Biodiversity and Climate Change

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Belgian Biodiversity Platform

"Jumping the garden fence gives plants a head start on climate change"

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- Setting the scene: land use changes & climate change
- Objectives
- Methods
- Results
- Discussion & conclusions

Ref: Van der Veken et al. 2007. Garden plants get a head start on climate change. Frontiers Ecology & Environment (subm.)

Land use changes

- Quality and quantity (in the past and actually)

- Extinction (rate) last 130 yrs:

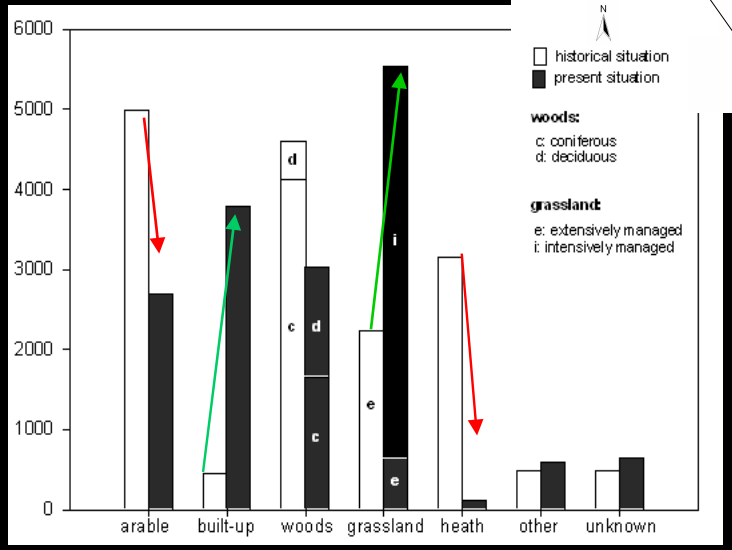
→ An urbanized region: Turnhout (Fl.; 56 km²):

→ ± 25 % of plant species (1 species / year; 0.22 %/ year)

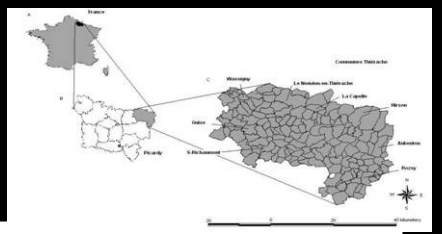
→ 15 sub-regions: av. 51 %

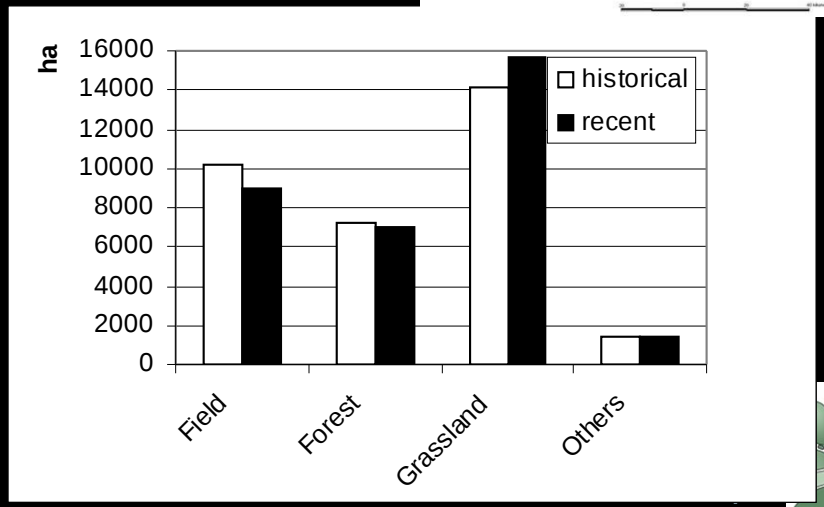
→ A rural area:Thièrache (N.Fr; 230 km²):

→ ± 22% of plant species (2 spp/year; 0.24 %/year)



Van der Veken et al. 2004 _ Flora 199





Vandenberghe 2007 – unpubl.

