

# ICP Forests

## Establishing a link between pollen dispersal, seed production and throughfall dissolved organic carbon (DOC) flux in temperate forests

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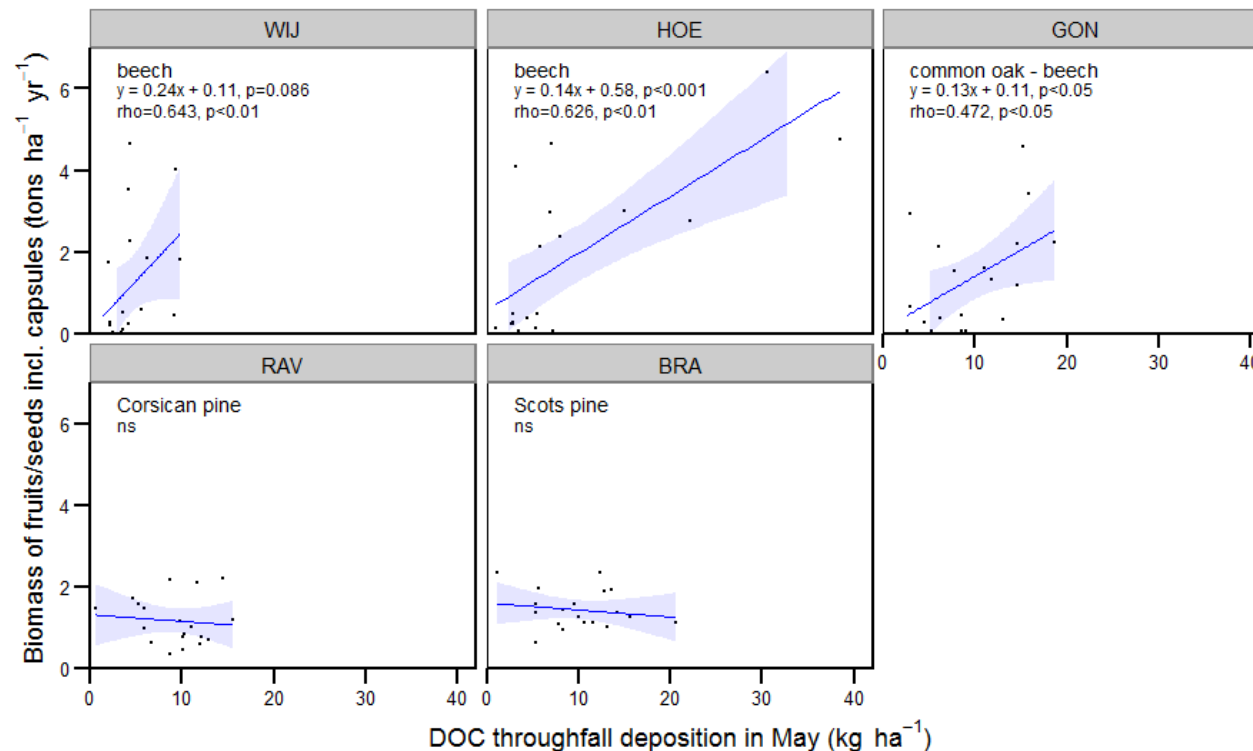
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## Background of this study

- We occasionally observed high throughfall (TF) DOC fluxes in May in Flemish Level II plots
- TF DOC peaked particularly in masting years for beech and oak but not pine

### Biomass of fruits/seeds incl. capsules vs. TF DOC flux in May (1999-2017)







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## Aim of this study

1. Check whether pollen air concentration is linked with fruits/seeds production in forest stands (oak, beech, pine)
2. Investigate whether pollen and/or flowers contribute to throughfall DOC (internal source of C)



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## What could release additional DOC in mast years?

