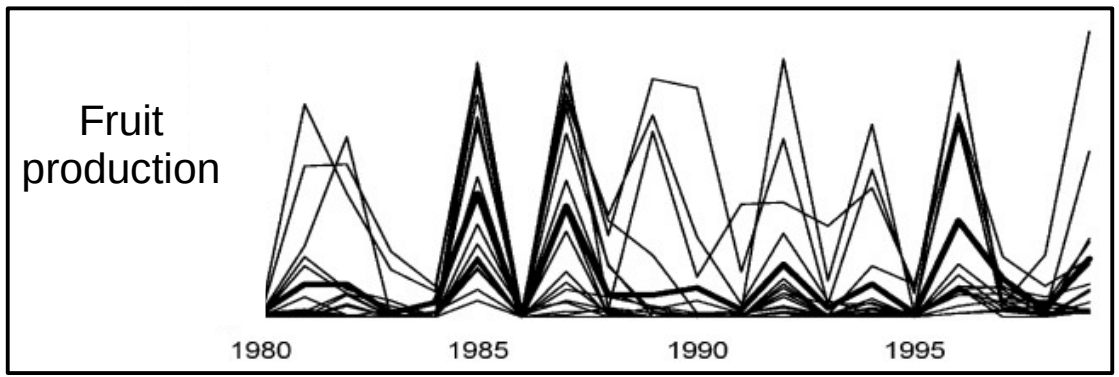
Climate change, shifting flowering phenology and their consequences on the reproduction of oak trees

Fleurot Emilie,

Bel-Venner Marie-Claude, Schermer Eliane, Boulanger Vincent, Delpierre Nicolas, Delzon Sylvain, Boussau Bastien, Oliver Gilles, Venner Samuel

Masting, a reproductive strategy with cascading effects

Masting : A reproductive strategy characterized by **massive**, **intermittent** and **synchronized** seed production



Liebhold *et al*., 2004

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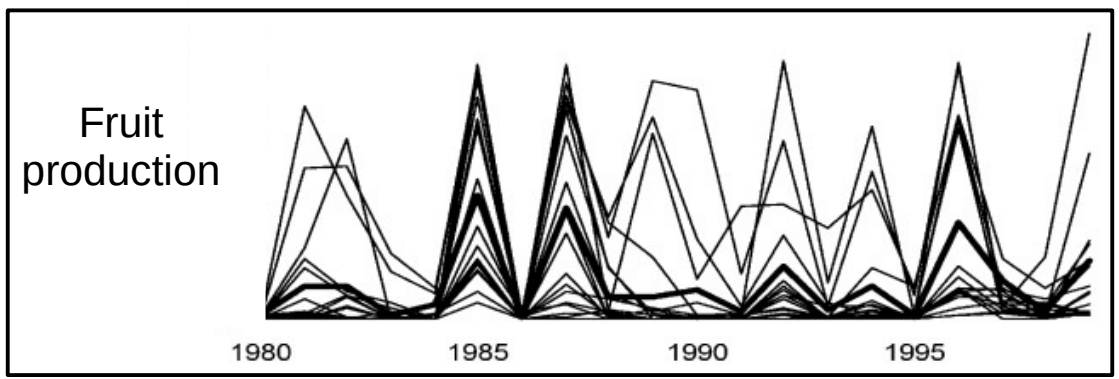