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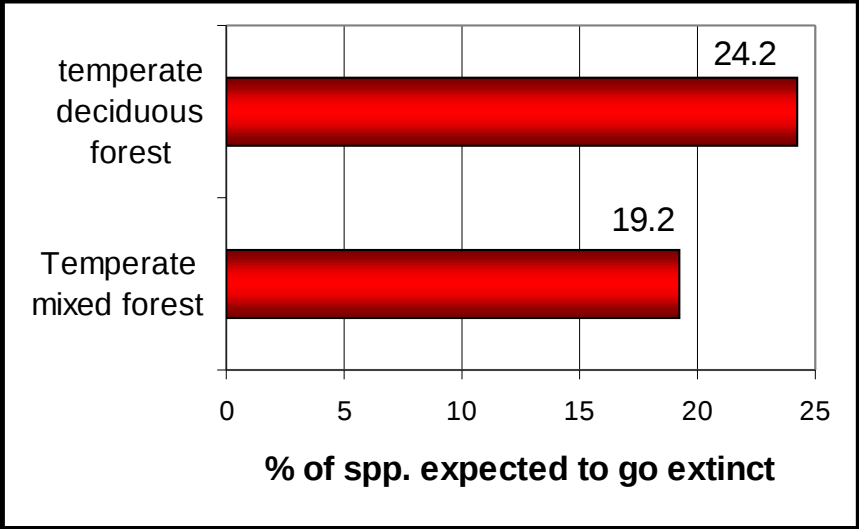
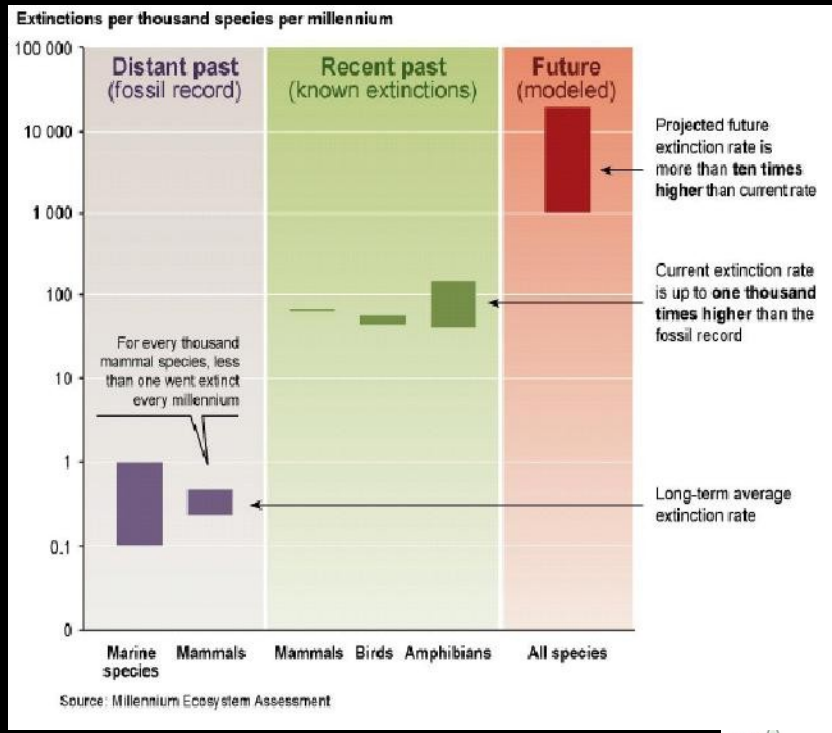
Climate change

- A rise in global temperatures (1.5 – 2.5°C)
  - extinction risk of 20-30% of plants & animals or > 10 times higher than current one +
  - extinction debt !





