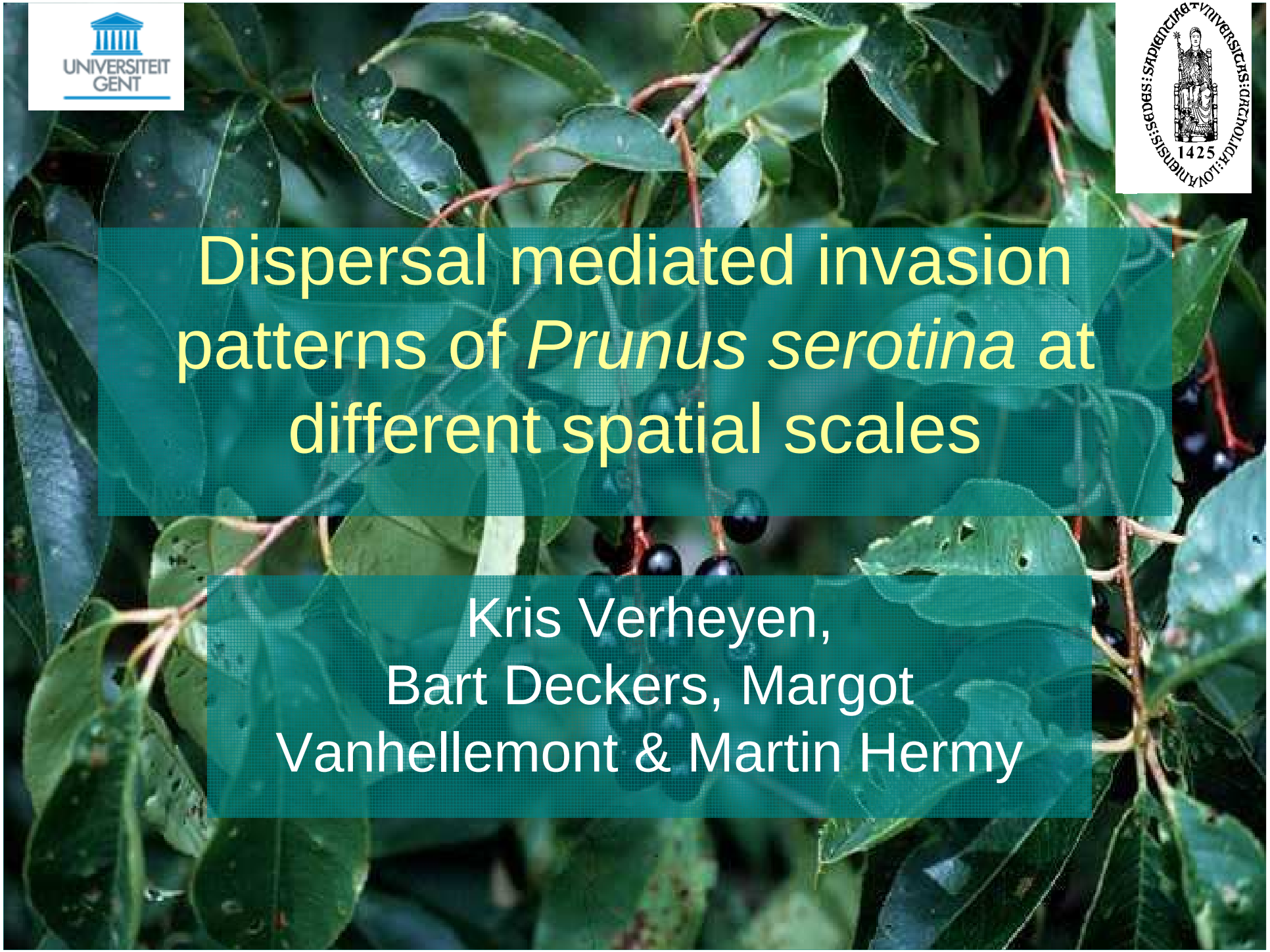


Dispersal mediated invasion patterns of *Prunus serotina* at different spatial scales