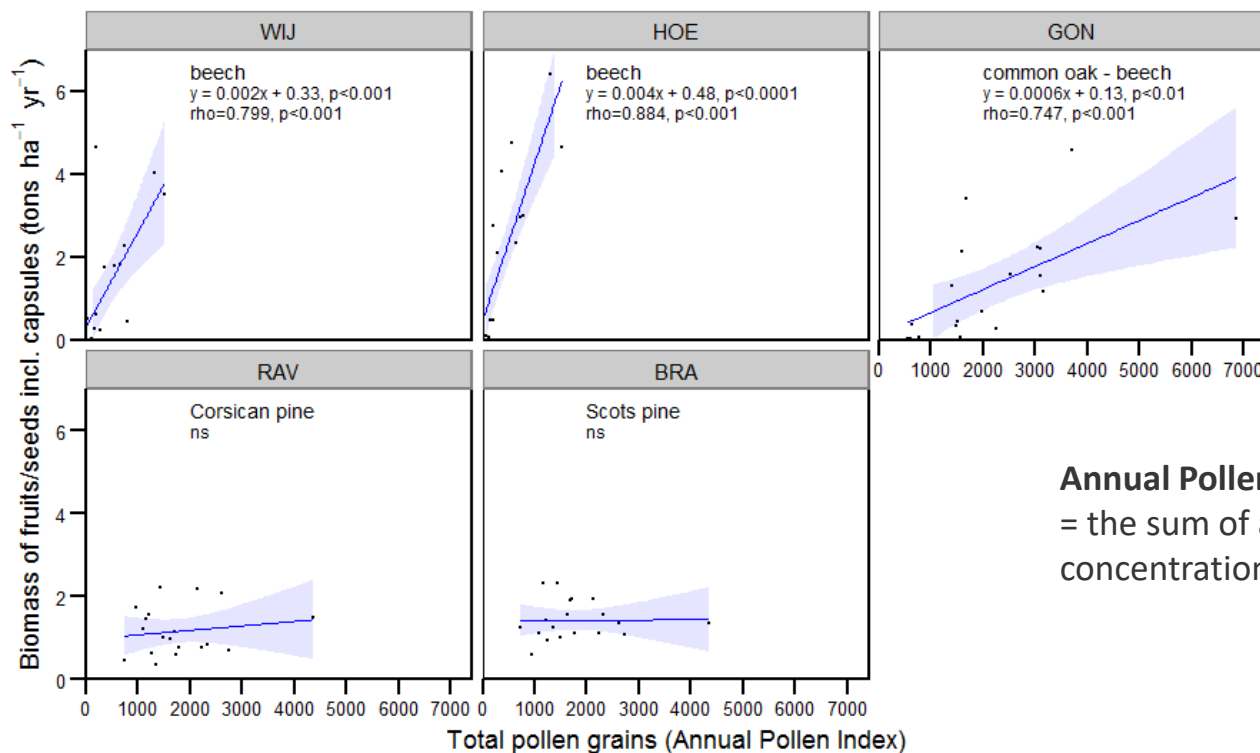
- **Pollen**
  - possible source of DOC, among others (Le Mellec et al. 2010)
  - distribution peaks in April-May
  - considerable year-to-year variation in concentration
  - but pollen grains (50-100  $\mu\text{m}$ ) don't pass the 0.45  $\mu\text{m}$  filter
  - any dissolvable compounds? Pollen contains 200 substances including proteins, amino acids, carbohydrates, lipids and fatty acids, phenolic compounds, enzymes, coenzymes, vitamins and bio-elements (Komosinska-Vassev et al. 2015)
- **Flowers?**

