



Impacts of climate-related dieback on regeneration in a drought-prone European beech population

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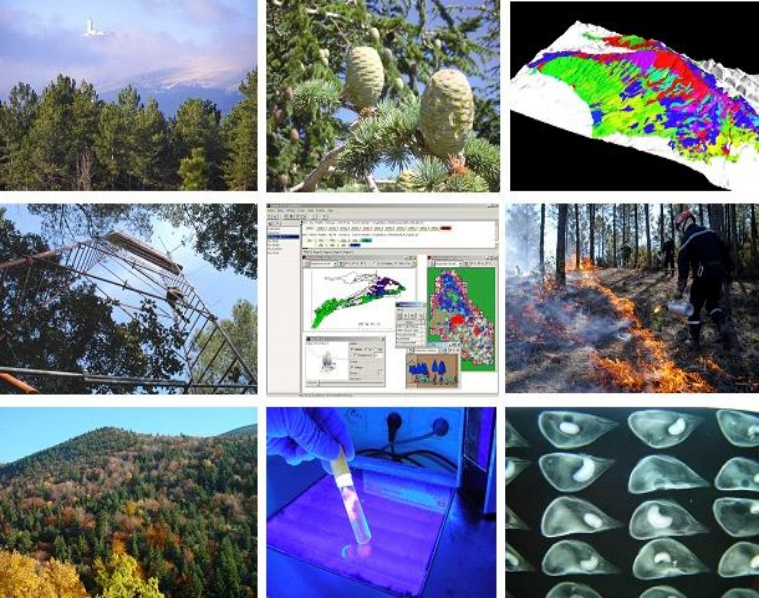
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