Kris Verheyen,
Bart Deckers, Margot Vanhellemont & Martin Hermy

Introduction

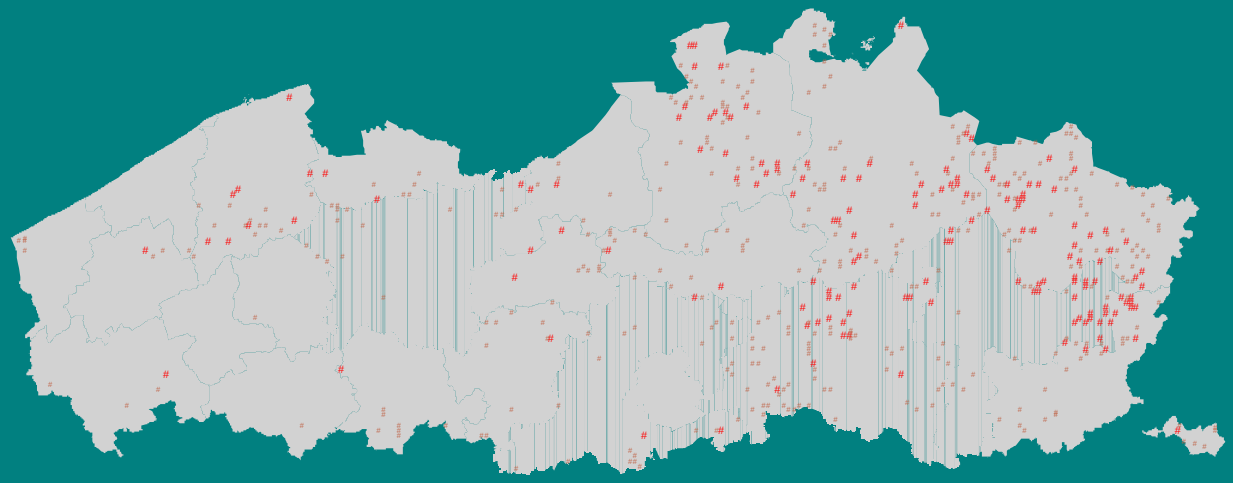
- Until the 1950's, Black Cherry (*Prunus serotina)* was **deliberately introduced**, particularly in understories of pine plantations on poor sandy soils.
- Since then, this species has spread spontaneously and it is currently one of the **most frequently** regenerating woody species in Flanders.
- At this moment, **large-scaled and costly programs** have been established to control the species
- However, surprisingly **little information** is available about the ecological factors that determine *Prunus serotina* invasion patterns and processes !?

Aims

- On a **regional** scale, to quantify the relative importance of the factors determining the distribution of *Prunus serotina*
- On a **landscape** scale, to document the pattern and processes of *Prunus serotina* invasion

