FORRISK

SUDOE Interreg IV B

UE/EU - FEDER/ERDF

Modelling regional forest health risks related to the pine processionary moth on maritime pine

INRA SCIENCE & IMPACT

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Context: climate change and increasing **global trade** are triggering new forest risks, especially biotic risks

- Higher intensity and frequency of pest outbreaks, expansion of their natural range
- Increasing introduction and establishment of invasive species

⇒ **concern for forest health & need to better evaluate risks**

However comprehensive risk analyses are, integrating **hazard**, **vulnerability** and **impact** are rarely made due to a lack of knowledge or data

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→**Pine processionary moth (PPM) on maritime pine in South-West France** as an example

- PPM is the main **pine defoliator** in the Mediterranean Basin (including SW France).

  Frequent defoliations (cyclic epidemics) are causing significant growth reduction (Jacquet J.-S., 2012), and **then economic losses,** thus questioning the relevance of pesticide application (Gatto et al., 2008)

- **A well-studied insect** (more than 30 years of research)

- **Long-term monitored insect** by the Forest Health Department (since 1980)

⇨ **Relevant case study for full risk analysis**

Photo By B. Castagneyrol

Photo By I. Van Halder

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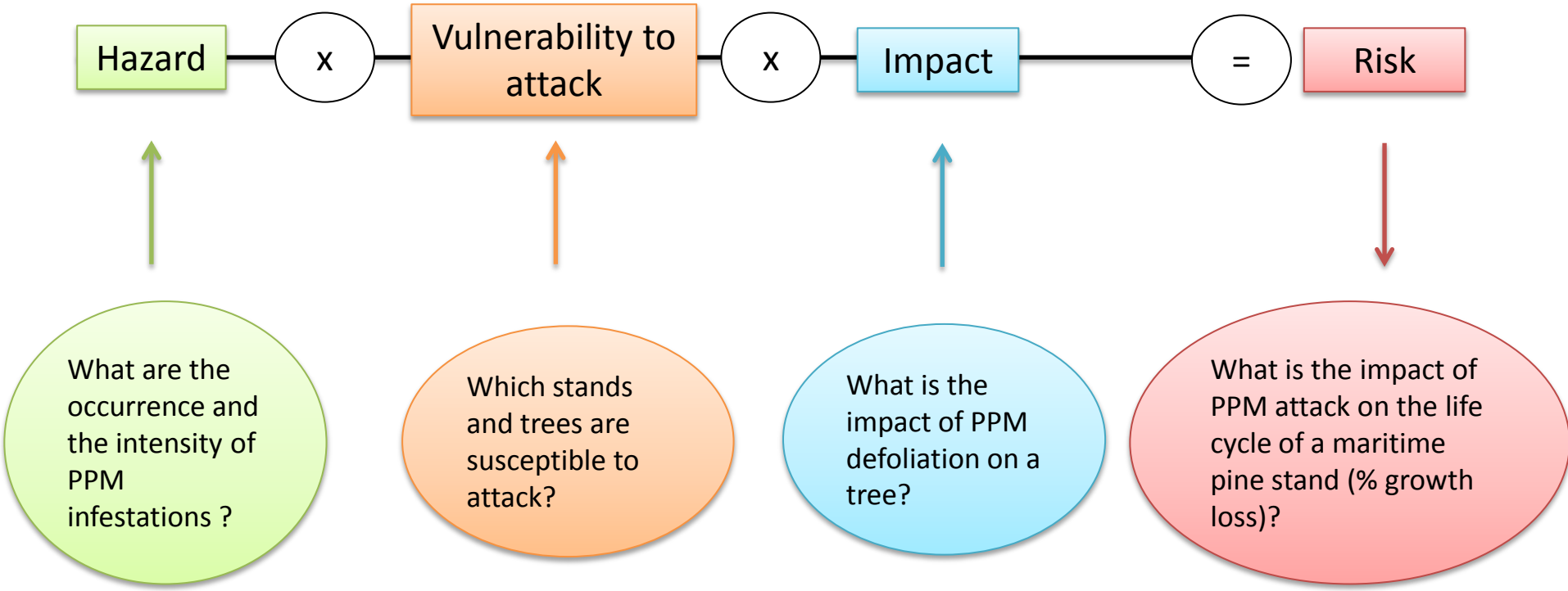