Thomas et al. 2004 – Nature 427

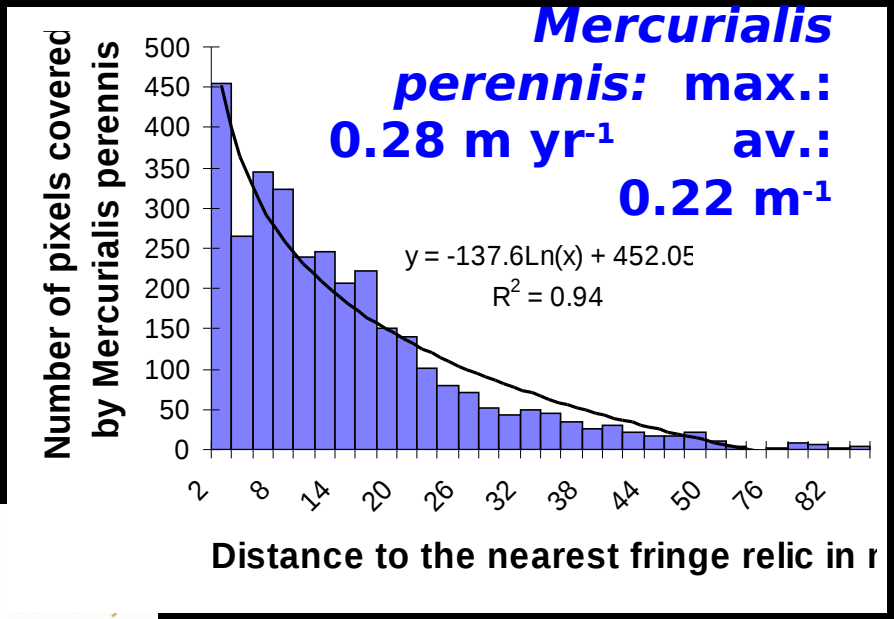
Real world migration of plant species

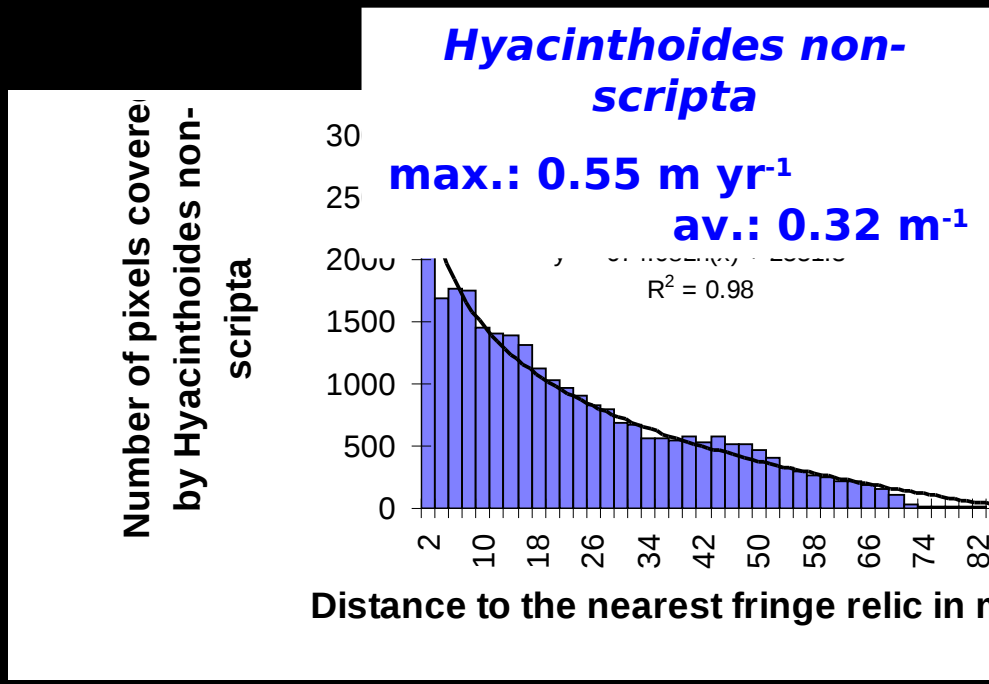
- Many species: unable to disperse sufficiently rapidly to follow global change (extra difficult low connectivity landscapes) (100-1000 m yr^{-1} to track climate change) (Malcolm et al. 2002 – J. Biogeogr. 29)

→extremely low migration rates

→"assisted migration"?