Regional scale

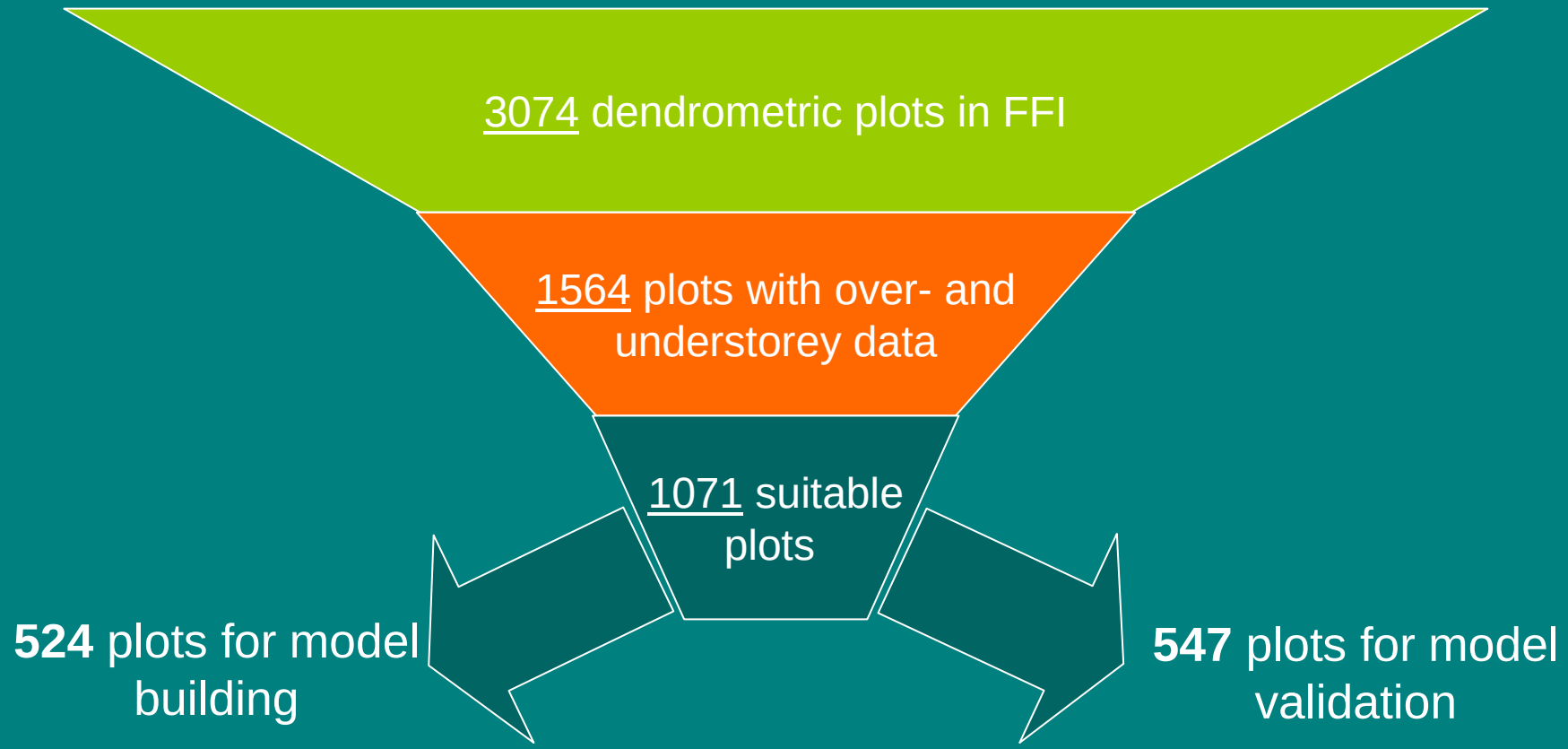
The Flemish Forest Inventory



3074 regularly distributed plots on a 1 km x 0.5 km grid

Prunus serotina present in **~ 30%** of the plots

Plot selection



Prunus serotina predictor variables

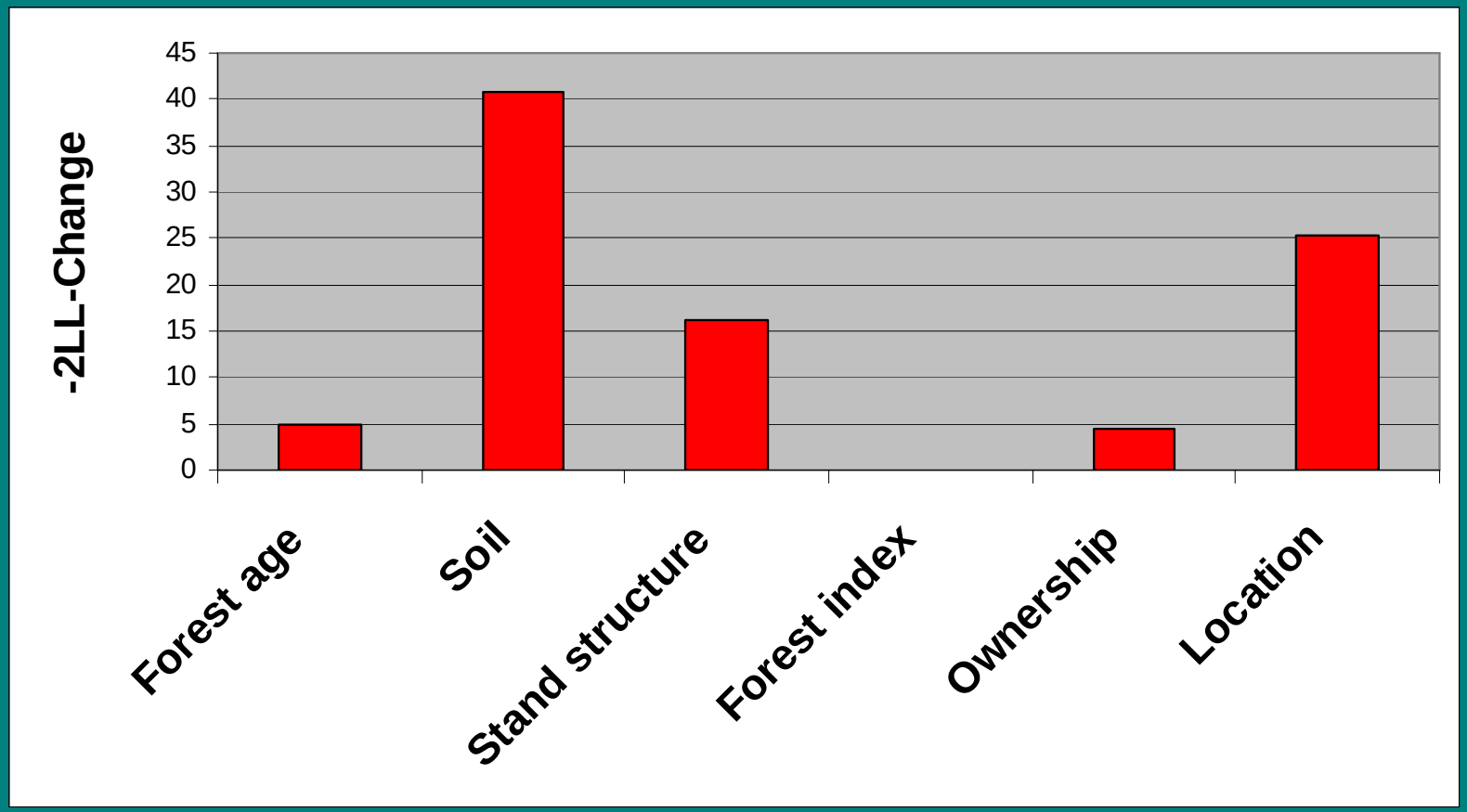
- Local scale variables:
  - Forest age (De Keersmaeker et al. 2001): <1775, 1775-1850, 1850-1930, >1930
  - Soil (Belgian Soil Map)
    - Texture: Sand, Sandy loam, Loam, Clay (Peat excluded)
    - Moisture: Dry, Moist, Wet
    - Type: Luvisol, Podzol, Anthrosol, Inceptisol
  - Stand structure (FFI):
    - Basal Area Canopy (circ. > 22 cm; m^2/ha)
    - % Basal Area consisting of light-demanding species
    - % Basal Area consisting of coniferous species