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## RESULTS

### 1) Link between fruits/seed production and pollen air concentration? YES!

#### Biomass of fruits/seeds incl. capsules vs. Annual Pollen Index (1999-2017)



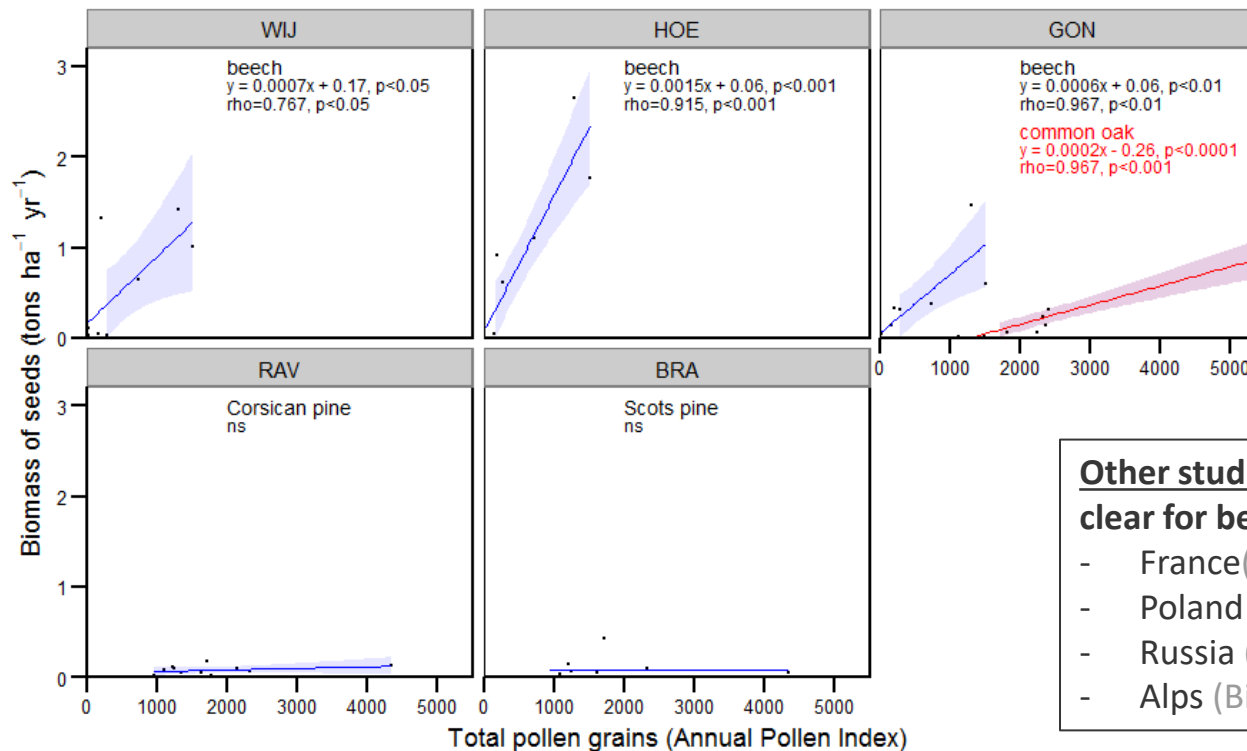


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## RESULTS (preliminary)

### 1) Link between fruits/seed production and pollen air concentration? YES!

#### Biomass of seeds vs. Annual Pollen Index (2009-2017)



#### Other studies:

clear for beech, less for oak, not for pine

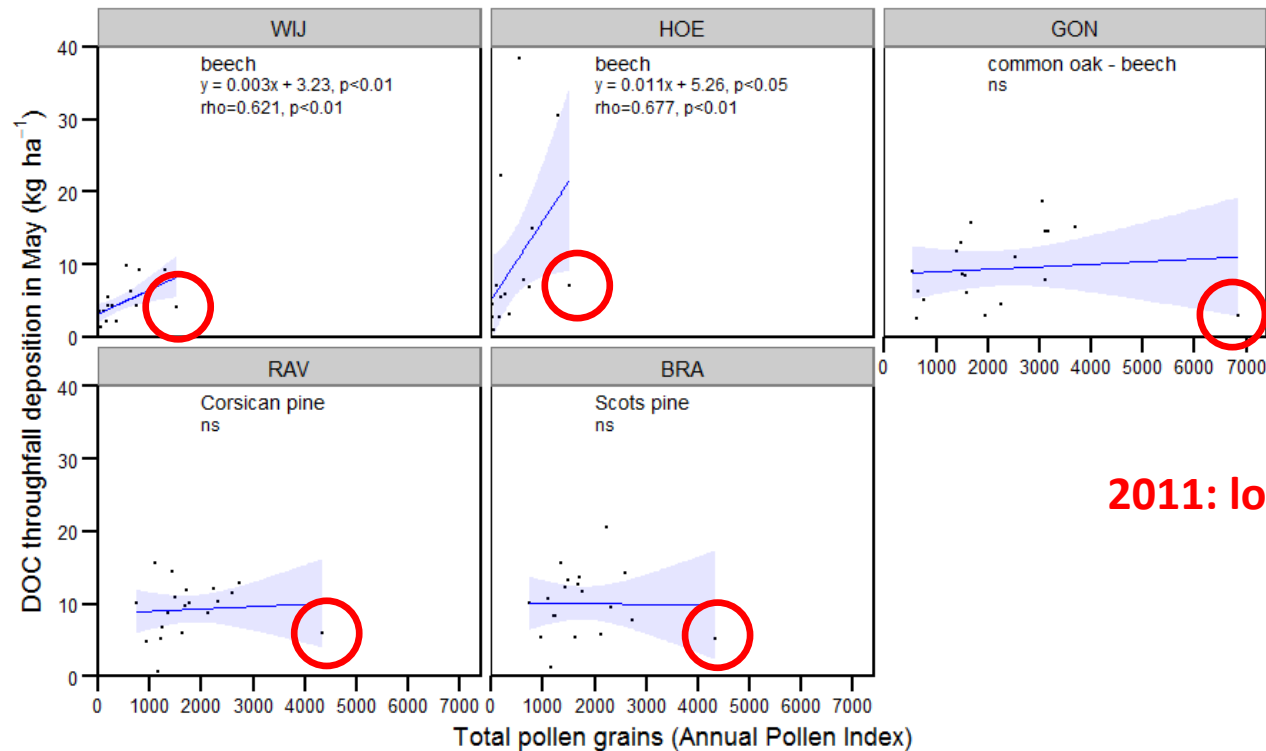
- France (Lebourgeois et al. 2018)
- Poland (Bogdziewicz et al. 2017)
- Russia (Kasprzyk et al. 2014)
- Alps (Bisi et al. 2016)

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## RESULTS (preliminary)