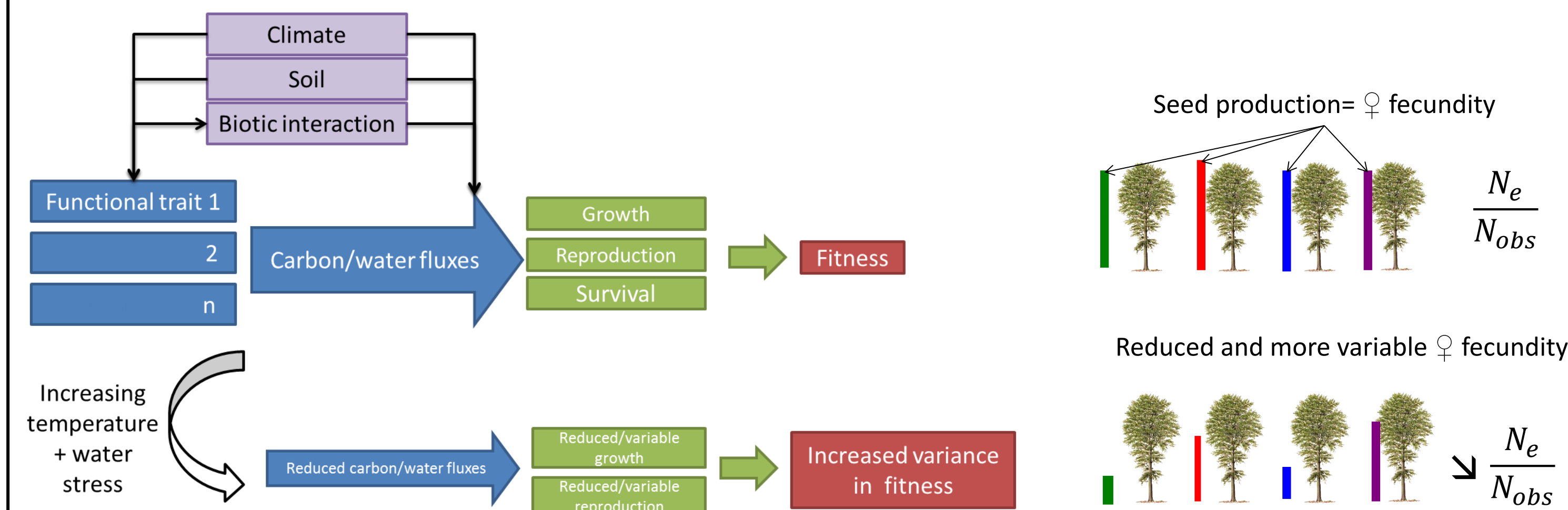
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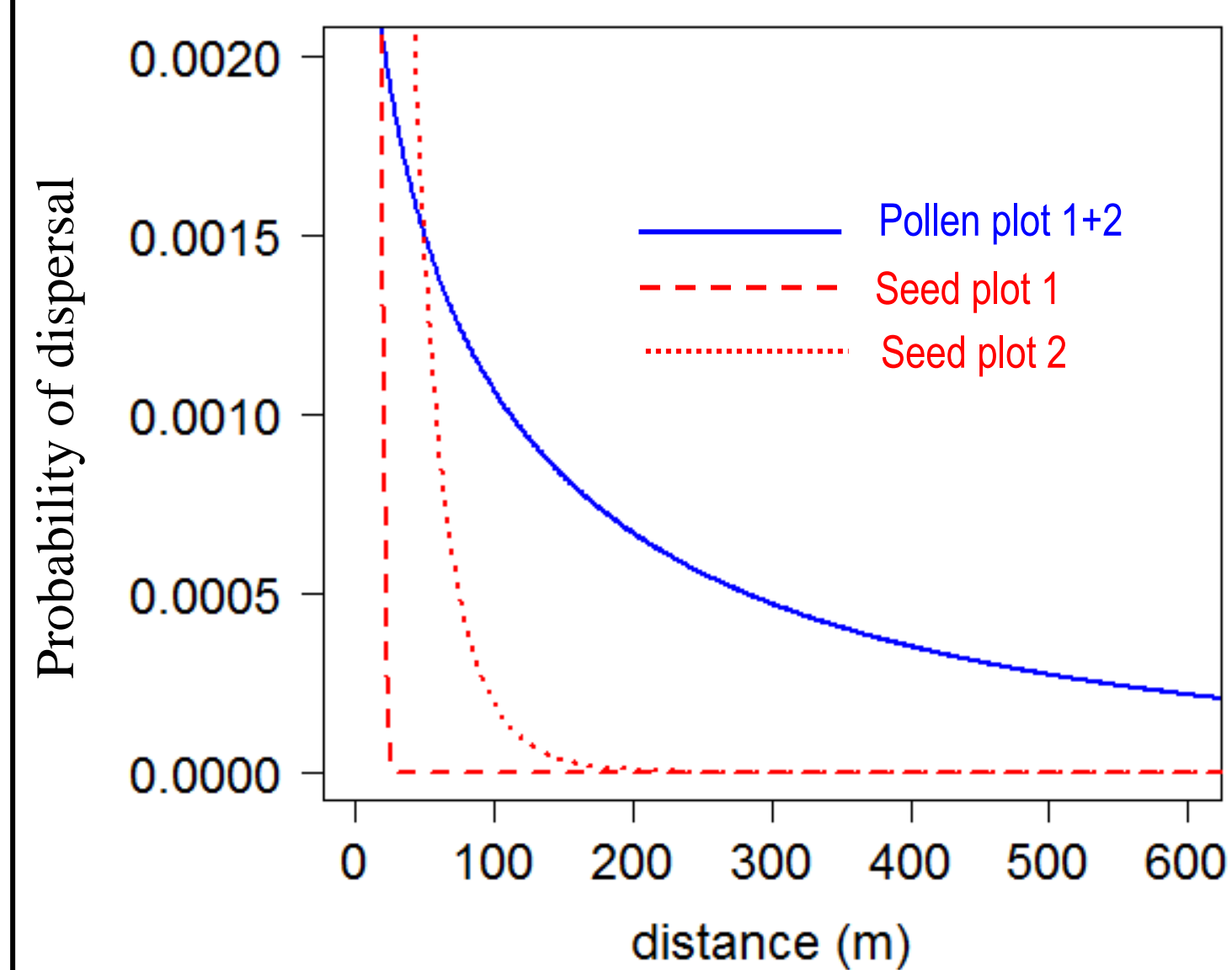
The issue: does climate-driven individual tree dieback reduce effective seed output and population size (N_e) ?