- Landscape scale variable (Forest Map of Flanders):
  - Area forest within 500m radius (ha)

- Socio-economic variable (FFI):
  - Ownership: private vs. public

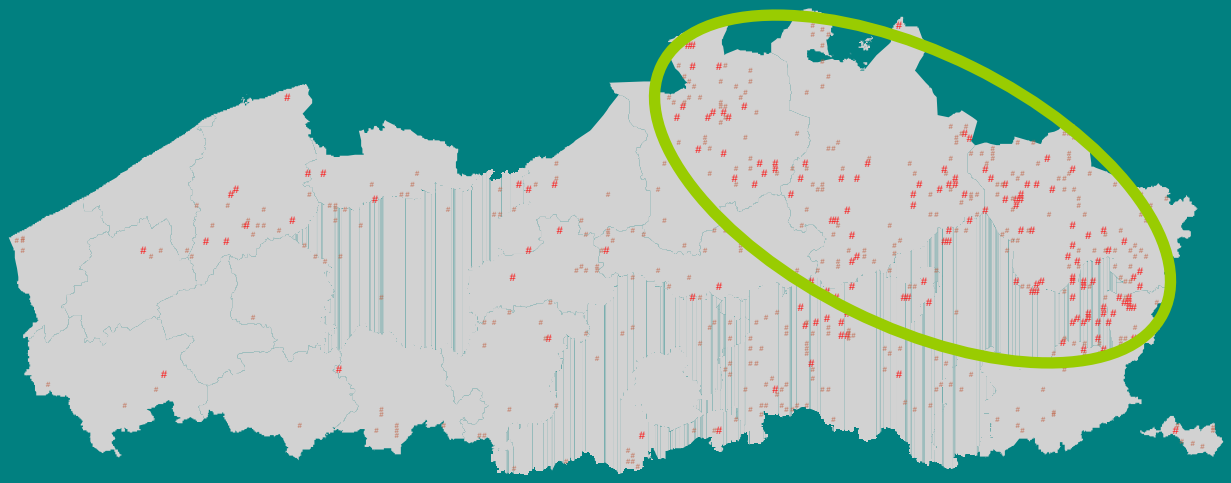
- Location variables (FFI):
  - X, Y, XY, X^2, Y^2, X^3,Y^3,X^2Y,XY^2