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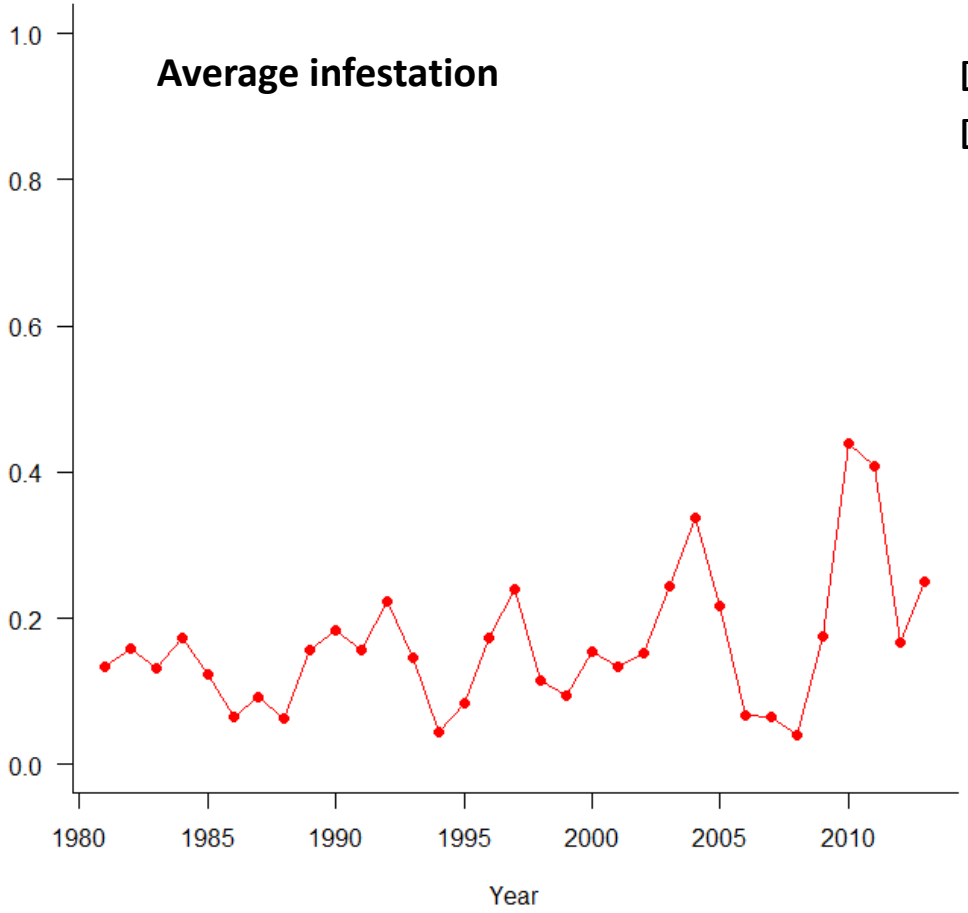
Hazard