(*McLachlan et al. 2007 – Cons.Biol. 21*)





Honnay et al. 1999 – Forest Ecol. & Managem. 115: 157-170

- ➔ Widespread extinctions: 50 (-75) % species loss by the end of this century + extinction debt
- ➔ Global biodiversity crisis

- Horticulture industry provides a major pathway for cross-continental establishment and invasion of non-native species (Reichard and White 2001- Bioscience 51).

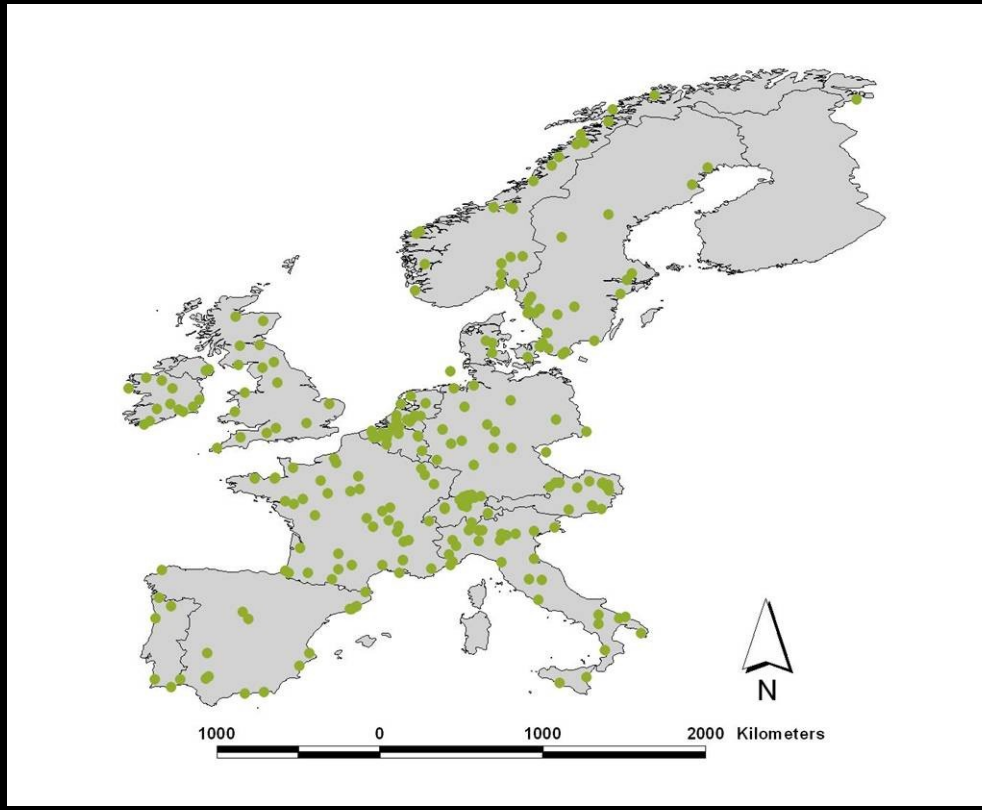
- Nurseries also distribute many native species within the continents

- Here we investigate the potential for commercial nurseries to provide a head start for northward range shifts of native European plant species in the face of ongoing climate change.
  - To what degree have we already inadvertently assisted plant migrations?