Factors determining *Prunus serotina* presence



$R^2_{Nagelkerke}$ = 0.33 and 70% correct prediction of validation data-set

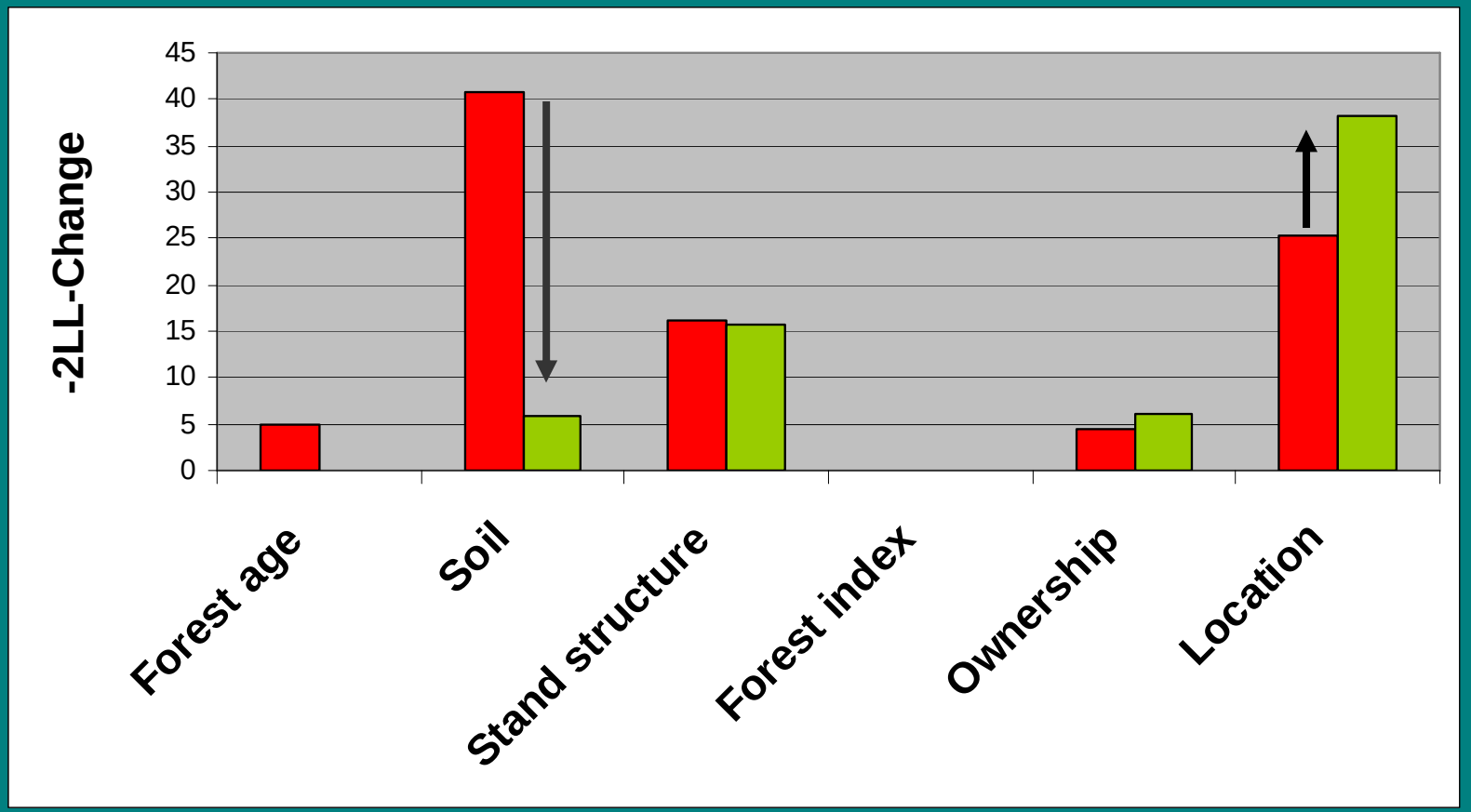
Prunus serotina presence in the Kempen ecoregion



More homogeneous site conditions: Soil ↓ ?

Region with most widespread introductions: Location ↓ ?