Interactions between biotic and abiotic environment and tree functional traits determine carbohydrate and water fluxes at tree-level, which in turn affect demographic rates and fitness at tree- and population-level. The total number of reproductive trees (N_{obs}) and the among-trees variations of seed production determine the effective population size (N_e).



Climate-induced tree dieback may result in a reduced quantity and/or quality of seed output at population level, even without or before tree mortality. We investigate the relationship between individual tree dieback and fecundity in the forest tree *Fagus sylvatica* (the European beech) in Southern France (La Massane, Pyrénées Orientales). *Fagus sylvatica* is known to be sensitive to summer drought, but shows so far limited mortality; for instance at the study site the mortality rate is 1.75%/year (between 2003 and 2005) while the rate of tree dieback (measured through foliar mortality) is 10.5 %.

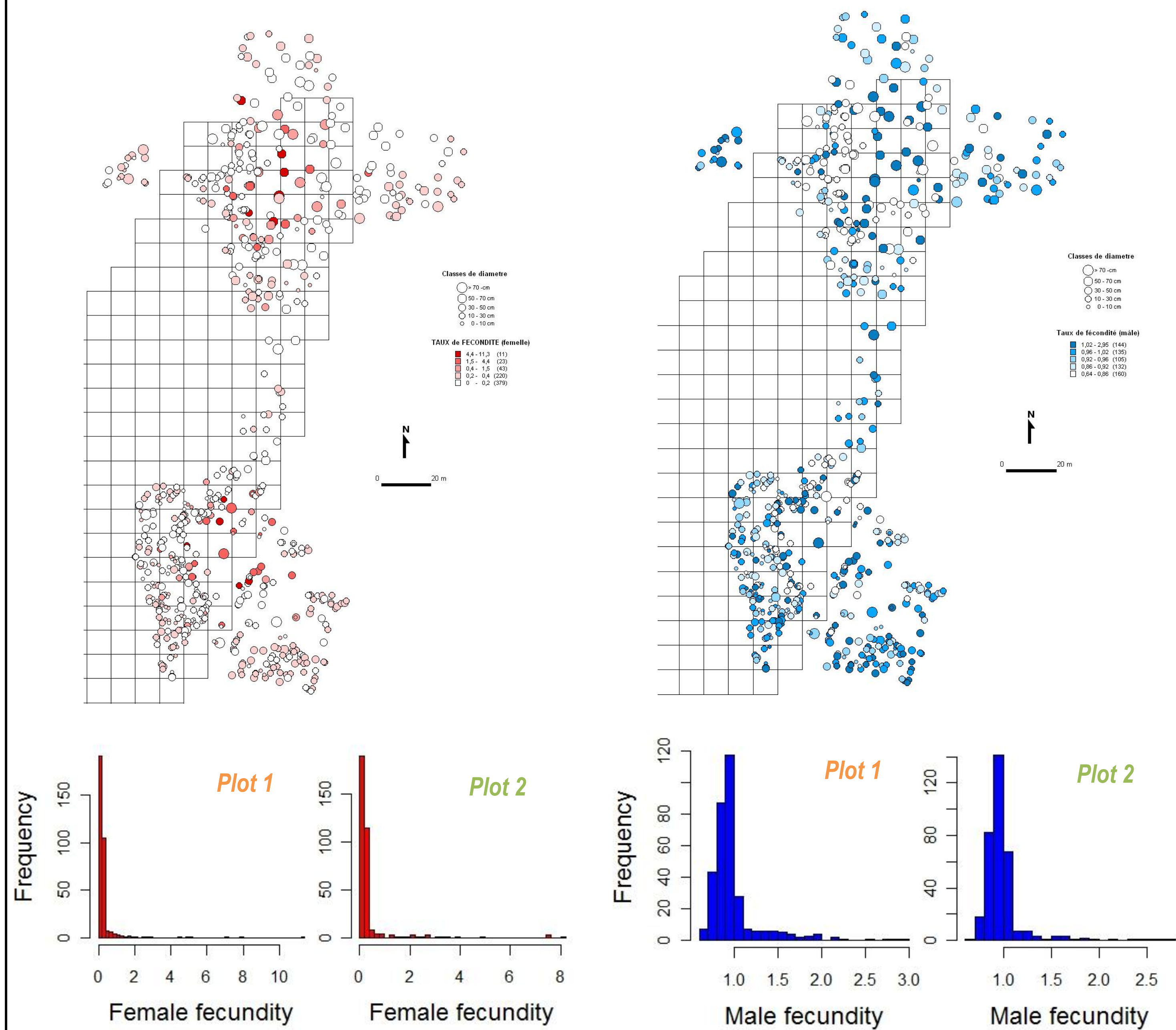
Results: estimated dispersal and fecundity parameters