Data collection

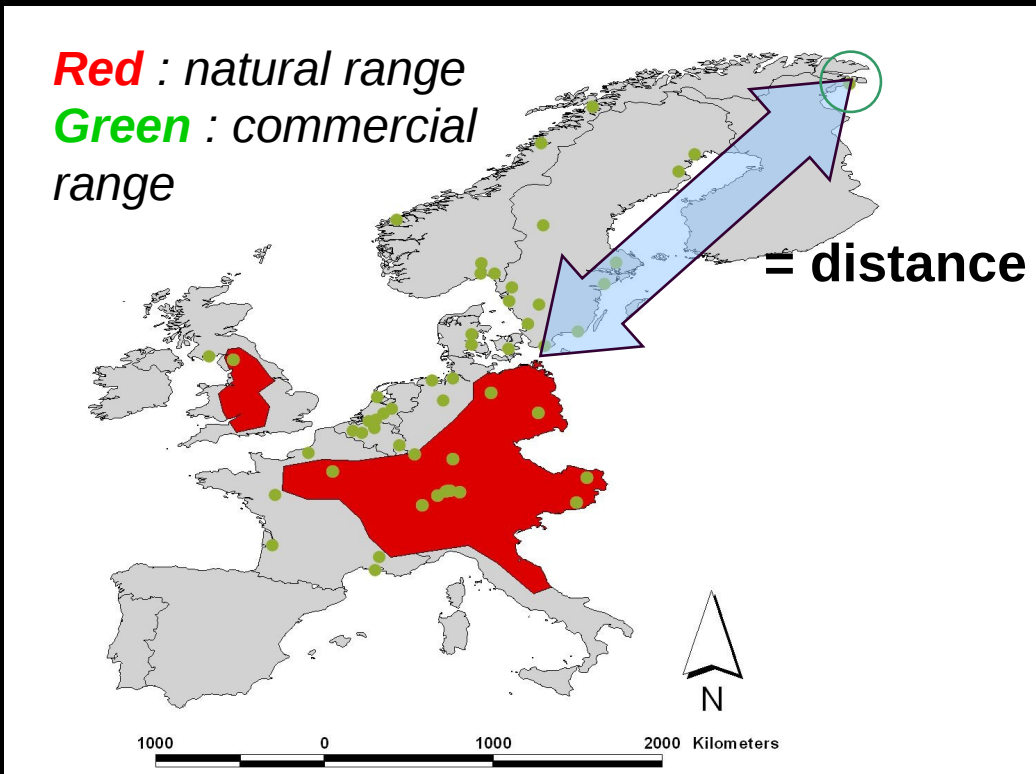
- national and international websites and databases to collect information on commercial plant nurseries in most of Europe.

- 246 nurseries were selected for this study based on their geographical location (i.e., situated along a north-south gradient and more or less evenly spread over countries) and commercial activities (large, non-specialized, locally-selling plant nurseries)
  - **data matrix : 246 catalogues x 12,424 (sub-) species (**excl . Forms, varieties, cultivars and hybrids)



- Successful establishment of introduced species strongly influenced by **propagule pressure** = estimated for horticultural plants as the **number of nurseries** where a species is sold → we restricted our analysis to (sub-) species that were sold in at least 25 plant nurseries (~10% of our sample) → reduced data matrix to 575 (sub-) spp.

- For all species native to Europe (**N = 357, 62%**),
- the distance between the northern edge of the 'commercial range' (= northern most plant nursery in which the plant was sold) and the northern edge of the 'natural range'