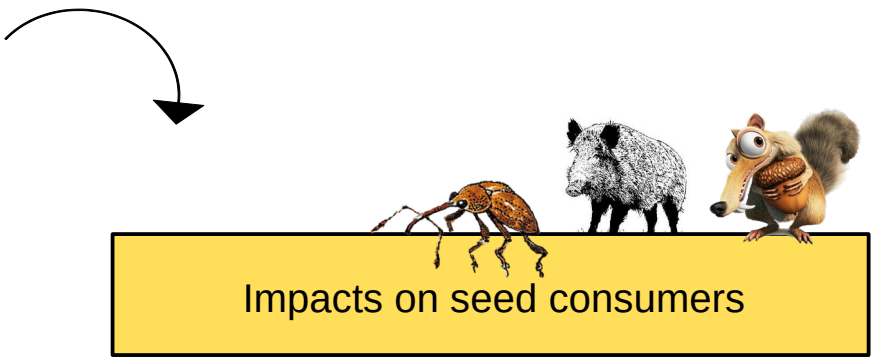

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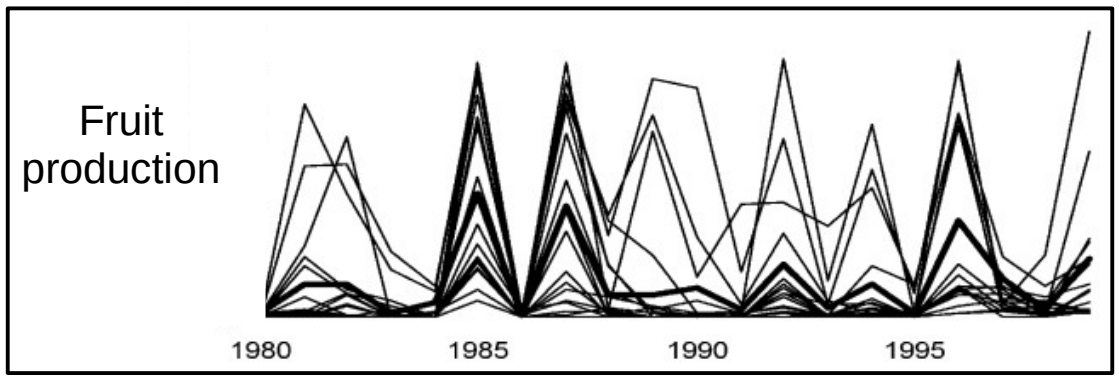

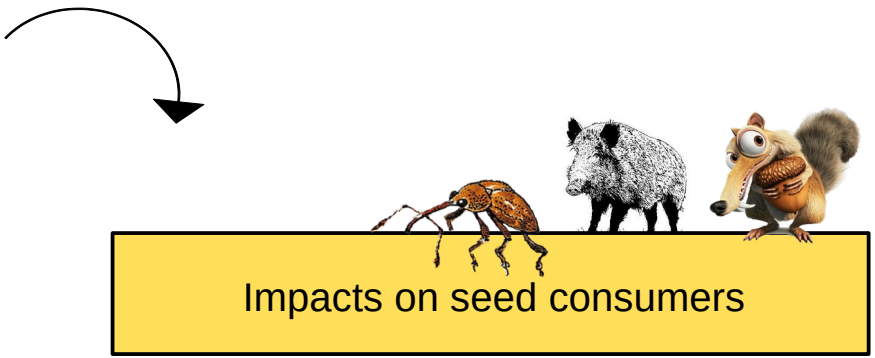

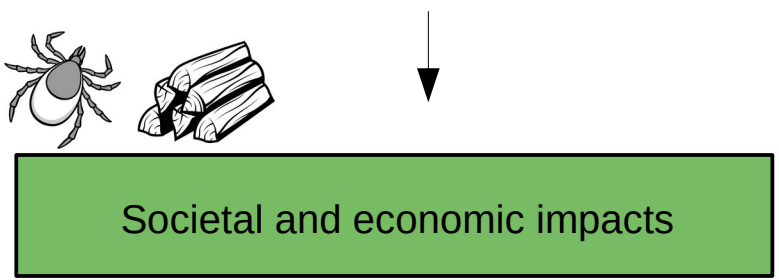

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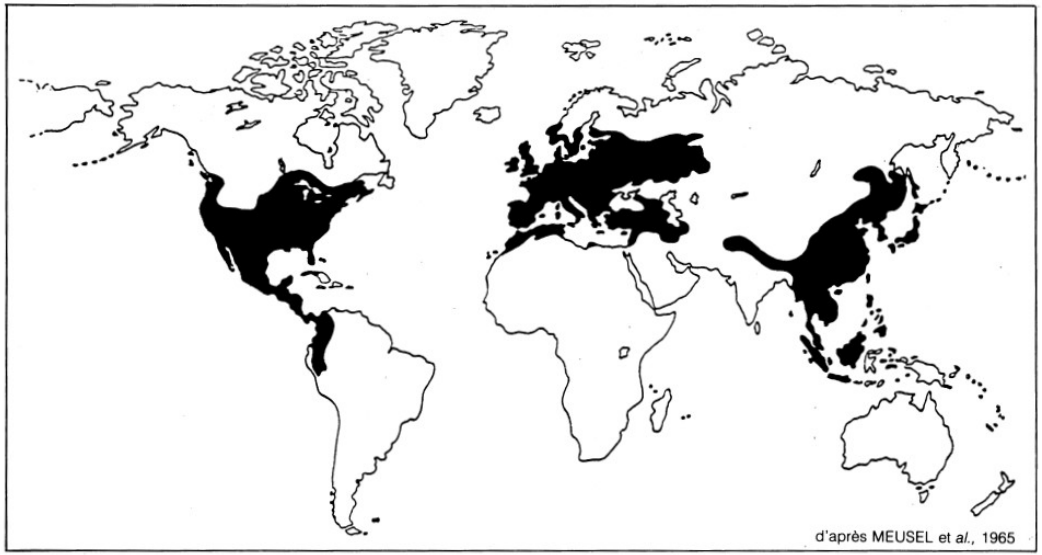
Oak masting impacts numerous ecosystems