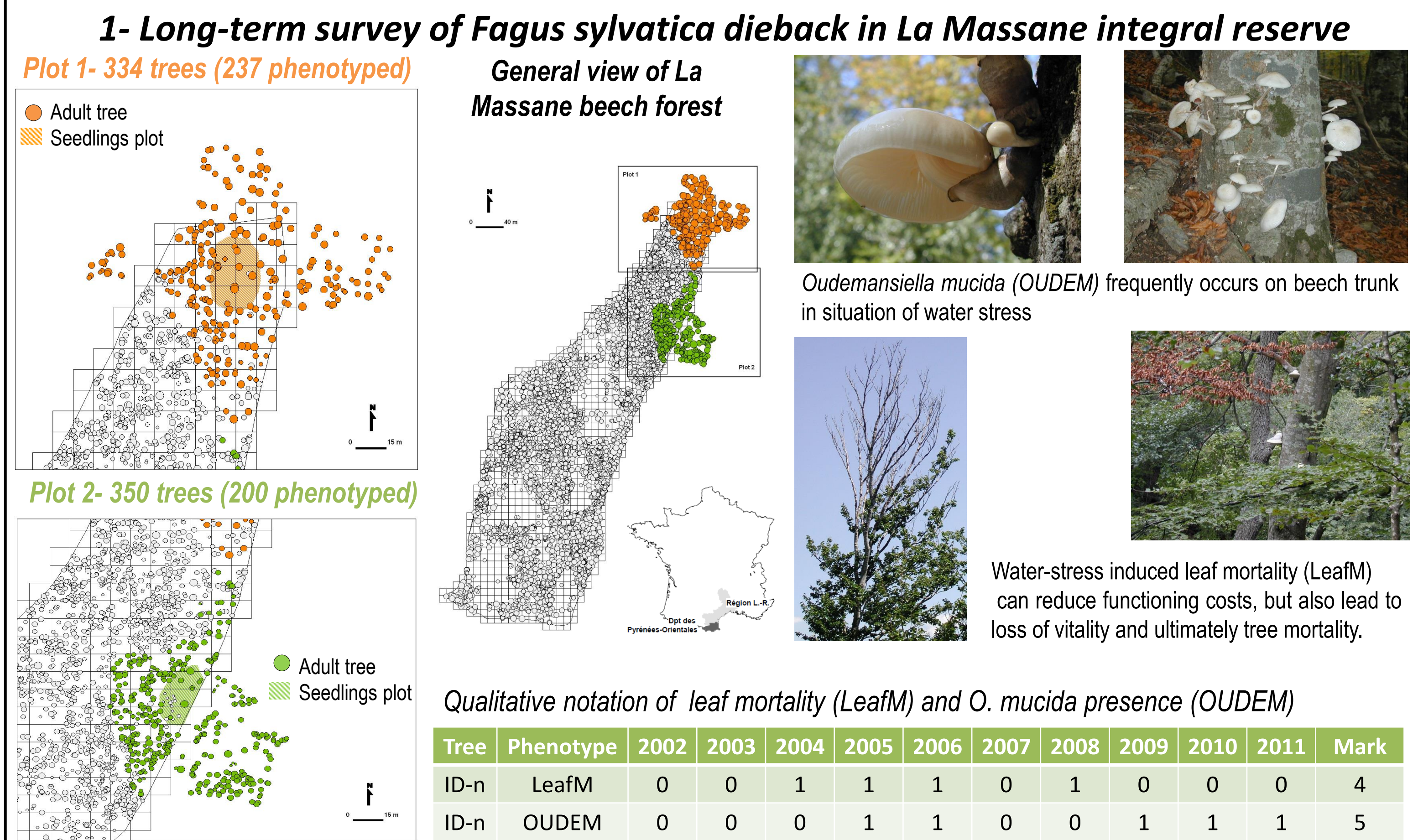
1. Pollen and seed dispersal abilities

- Pollen and seed dispersal kernel were modeled with exponential power distribution with parameters (δ_p , b_p) and (δ_s , b_s).
- Pollen is dispersed on average at $\delta_p = 62$ m, with non negligible events of long distance dispersal ($b_p = 0.46$)
- Seeds are dispersed on average at $\delta_s = 12$ m, with fewer long distance dispersal events than for pollen ($b_p = 0.83$)
- 13% of the seedlings have their mother-tree out of the plot, and 67% of the offspring with local mother have their father-tree out of the plot.