Data from Forest Health Department monitoring

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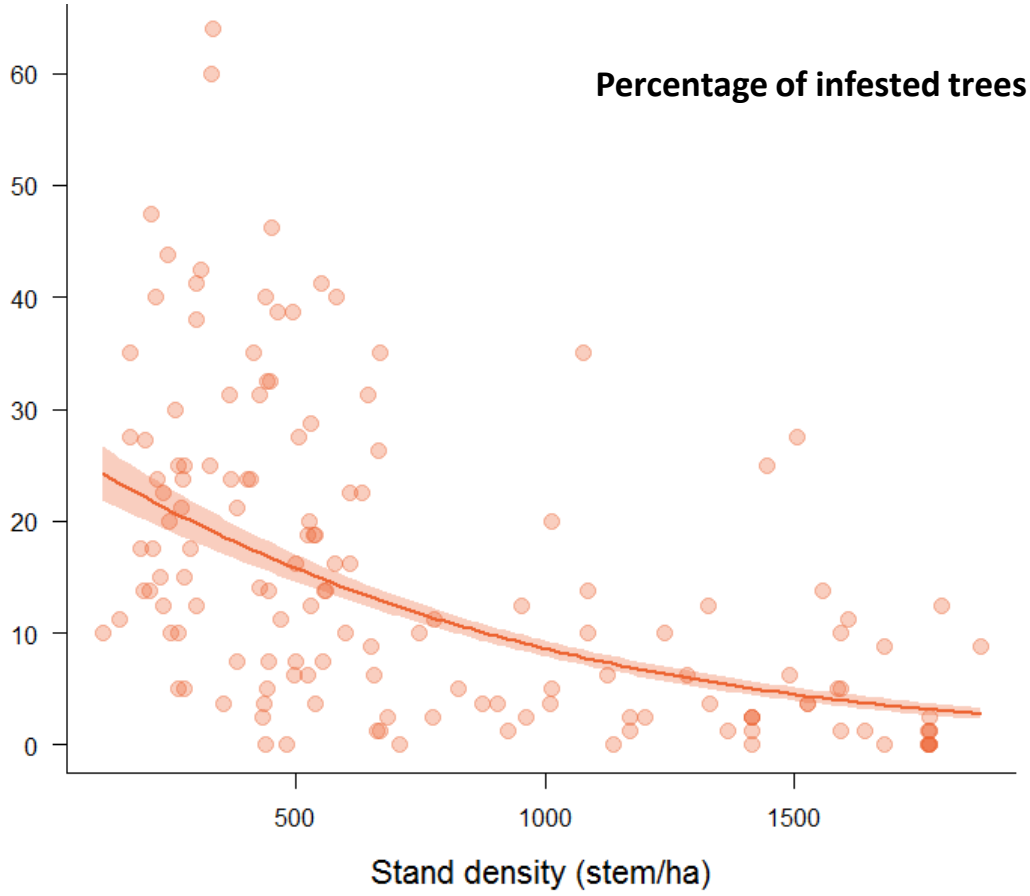
Vulnerability to attack

