

The invasive potential of introduced exotic trees: what do arboreta tell us?

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CONTEXT

Forestry is the second largest pathway of invasive tree introductions in Europe and it is likely that climate change will encourage forest managers to plant exotic tree species to maintain wood production. In the early 1900's, several arboreta were established in Southern Belgium to assess the wood production potential of prospective exotic trees. One century later, they offer the unique opportunity to assess their potential invasiveness.

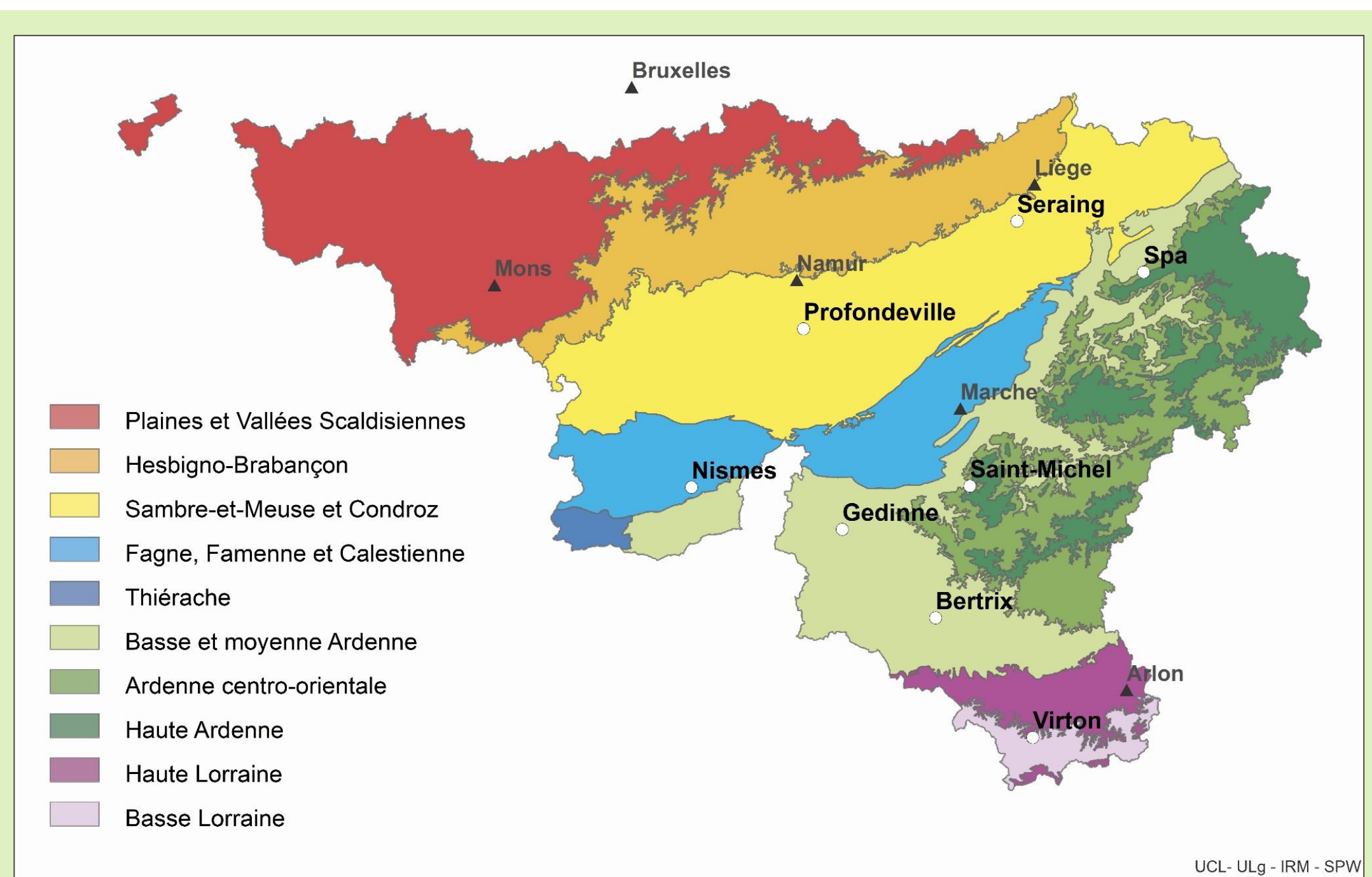
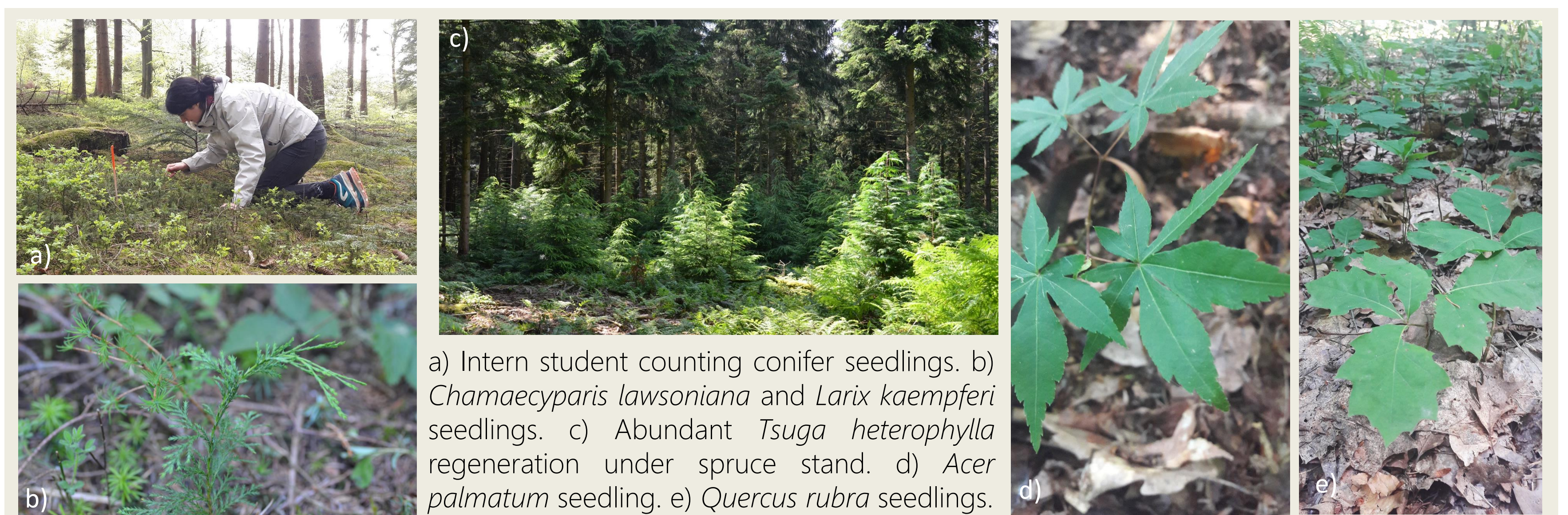