Flanders vs. Kempen

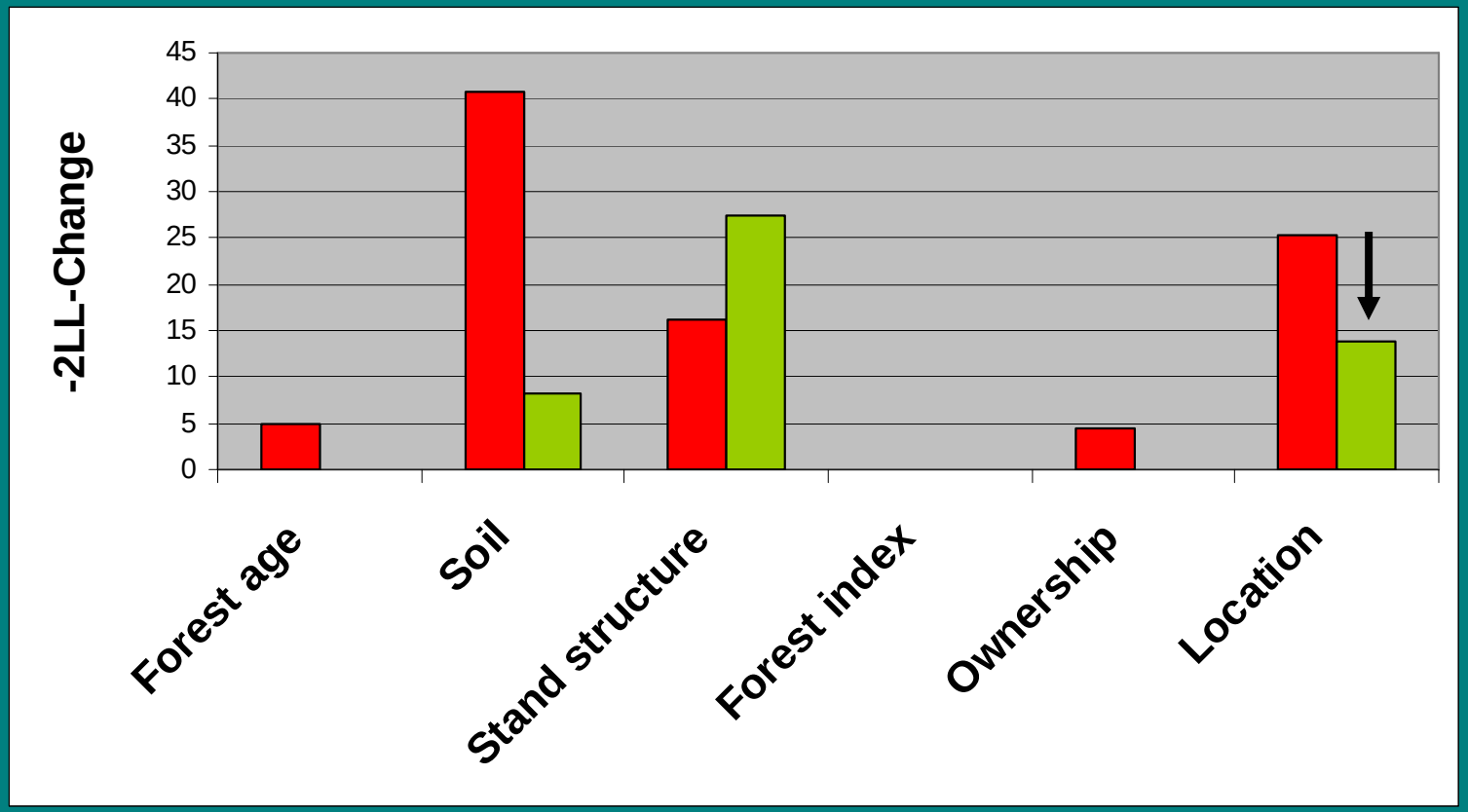


41% frequency in Kempen and $R^2_{Nagelkerke} = 0.29$

Sorbus aucuparia presence in Flanders

Native species with more or less similar ecology : Location ↓?

Prunus serotina vs. *Sorbus aucuparia*



27% *Sorbus aucuparia* frequency and $R^2_{Nagelkerke} = 0.15$

First conclusions

- Highest chances to encounter *Prunus serotina* in privately owned forest of recent origin which are located on dry, coarse textured Podzols and have a not too open canopy consisting of light demanding species.

- However, the present-day distribution patterns are still to a large extent determined by the locations of past introductions!

The regional distribution of *Prunus serotina* is dispersal limited and hence, not all potential sites have been occupied yet

Landscape scale

Study area

- Agricultural landscape in Meerhout (~ 250 ha)
- Dominant land-uses are grassland and corn
- Dense hedgerow network:
  - 511 hedgerows
  - total length of 36 km
- Partially invaded by *Prunus serotina* (~33 %)

Data collection

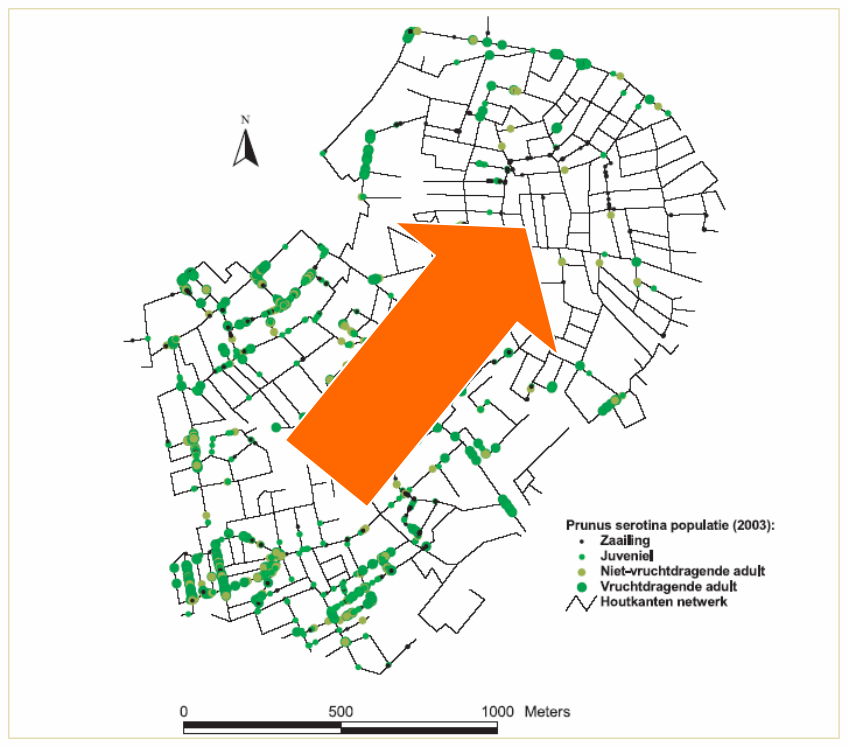
- **Localization** all *Prunus serotina* individuals within hedgerow network and height and circumference measurements
- **Age determination** on subset of 100 individuals
- Quantification of **fruit production** for a random selection of 31 *Prunus serotina* individuals
- **Frugivore observations** on a subset of 12 large, well-observable seed trees, with individual observation sessions lasting one hour (~150 hours of observation)