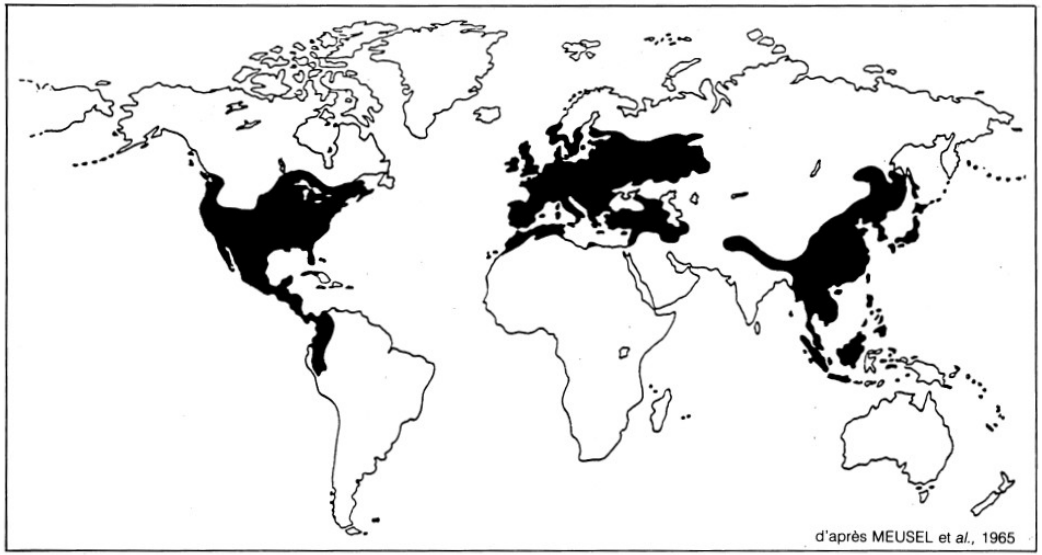


R. Keller, 1987

Oak masting impacts numerous ecosystems

→ More than **430 species**

→ **24 %** of French forest cover



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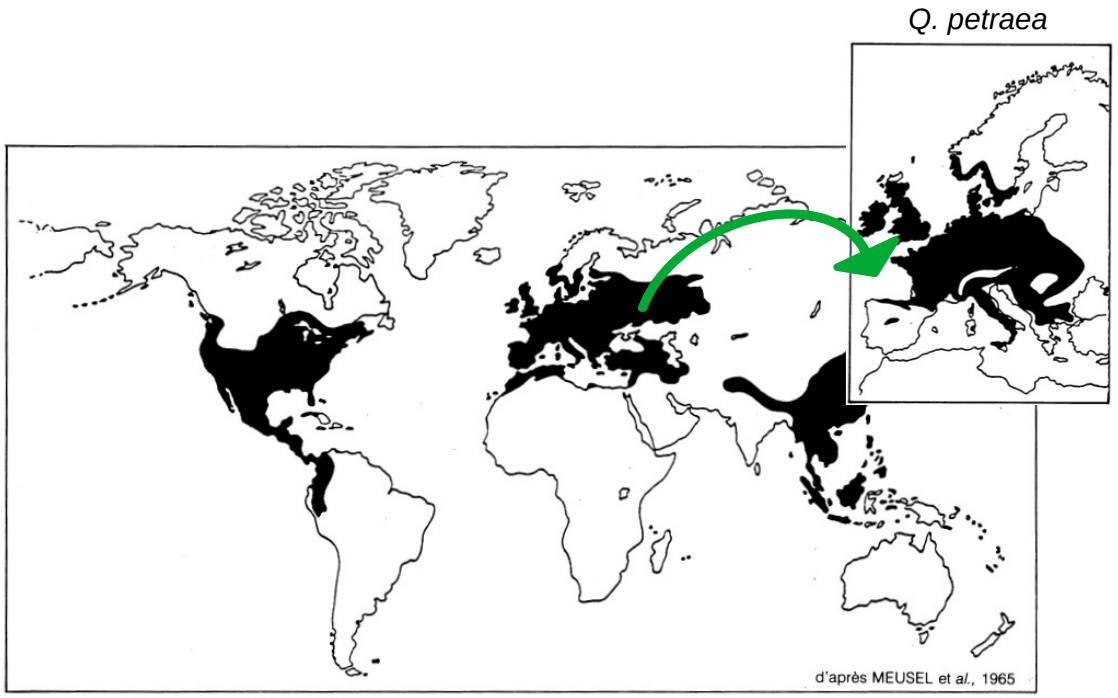