Fig. 1. Location of the arboreta in the bioclimatic regions of Wallonia. Bioclimatic regions represent climatic suitability of groups of tree species.

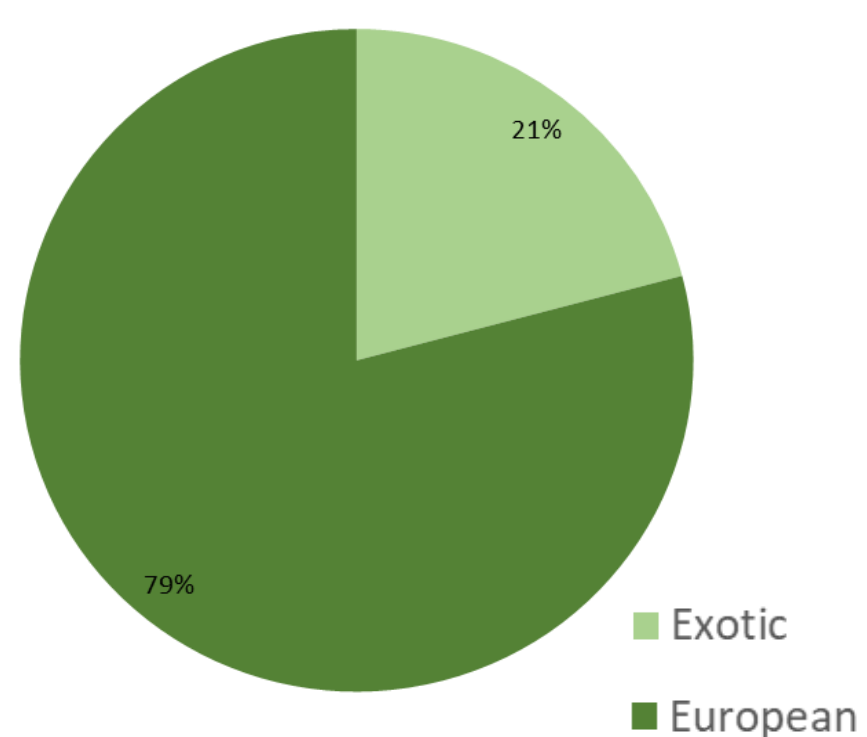
METHOD

- ▶ 8 public forest arboreta were selected (fig. 1).
- ▶ A systematic sampling (2-meters radius plots every 30 meters) was conducted in the arboreta and in a 100 meters buffer.
- ▶ Each non-planted tree individual was measured, as well as biotic and environmental variables: pH, canopy openness, herbaceous competition, etc.
- ▶ Exploratory statistical methods were used to determine the most abundant species and their dispersal distances.
- ▶ Multivariate and univariate methods were used to determine the influence of environmental variables and species traits in species' repartition.