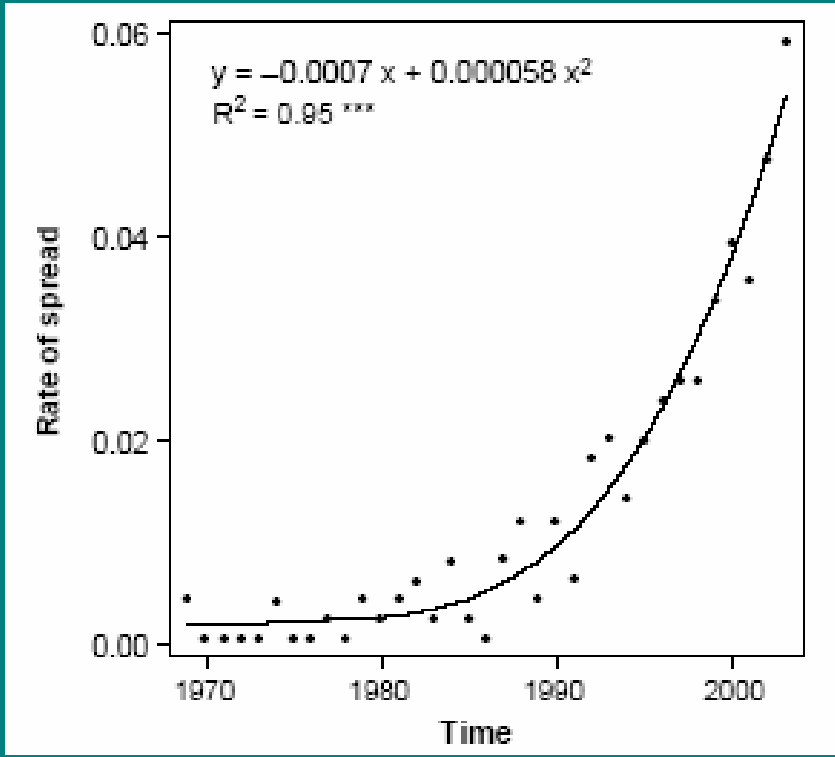
Age structure of the *Prunus serotina* population

- 2962 *Prunus serotina* individuals in total
- Preponderance of young individuals:
  - 40% seedlings
  - 35% saplings
  - 10% non-reproducing adults
  - 15% reproducing adults

Evidence for an expanding population?