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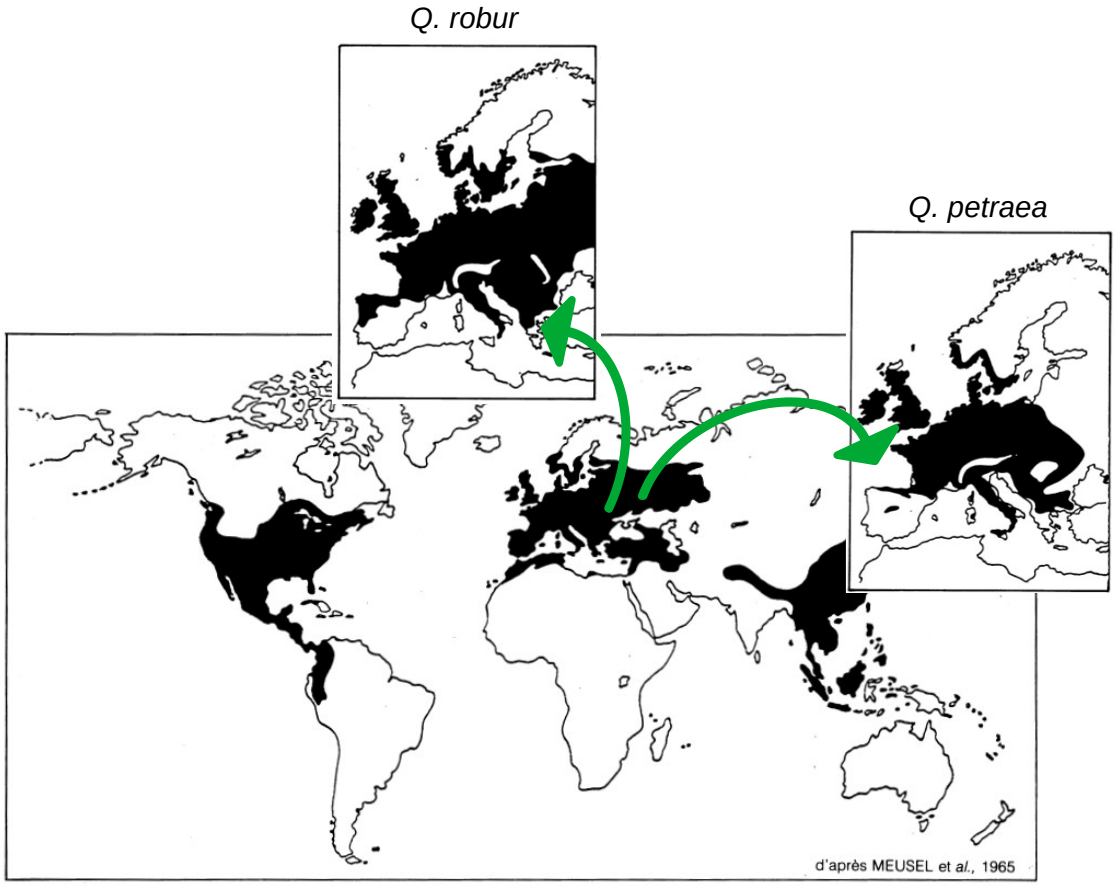

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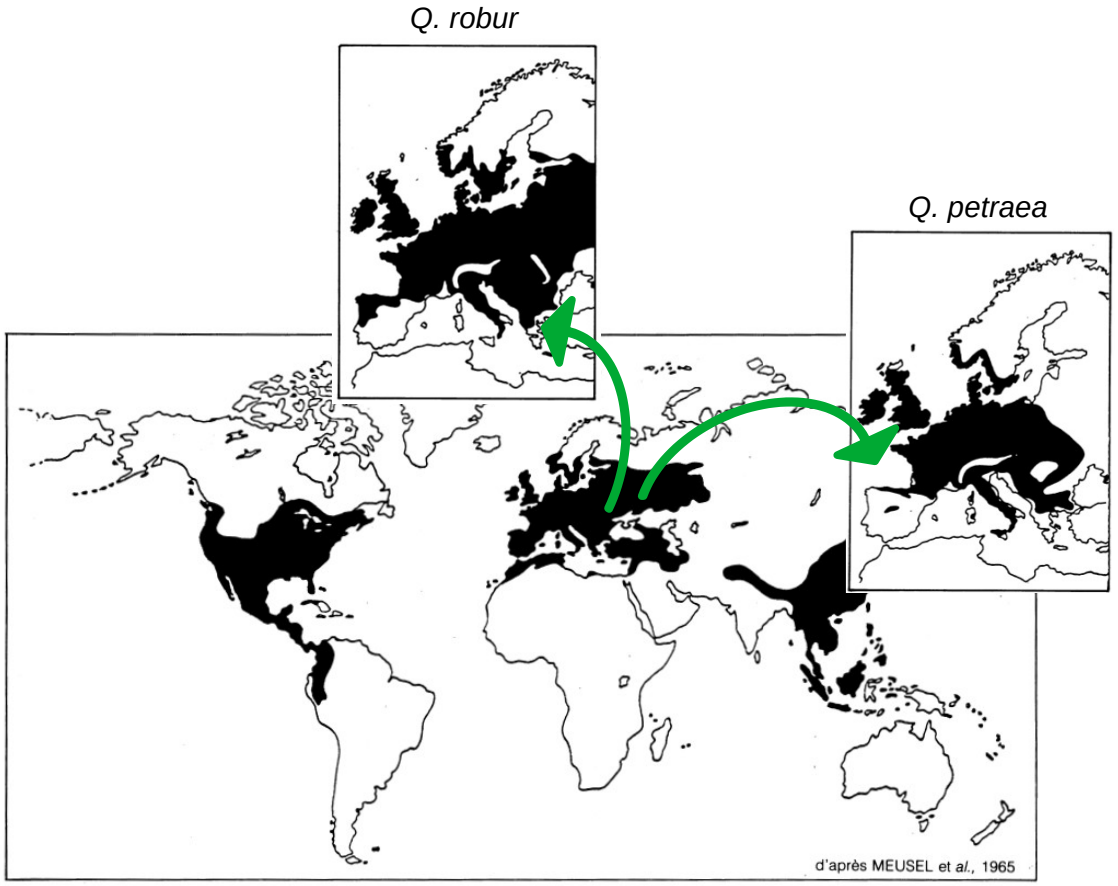