Depends on stand density



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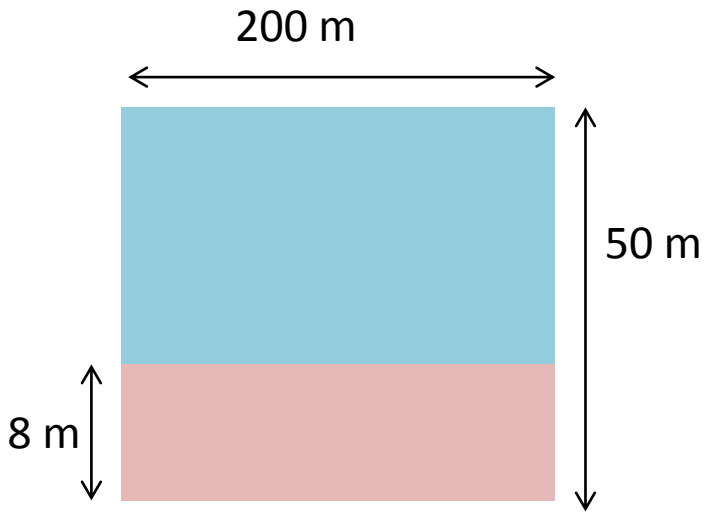
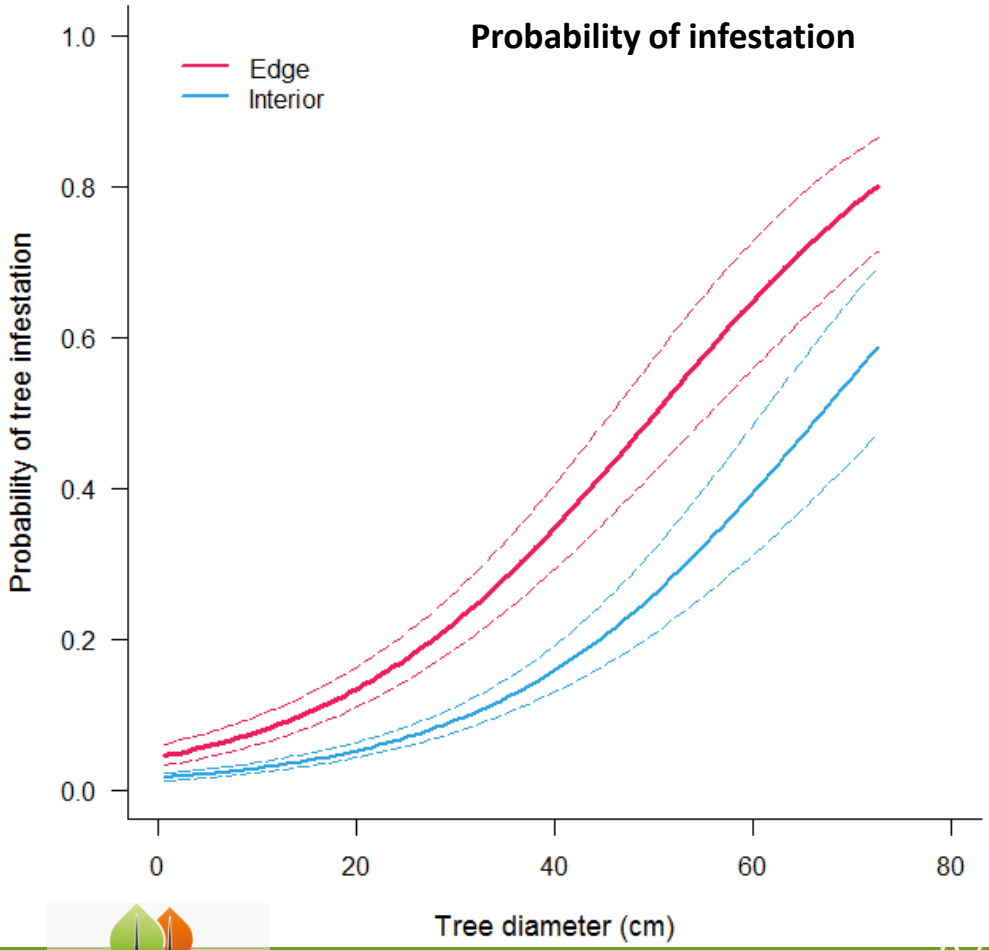
Vulnerability to attack

Depends on tree location and tree size



16% of trees located at stand edge (2 rows)



