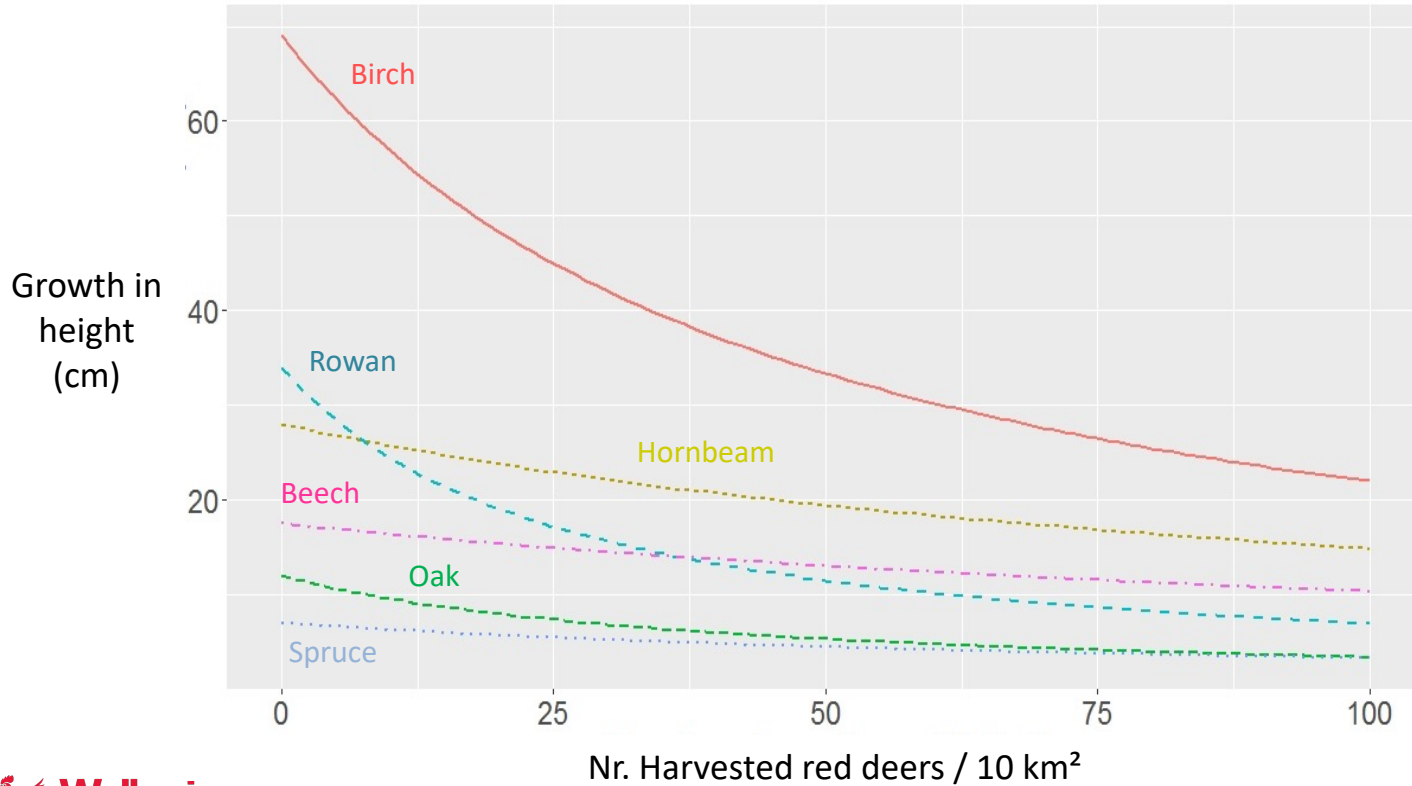
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Conclusion :

- Ungulate effect is determinant and undesirable on the regeneration :
 - Among abundant species :
 - oak ↓↓↓ Less sensitive to heat and droughts
 - beech and spruce → → More sensitive to heat and droughts
 - Less abundant species : birch, and rowan ↓↓↓↓ Diversification potential
 - Fastens the forest succession to the climax :
 - More monospecific climax (beech)
 - Reduces resilience to climate change : undesirable
 - Further research needed to characterise :
 - Tree recruitment
 - Its relation with ungulate abundance <-> environment covariates
- ➔ Should be taken into account in further forest predictions.

Perspectives




Thank you so much ...

... for your attention !

And thanks to the DEMNA and SRFB teams, DNF officers, all the volunteers and the partners of this project.

ACCORD-CADRE RECHERCHES ET VULGARISATION FORESTIÈRES



A close-up photograph of a deer's head in profile, facing right, as it eats a green leaf. The deer has light brown fur and large, upright ears. The background is a dense thicket of green foliage, slightly out of focus. A white speech bubble with a thin black outline is positioned to the right of the deer's mouth, containing the text "I listen to your questions." in a white, sans-serif font.

I listen to your questions.

Citations :

Alderweireld M, Burnay F, Pitchugin M, Lecomte H (2015) Inventaire forestier wallon : résultats 1994-2012. SPW, DGO, DNF, Direction des Ressources forestières, Jambes

Latte N, Lebourgeois F, Claessens H (2015) Increased tree-growth synchronization of beech (*Fagus sylvatica* L.) in response to climate change in northwestern Europe. *Dendrochronologia* 33:69–77.

<https://doi.org/10.1016/j.dendro.2015.01.002>

Hanewinkel M, Cullmann DA, Schelhaas M-J, et al (2013) Climate change may cause severe loss in the economic value of European forest land. *Nature Climate Change* 3:203–207.

<https://doi.org/10.1038/nclimate1687>