Changes in the context of climate change will have large scale impacts

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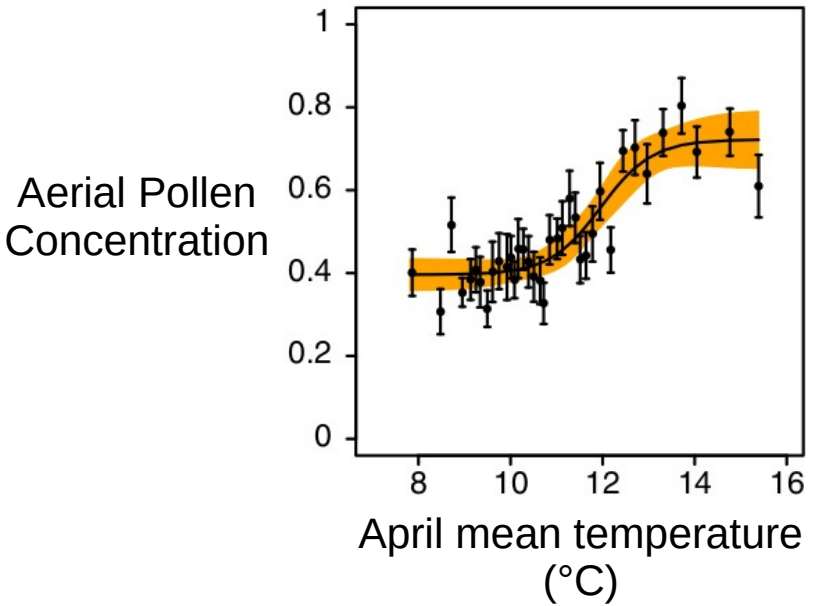
Spring temperatures influence oak masting

→ Pollen concentration **increases** with april's temperatures



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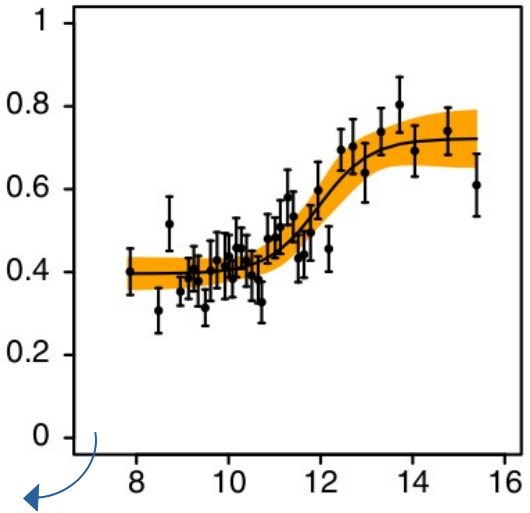

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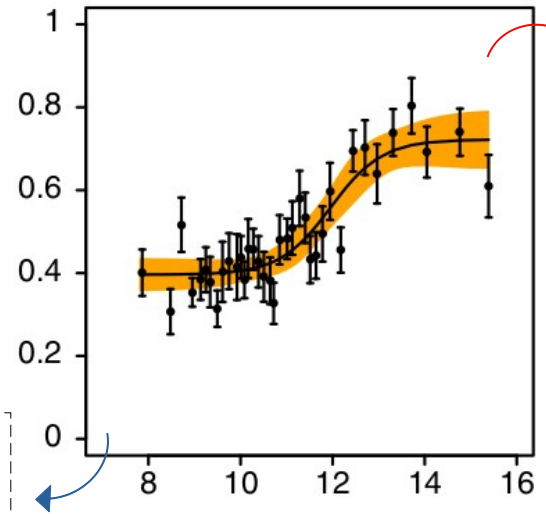