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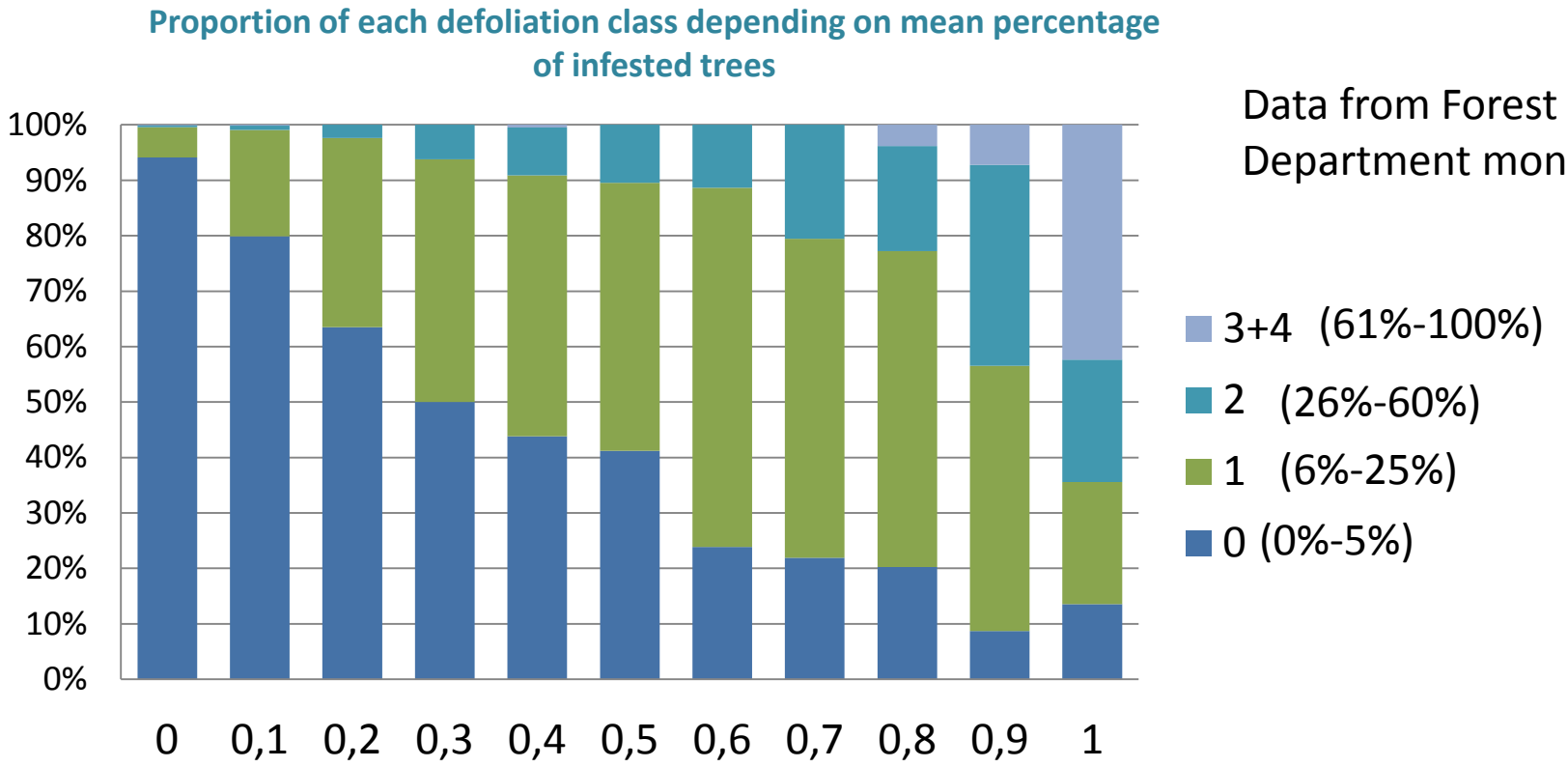
Impact

Relationship between