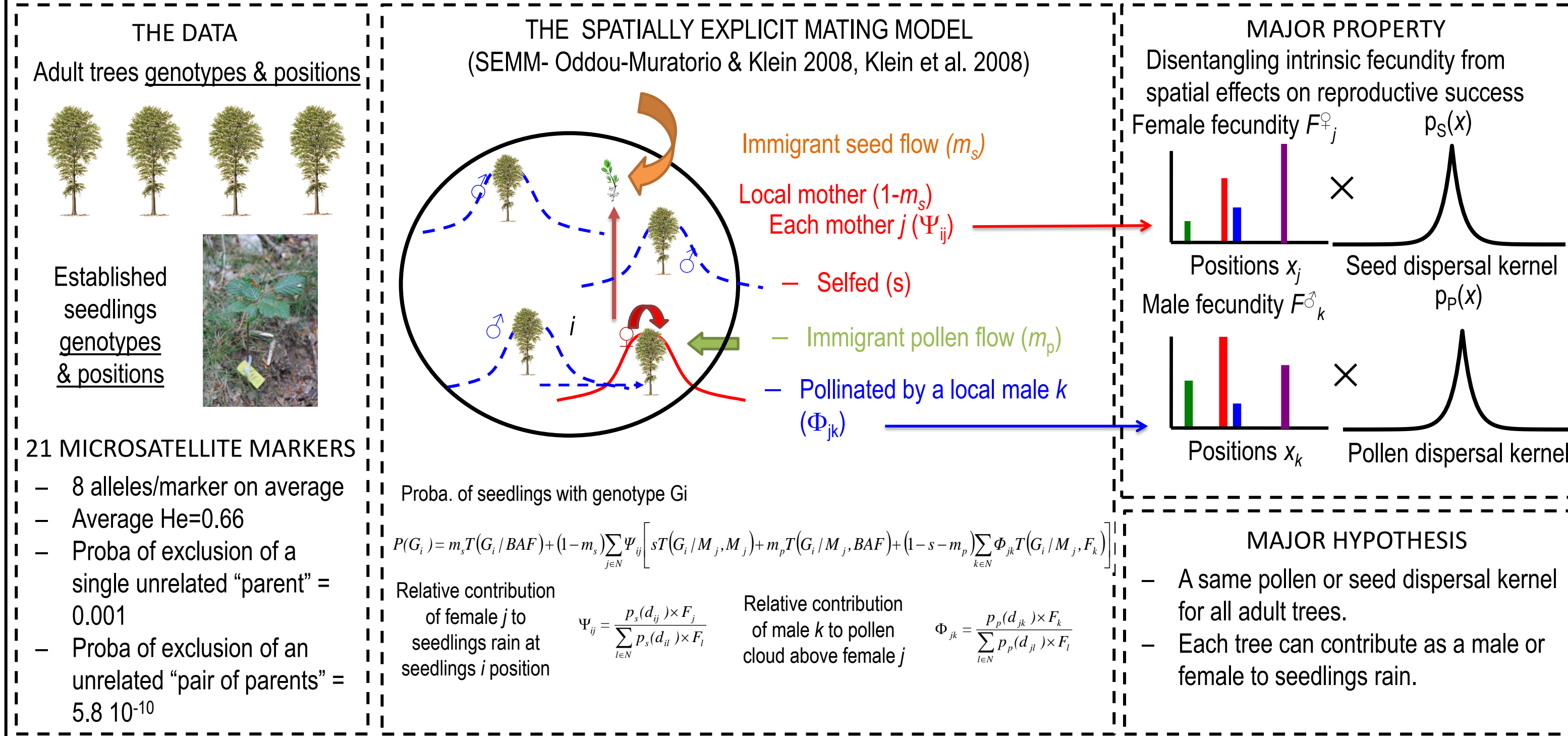
2. Distribution of female and male fecundities on each plot