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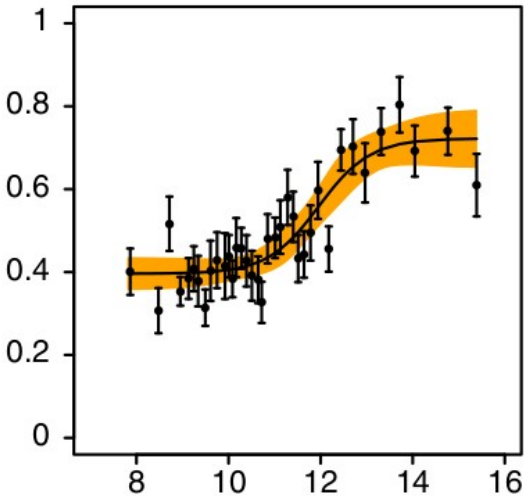
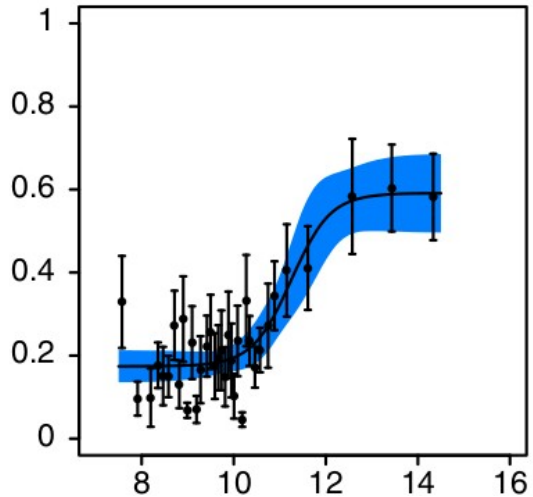
Aerial Pollen Concentration



Intensity of annual fruit production



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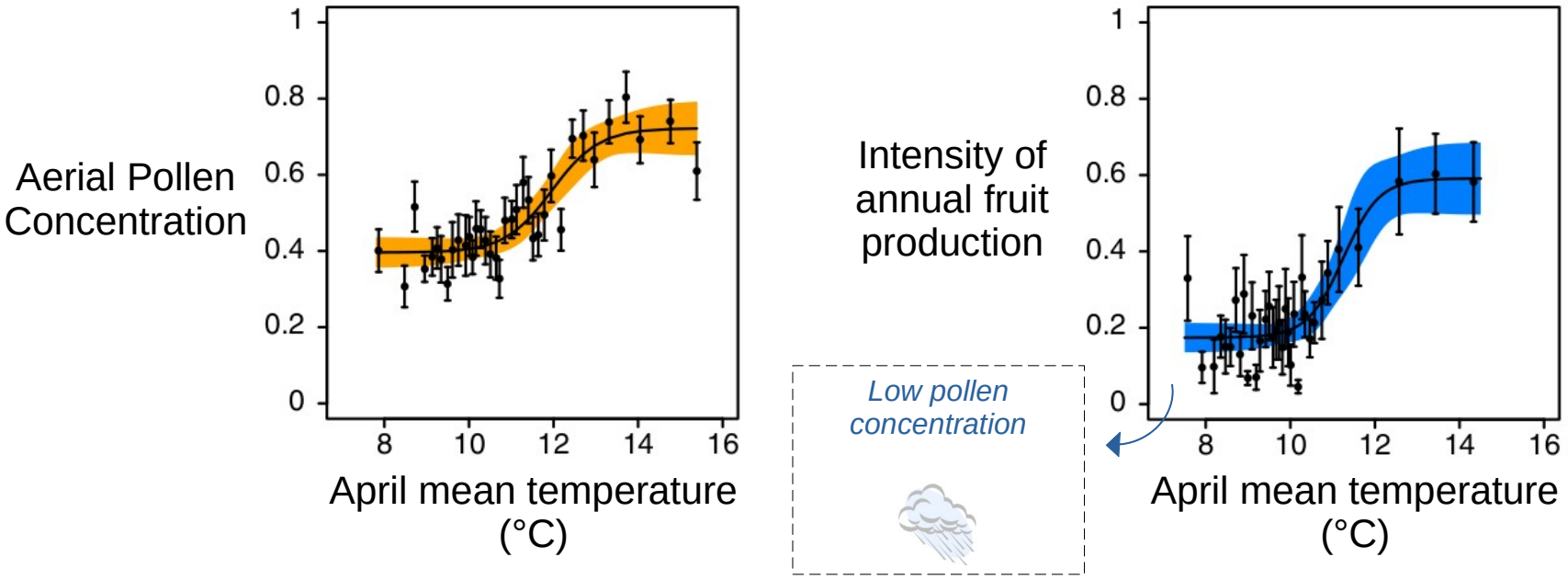