infestation and defoliation



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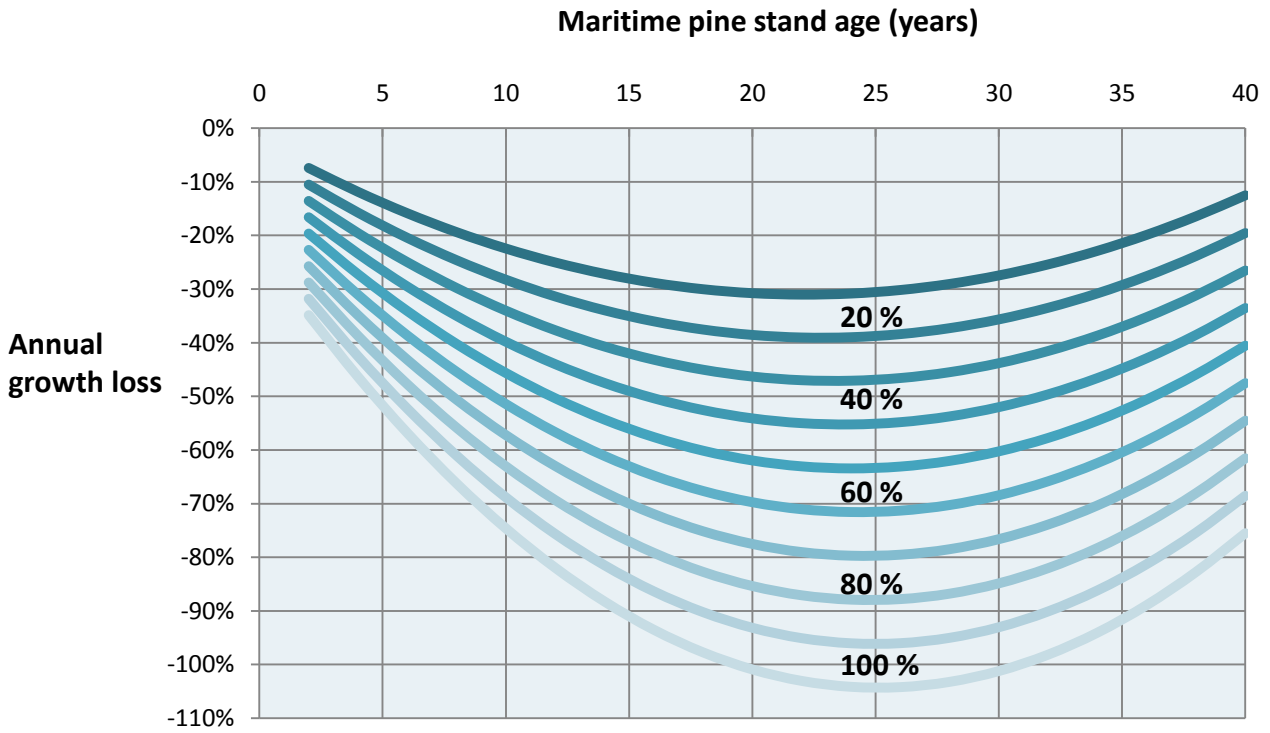
Impact