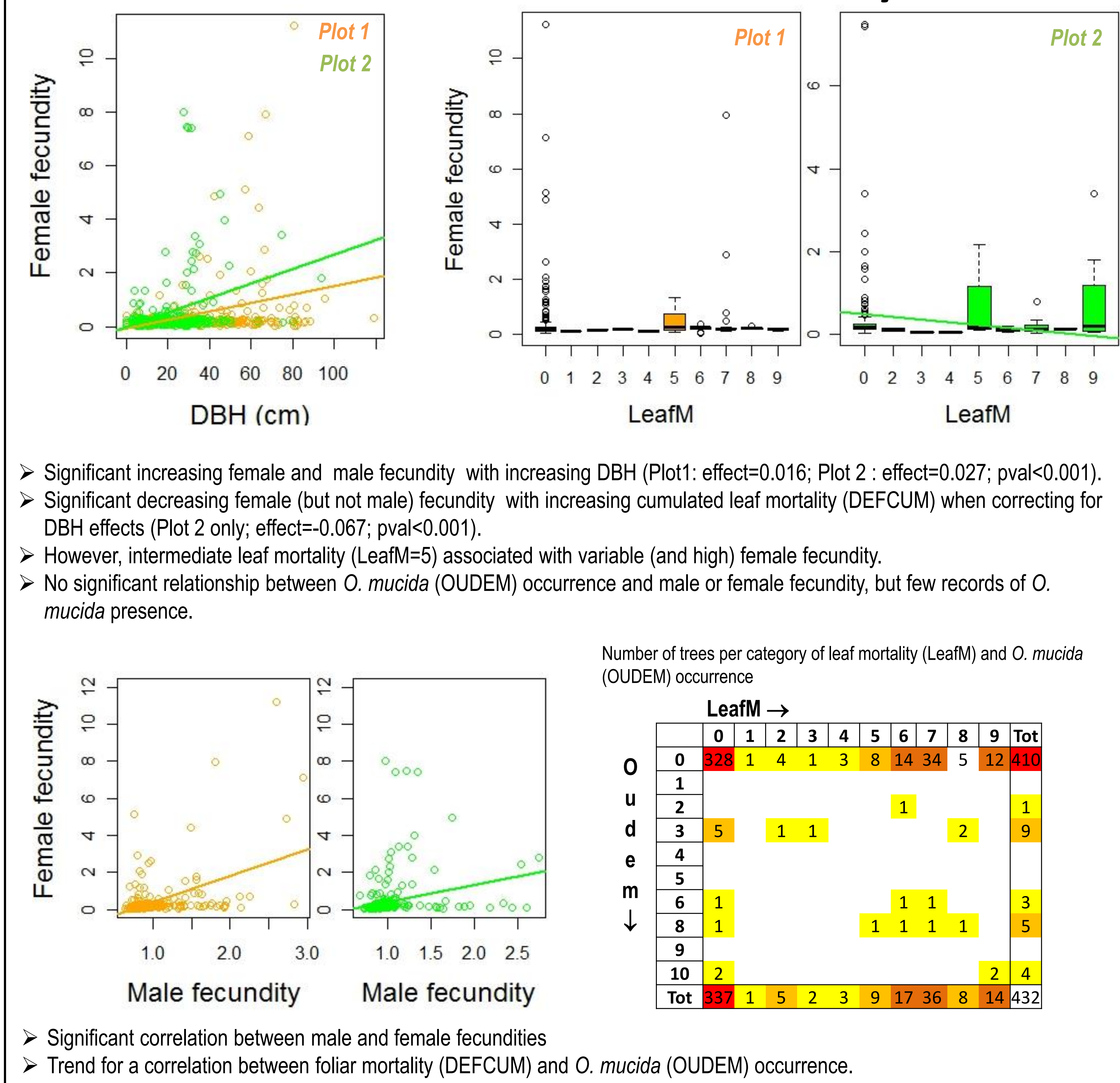
Methods



2- Estimation of realized fecundities and dispersal with the SEMM



Results: relationship between dieback and fecundity



Conclusions

- Individual tree dieback (through foliar mortality) is associated to lower relative female fecundity, consistently with costly nut-seeds in *Fagus sylvatica*.
- Non negligible female fecundity can however be achieved for intermediate leaf mortality, suggesting adaptive plastic response aiming at reducing functioning costs.
- Perspective : investigating whether there is a change in allocation to reproduction versus growth for trees showing evidence of dieback.

References : - Klein, E.K., Desassis, N., & Oddou-Muratorio, S. (2008) Pollen flow in the wildservice tree, *Sorbus torminalis* (L.) Crantz. IV. Whole inter-individual variance of male fecundity estimated jointly with the dispersal kernel. *Molecular Ecology*, 17, 3323-3336.
- Oddou-Muratorio, S. & Klein, E.K. (2008) Comparing direct vs. indirect estimates of gene flow within a population of a scattered tree species. *Molecular Ecology*, 17, 2743-2754.