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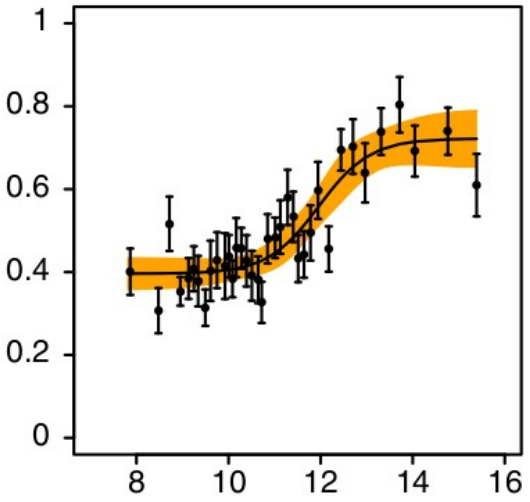

April mean temperature (°C)

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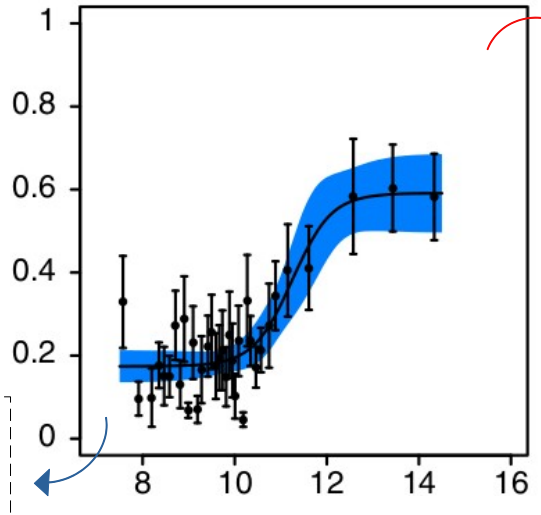

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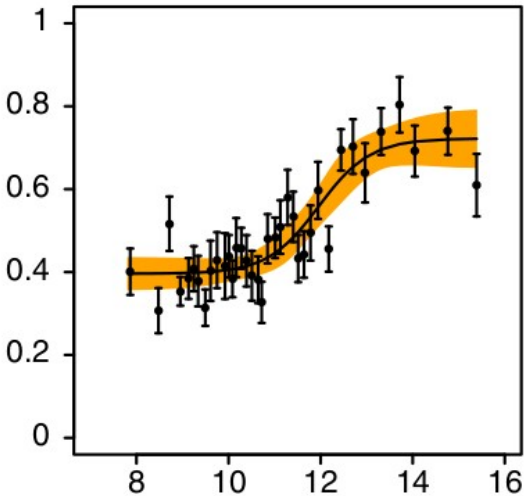

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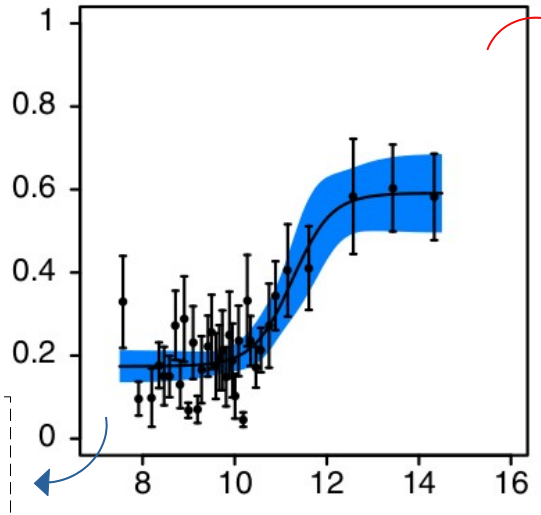

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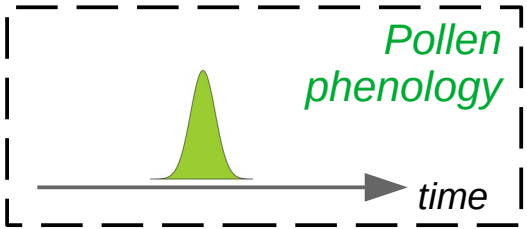
↘ **Climate change** could impact pollen limitation and thus oak masting

Schermer *et al.*, 2019

Pollen phenology influence pollen limitation



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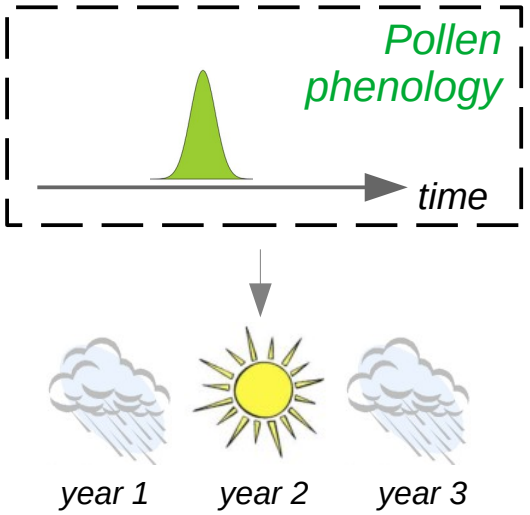