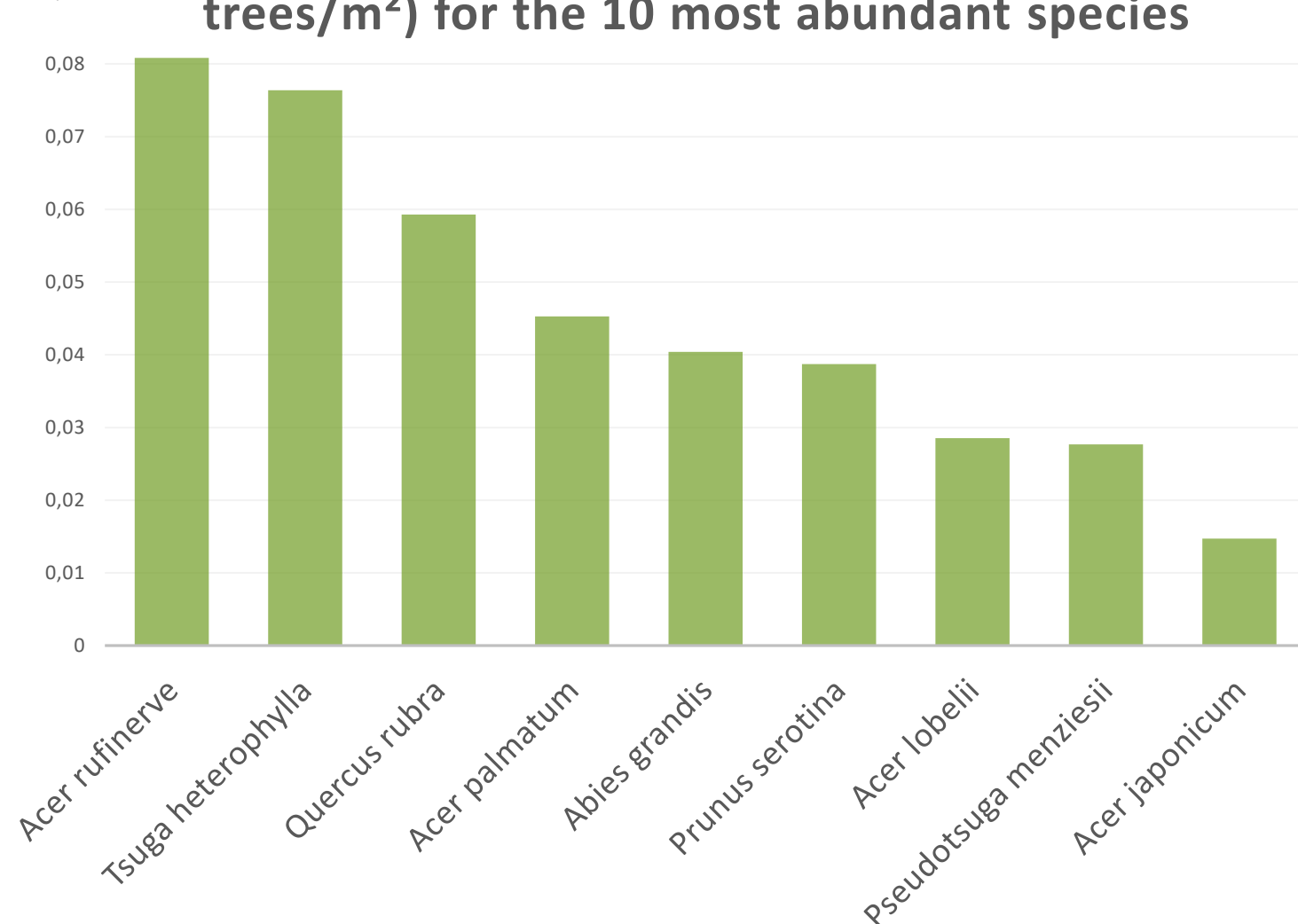
RESULTS

Origin of species regenerating (number of counted trees)



Exotic trees represented 19% of the counted regeneration. Only non-European species