Invasion patterns



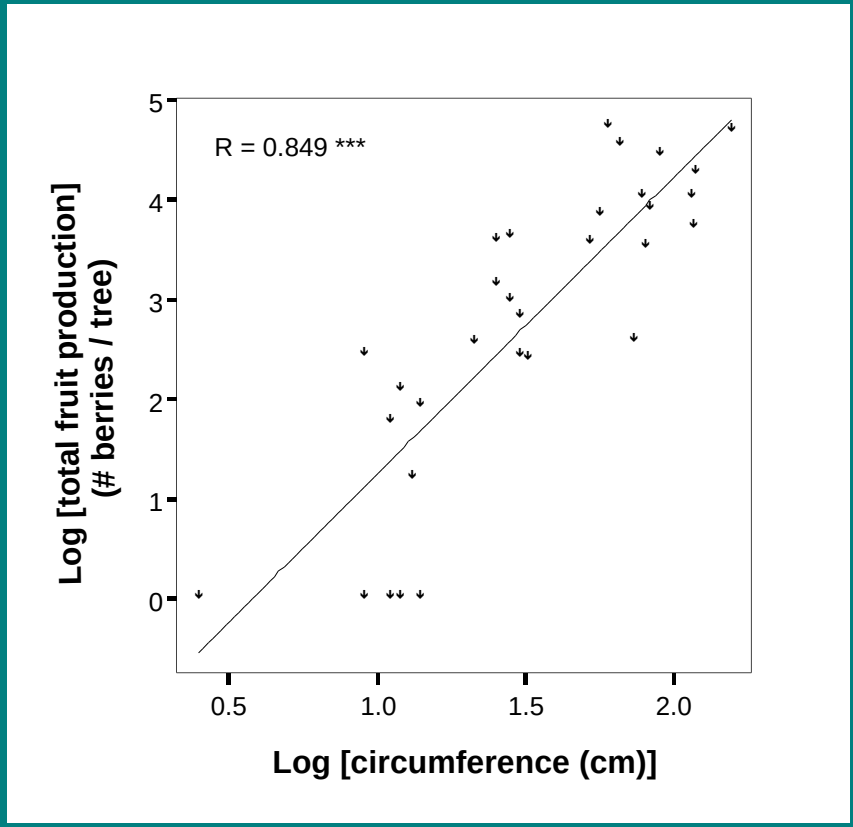


Invasion started in ~1970 and is proceeding at an increasing rate

Invasion process: seed production

- Mean seed production of 7814 berries / tree (0 – 53048)
- Strong, non-linear relationship between crop and tree size

90% reduction of seed availability by elimination of all individuals > 20 cm circ. !

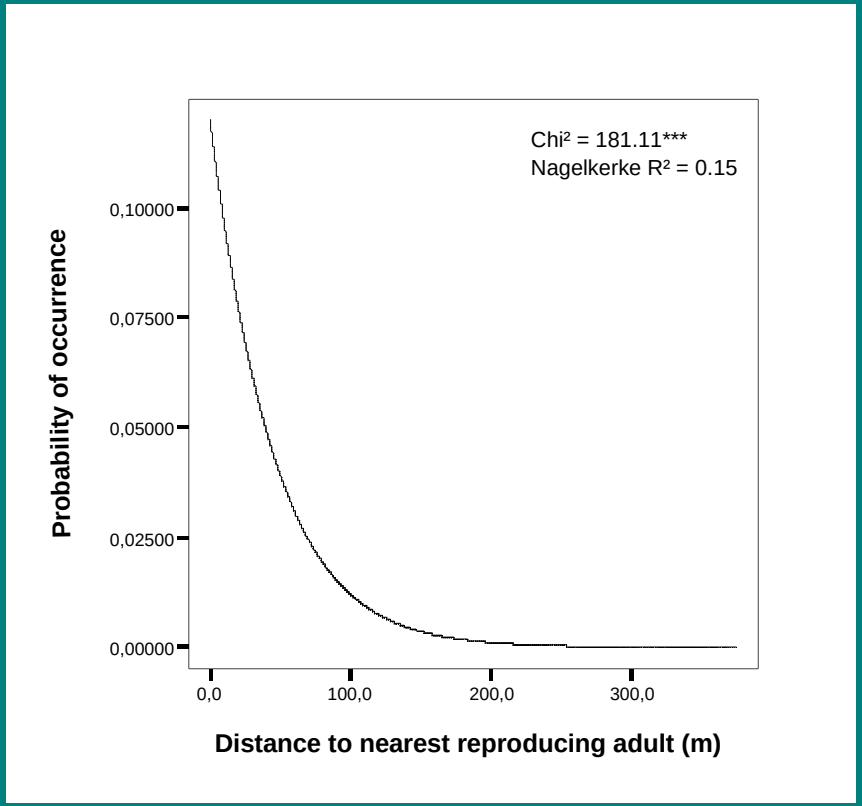


Invasion process: dispersal vectors

Woodpigeon and Blackbird responsible for, respectively, 56.4 % and 29.0 % all seeds dispersed

Invasion process: seed rain and recruitment

- Distance dependant distribution patterns of seeds and seedlings
- Association of seeds and seedlings with roost trees and hedgerow intersections



Second conclusions

- *Prunus serotina* population is still expanding at an increasing rate

- Abundantly produced seeds are mainly dispersed by two (common) vectors whose behaviour is strongly influenced by landscape structure

Management implications

Implications for management

- Unless widespread introduction and efficient dispersal, present-day distribution of *Prunus serotina* still dispersal-limited at both regional and landscape scale. Hence, **many more sites** risk to be invaded by this species.

- Need for:
  - (1) A **regionally coordinated** approach in which the limited resources are invested in landscapes where the invasion process is still ongoing.
  - (2) **Landscape-level control** programmes that focus on all sites (public and private) and eliminate the larger trees (> 20 cm circ.) in the first place.