Relationship between defoliation and growth loss



Data integration : Capsis- Pinuspinaster

t=1

Theoretical (or real) initial stand

Initial stand: Age≥12 years, density, G, Hdom

Edge depth
Aspect : N, S, E, W…

Silvicultural practices : thinnings

7-year cycles of PPM infestations : % of infested tree, defoliation for each year

Higher level of infestation

Lower level of infestation

Initial edge part

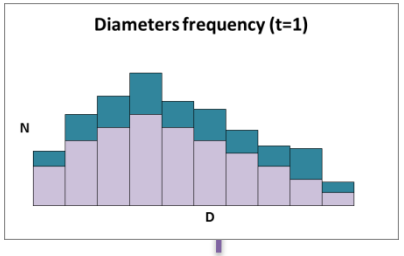
Initial interior part

Bigger trees infested in priority

Final edge

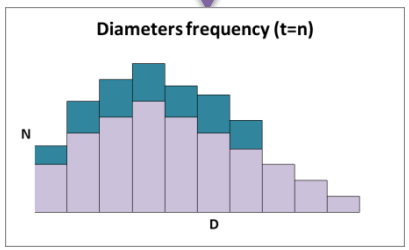
Final interior

Final stand: density, G, Hdom

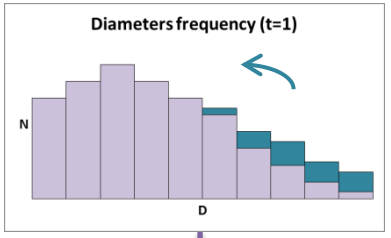


Dyear2=Dyear1+ΔDt

Dyear2=Dyear1+ΔDt – growth loss



t=n



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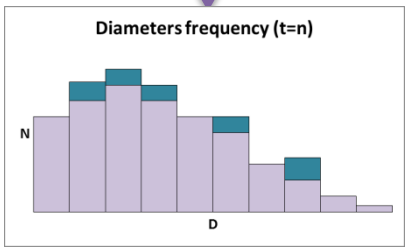
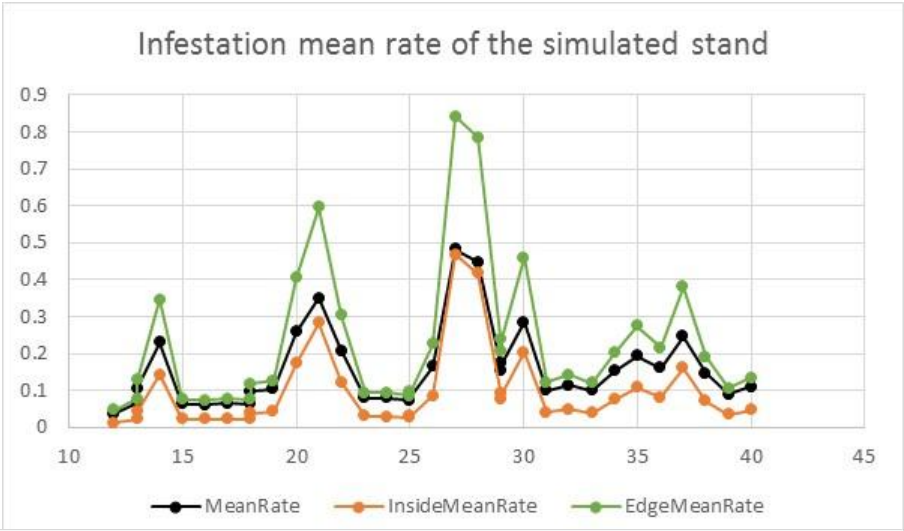
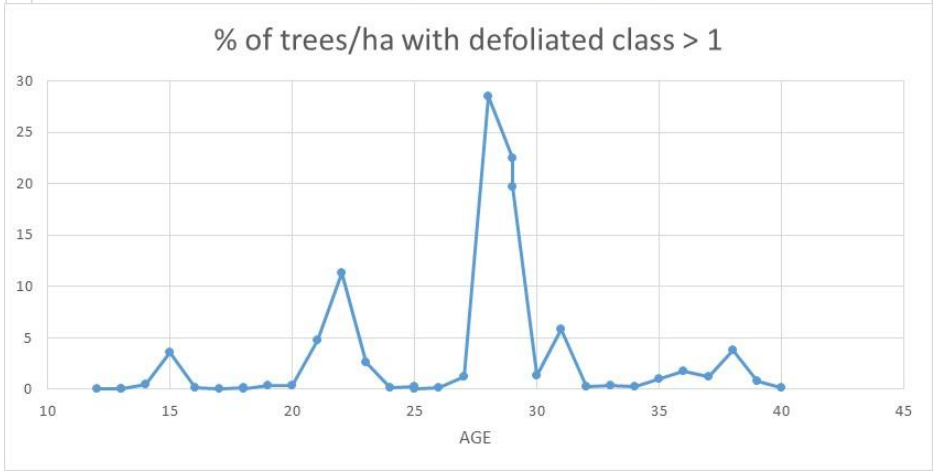


Final stand : exposed to PPM defoliation

Comparison of two simulated stands with and without moth infestation

- Input stand : 1250 trees/ha
- SI : 23.5 m at 40 years-old
- Initial age : 12 years-old
- 4 thinnings :
  - 13 years-old : 850 t/ha
  - 18 years-old : 560 t/ha
  - 25 years-old : 410 t/ha
  - 29 years-old : 290 t/ha
- Target diameter at final cut : 42 cm