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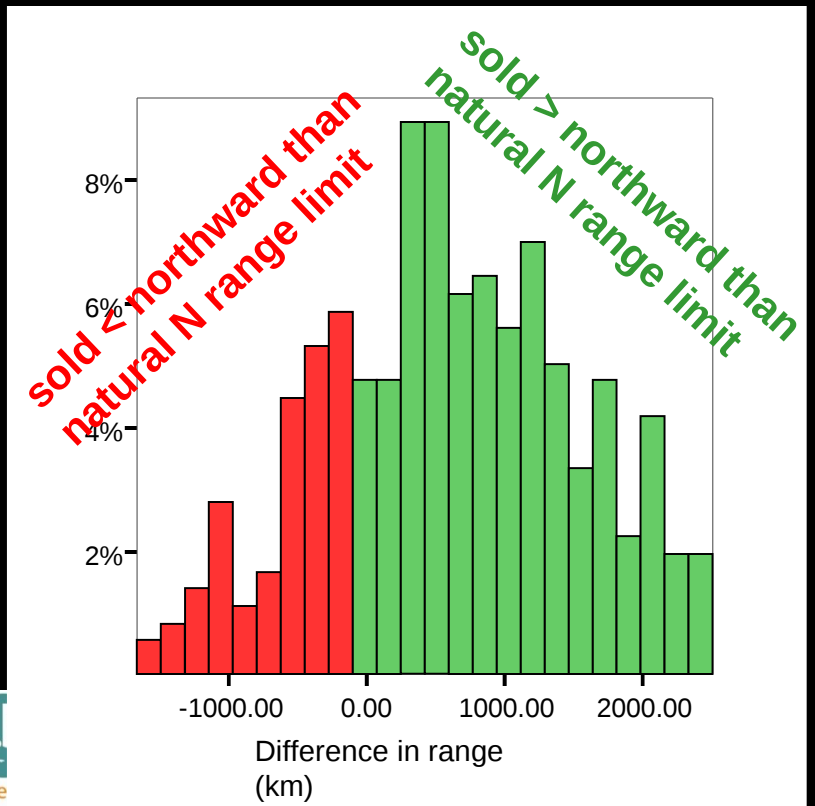
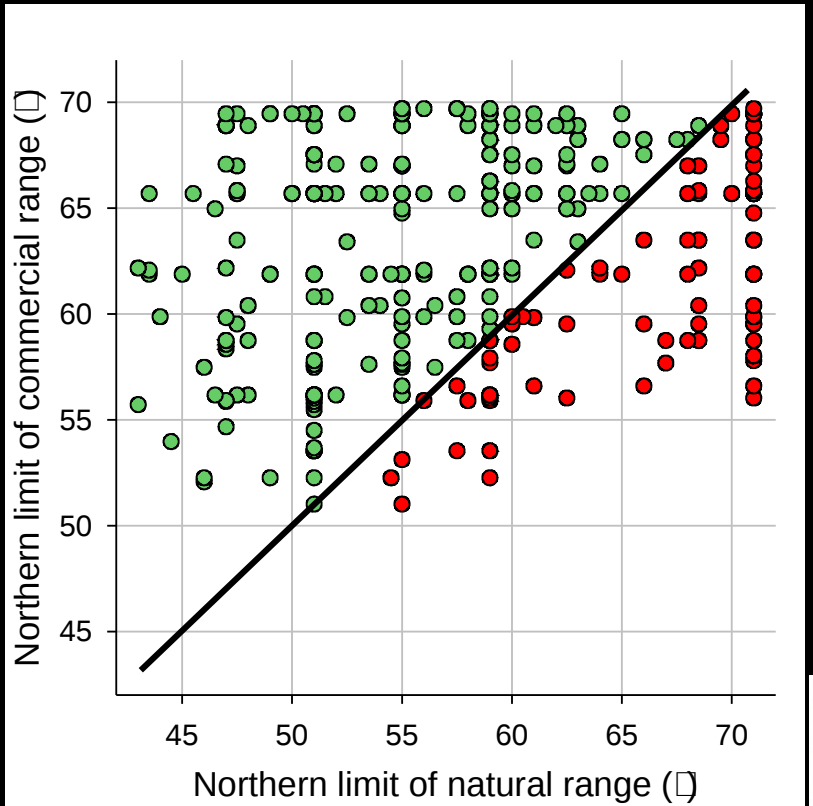
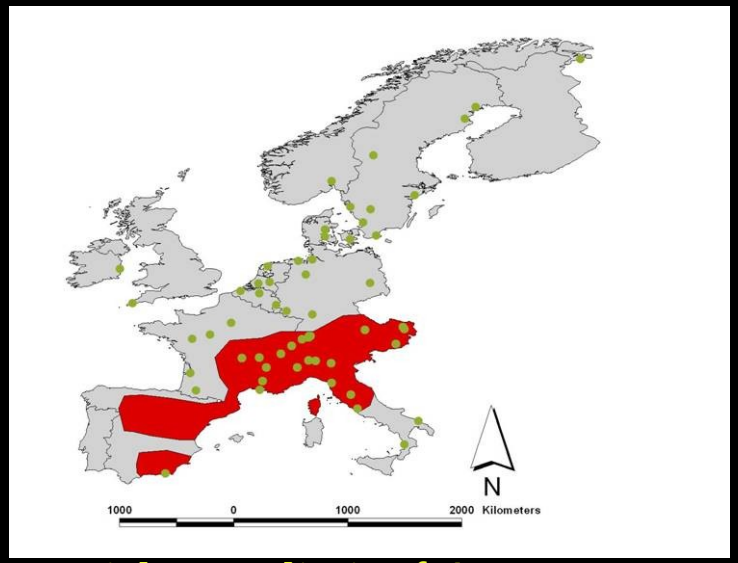
- Of the 357 native plant species ➔ 260 (=73%) were sold in at least one nursery further north than the natural nothern geographic range limit.
- Commercial N range limit exceeded the natural N geographic range limit by a mean of **1009 ± 632 km** (SD) for these 260 spp. and 588 ± 900 km for all 357 native spp.