### 2) Link between TF DOC and pollen air concentration? YES!

#### Throughfall DOC vs. Annual Pollen Index (1999-2017)



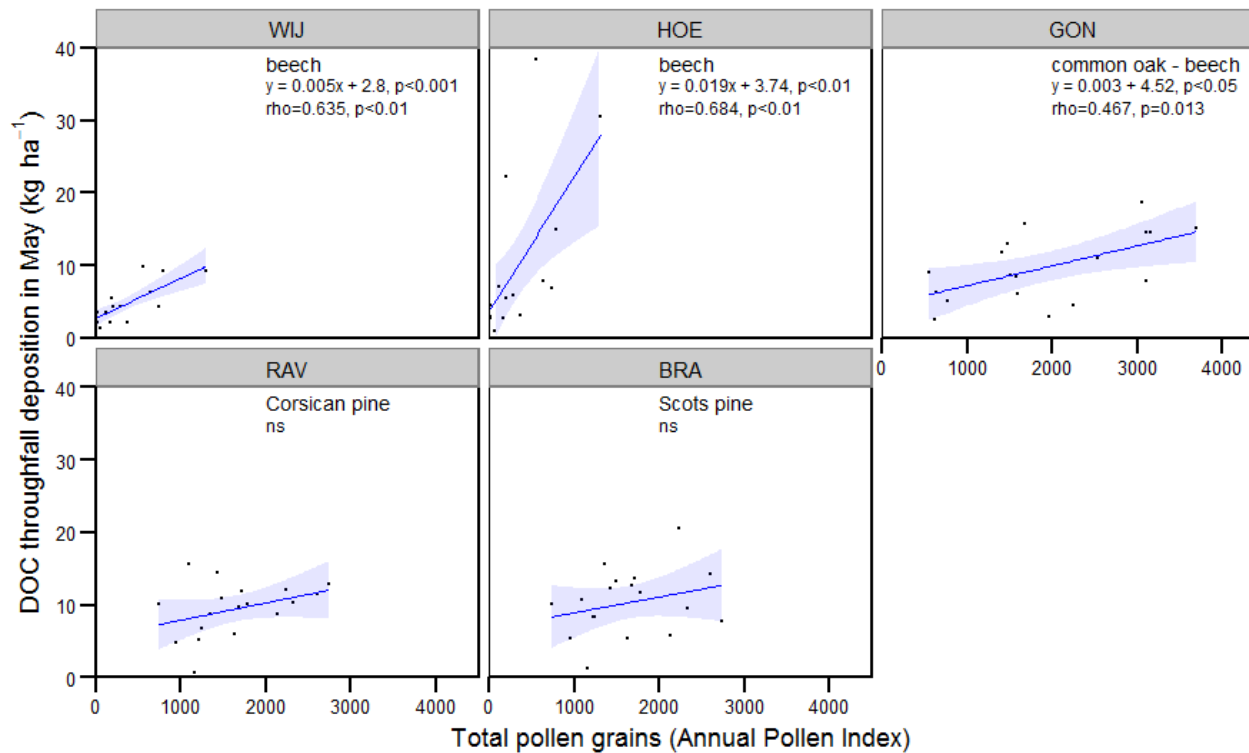
2011: low rainfall in May

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## RESULTS (preliminary)

### 2) Link between TF DOC and pollen air concentration? YES!

With 2011 excluded





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## Pollen sampling (April-May 2017)

We collected pollen (oak, beech, pine) from flowering branches incubated in glass greenhouse boxes at INBO











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## Next steps

- Include data from other Level II plots (Italy, UK, Norway, Finland, France, ...)
  - more clear relationships?
  - more tree species (*Picea abies*, *Abies alba*?)
  - **challenge**: get sites with long-term data (pollen + TF DOC + fruits/seeds)
- Wash pollen (flowers) with demineralized water and analyze the solution
  - DOC concentration
  - C thermal fingerprinting
  - C fractionation (acids/neutrals/bases, hydrophobics/hydrophilics, ...)?
- Same analyses for 0.45 µm filtered throughfall samples collected in April-June (2016 and) 2017
  - are there similarities indicating DOC release from pollen/flowers in TF samples?
- Analyze filters?
  - dry weight of residue
  - possible to determine the fraction of pollen?
- Analyze the pollen?



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## Preliminary conclusions

- TF DOC occasionally peaked during spring (May) in deciduous forests, particularly in mast years.
- Clear relationship between pollen air concentration and seed production for beech and oak, but not for pine.
- Clear relationship between pollen air concentration and TF DOC for beech and oak; less clear for pine.
- The availability of long time series (19 years) allowed to demonstrate these relationships (not every year is a MY, many factors influence fructification).
- No clear relationship for pine because:
  - often less explicit MY (Nussbaumer et al. 2016)
  - less year-to-year variation in pollen distribution
  - cones/seeds develop over 2-3 years
  - pollen data for all *Pinus* species combined
- **Link between pollen (flowers) and TF DOC will be further explored.**





**Thank you for your attention!**