recently imported (neophytes) were considered exotic.

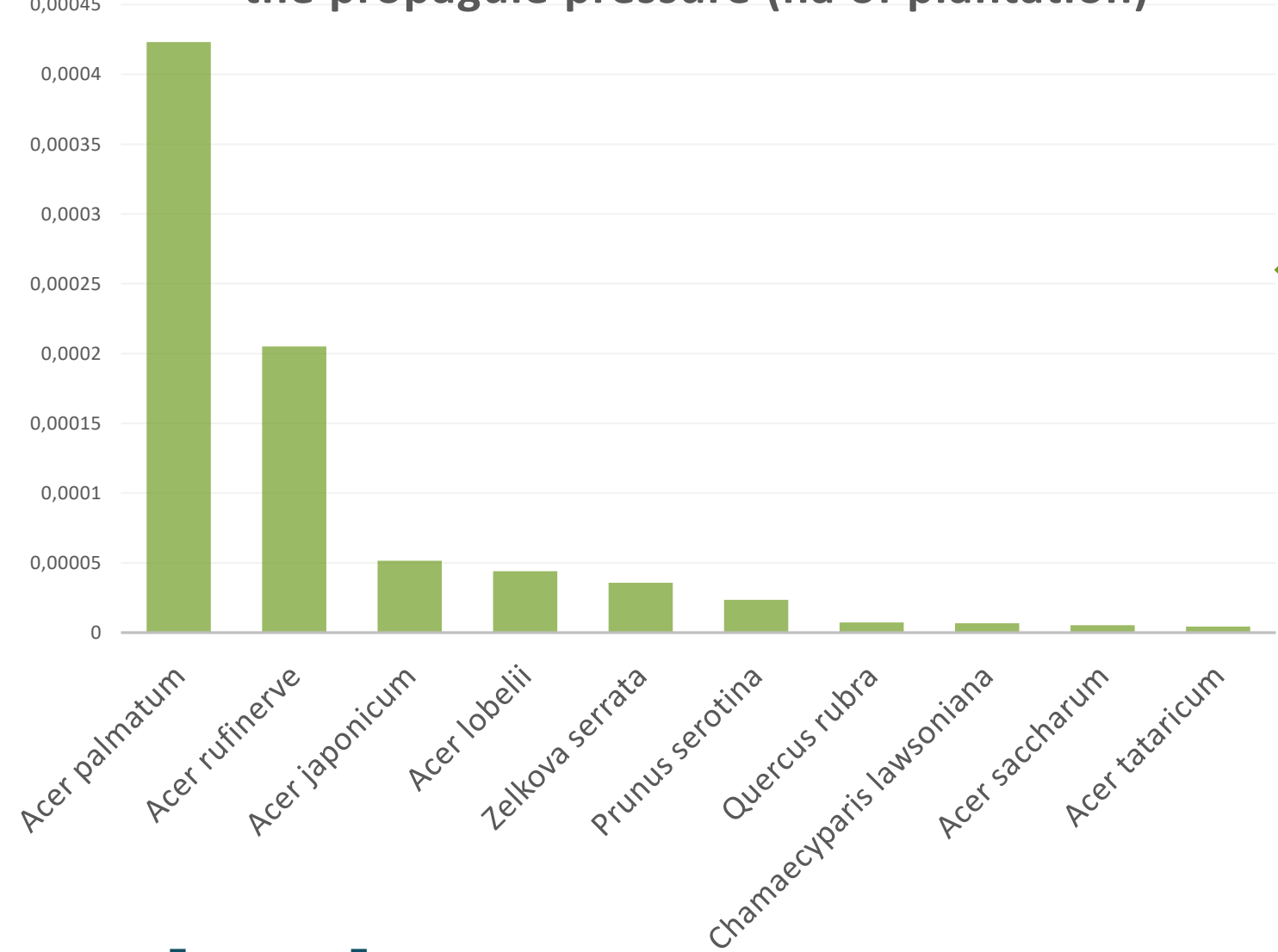
1. Density of exotic regeneration (number of trees/m²) for the 10 most abundant species