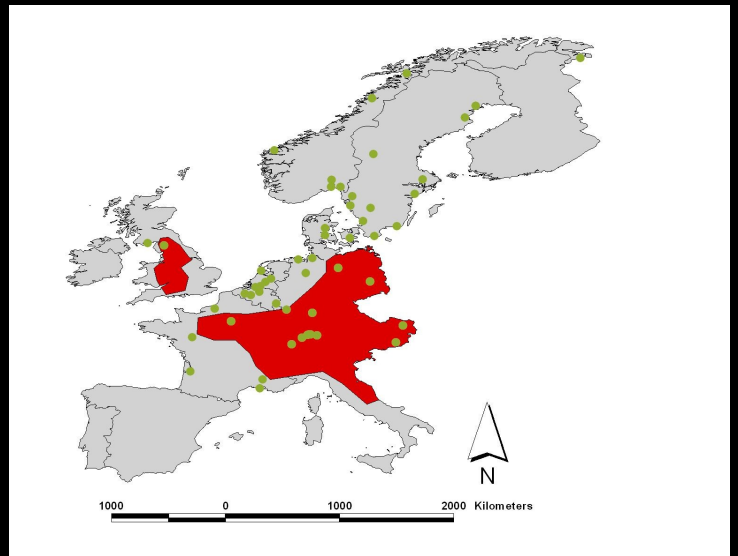




The northern commercial range limit of *Saponaria ocymoides* (69.46°N) exceeds the natural northern range (47.50°) by >2400km.



The. northern commercial range limit of *Asarum europaeum* (69.46°N) exceeds the natural northern range (55°) by >1600km.



- Presence of 260 spp. in nurseries 100s of kms further north than their natural range limits provides a big head start for migration in the face of anthropogenic climate change
- Extending range limits via horticulture may have a profound impact on the northward movement of plants → this may avert extinction
- Horticulture may cause the future native flora of N Europe to be biased towards “desired” species in particular plant families (overrepresentation of *Lamiaceae, Ranunculaceae* and *Rosaceae*)

- Horticultural centers & gardens, far north of the species' natural range limits essentially represent small outlying populations (have been extremly important in the past range shifts during the Holocene (McLachlan et al 2005 – Ecology 86))
- The idea of "assisted migration" suggests the promise of helping species avert extinction allowing them to keep pace with climate change, but it also presents the potential for all of the risks typically associated with the introduction of exotic species
- While the debate on assistend migration rages on, it is clear that we already have given an unintentional head start on climate change to many species across the earth.

Jumping the garden fence

Thanks for your attention