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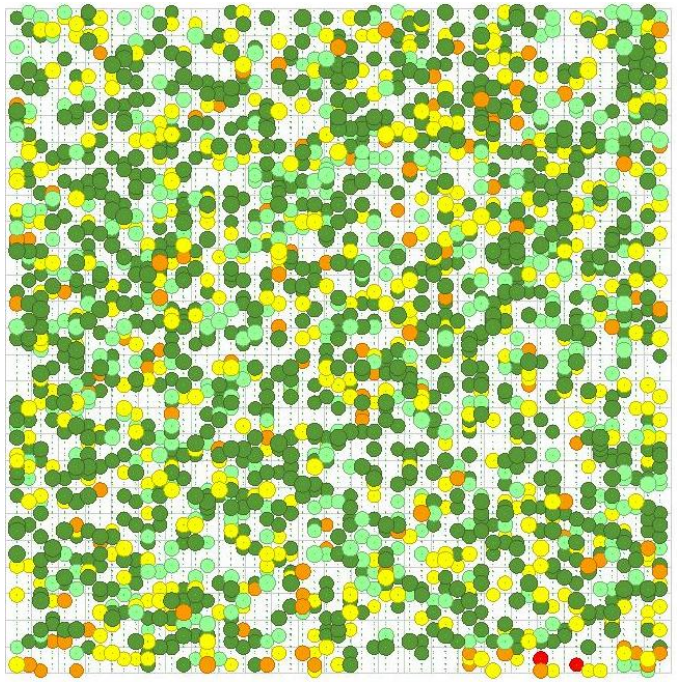
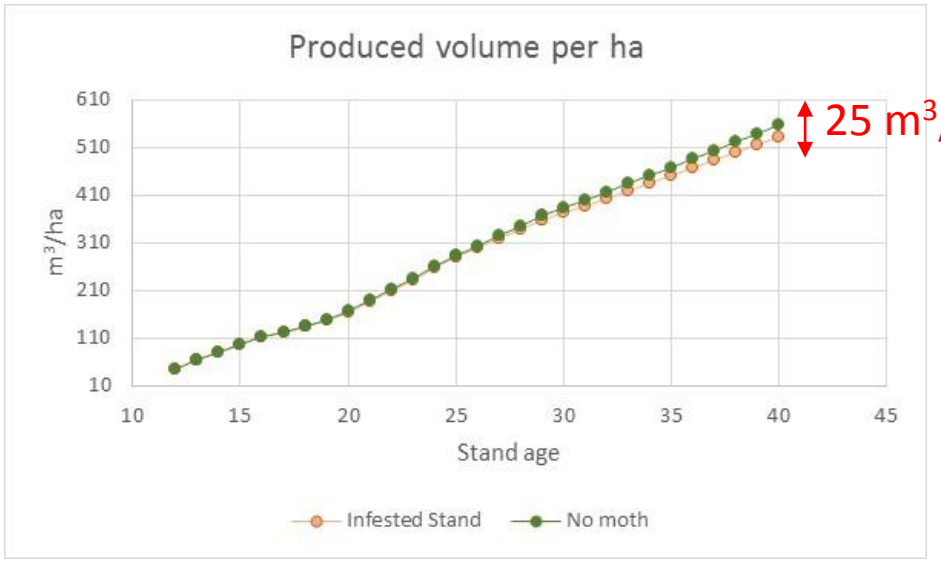
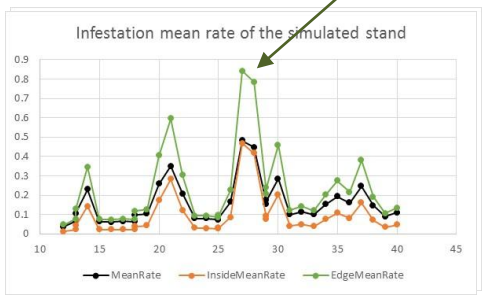
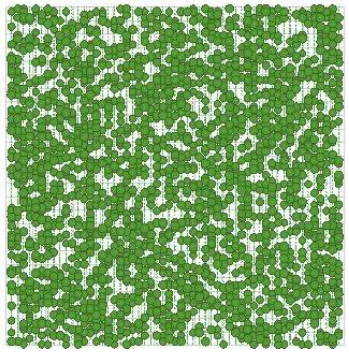




Around 18 trees of 1.3 m^3

Stand view at 28 years-old





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- **Conclusion**
  - **The tree dimension variability within stand is not taken well enough into account for mean rate infestation and it could have a huge impact**
  - **First simulations : only with one stand and one infestation sequence**

⇒To have regional impact of PM, we need to simulate a set of stands facing different infestations

⇒We will add stand aspect and presence of broadleaved hedges.

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- **Conclusion**

  - Some **stand characteristics** (stand dimension) the **tree dimension variability** within stand is not taken well enough into account for mean rate infestation and it could have a huge impact.

  - First simulations : **only with one stand and one infestation sequence**

    ⇒ To have regional impact of PM, we need to simulate a **set of stands** facing different infestations

    ⇒ We will add **stand aspect** and presence of **broadleaved hedges**.