Species already considered as invasive appear in the 10 most abundant species: *Acer rufrinerve*, *Quercus rubra* and *Prunus serotina*.

North American conifers are also well represented: *Tsuga heterophylla*, *Abies grandis* and *Pseudotsuga menziesii* offsprings were commonly found and reached large diameters.

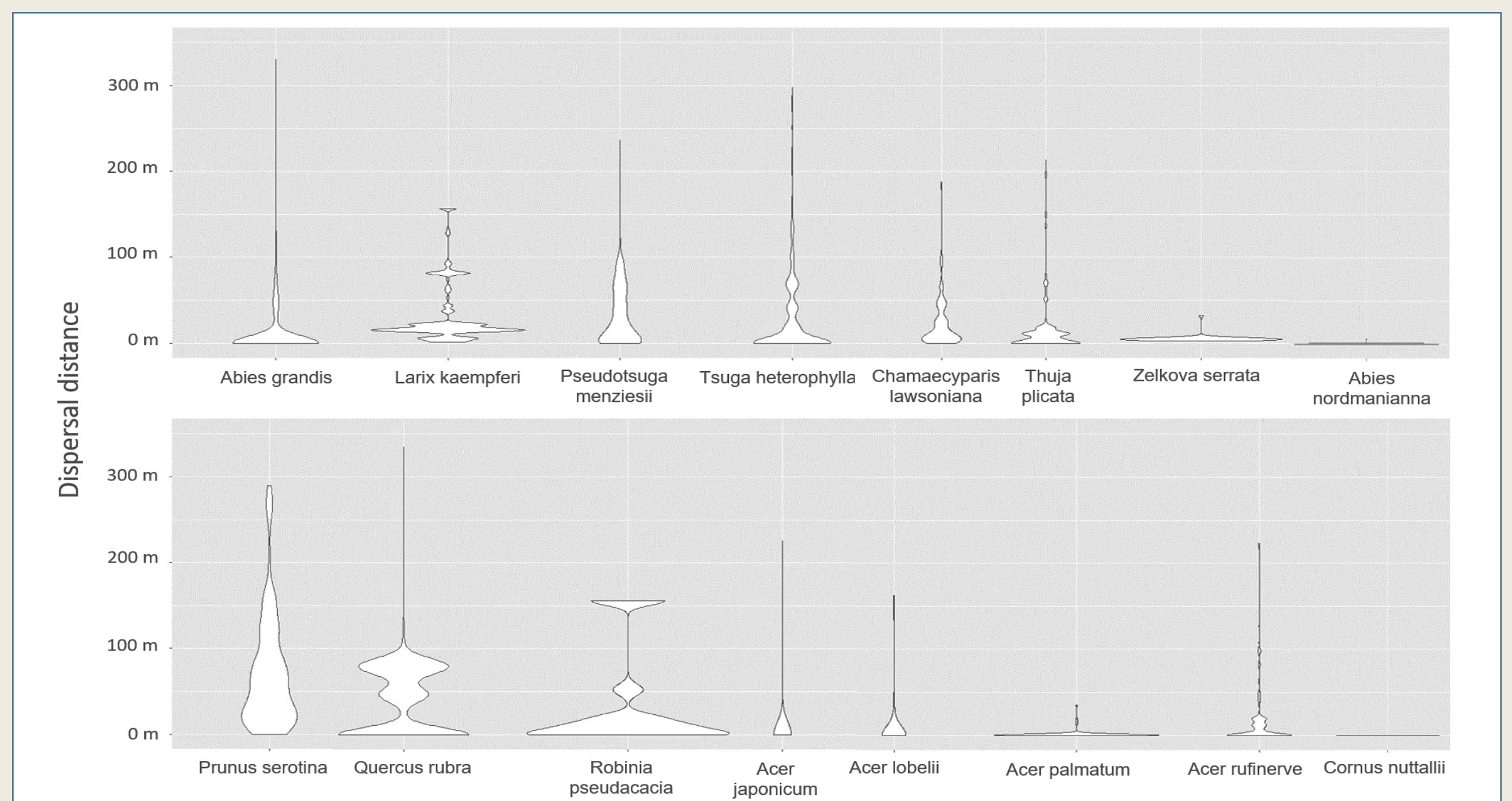
2. Density of exotic regeneration weighted by the propagule pressure (ha of plantation)



The propagule pressure is not equivalent for each species as some of them were planted with a much higher intensity. The density of exotic regeneration was divided by the area of planted plots for each species.

The *Acer* genus dominates the top ten ranking. Also, *Zelkova serrata* and *Chamaecyparis lawsoniana* now appear as species with high regeneration potential.

▶ Another important criterion : the dispersal distance



Dispersal distances (meters) of 16 species showing an abundant regeneration. *Quercus rubra*, *A. grandis*, *T. heterophylla* and *P. serotina* were found more than 250 meters away from the planted parcels. On the contrary, *Z. serrata*, *A. nordmanianna*, *A. palmatum* and *Cornus nuttallii* were found only under the parent trees.

A first analysis of species' traits* didn't show clear similarities between the species showing good regeneration rates compared to species not regenerating. However, the trend is that the regeneration is more efficient when :

- The species is shade tolerant (significant impact);
- zoochory is involved;
- The growth rate is moderate to rapid;
- The seed abundance per tree is high.

▶ What's next ? The next step is to analyze the environmental data to determine the optimal conditions for these species' regeneration. For instance, *Tsuga heterophylla* was mainly found on moist soils in colder regions, while *Quercus rubra* presented an abundant regeneration on superficial dry soils.

Take home message

- ▶ Several tree species planted for wood production show a potential invasive behavior;
- ▶ Risk assessments should be made before the large planting of new forest species;
- ▶ Old arboreta and plots with exotic trees provide useful information on the behavior of exotic species.



Want to talk about it ? Come and find me !

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*From the database TRY: Kattge, J. et al. (2011). TRY – a global database of plant traits. Global Change Biology, 17:2905–2935.