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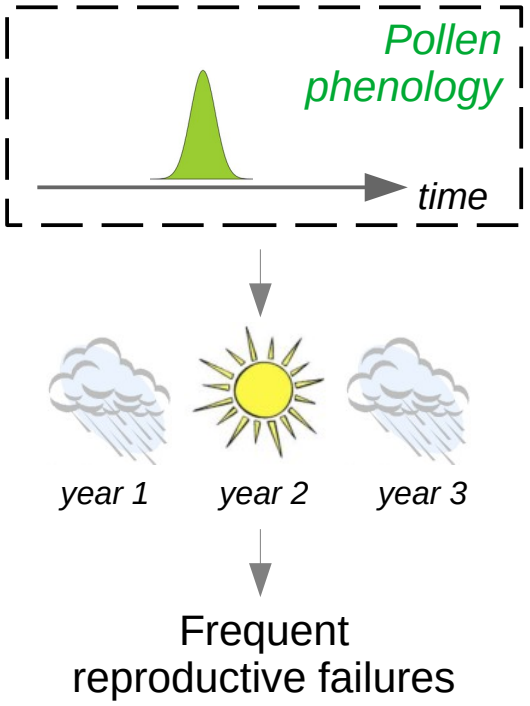

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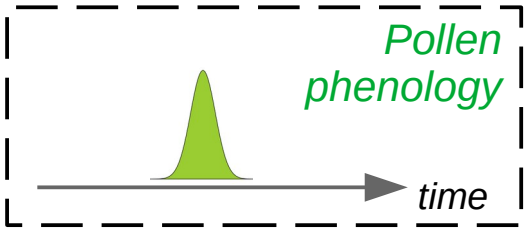
How will pollen phenology respond to climate change ?



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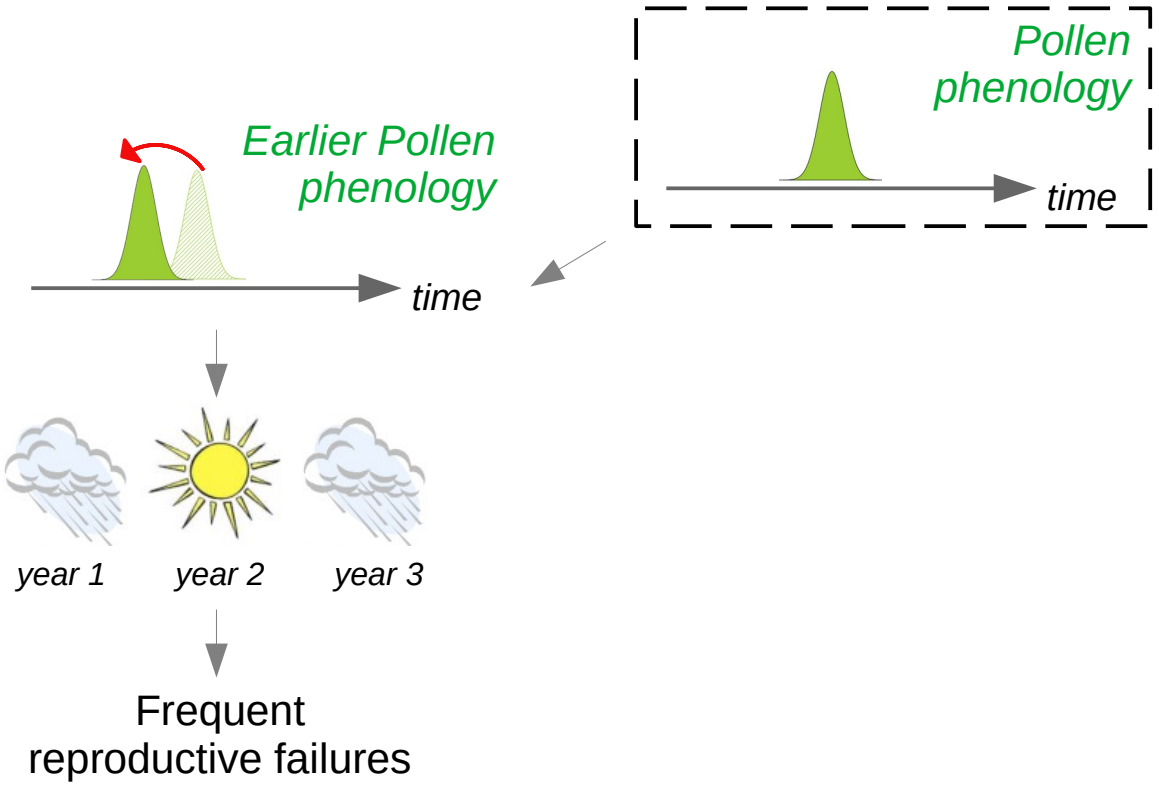

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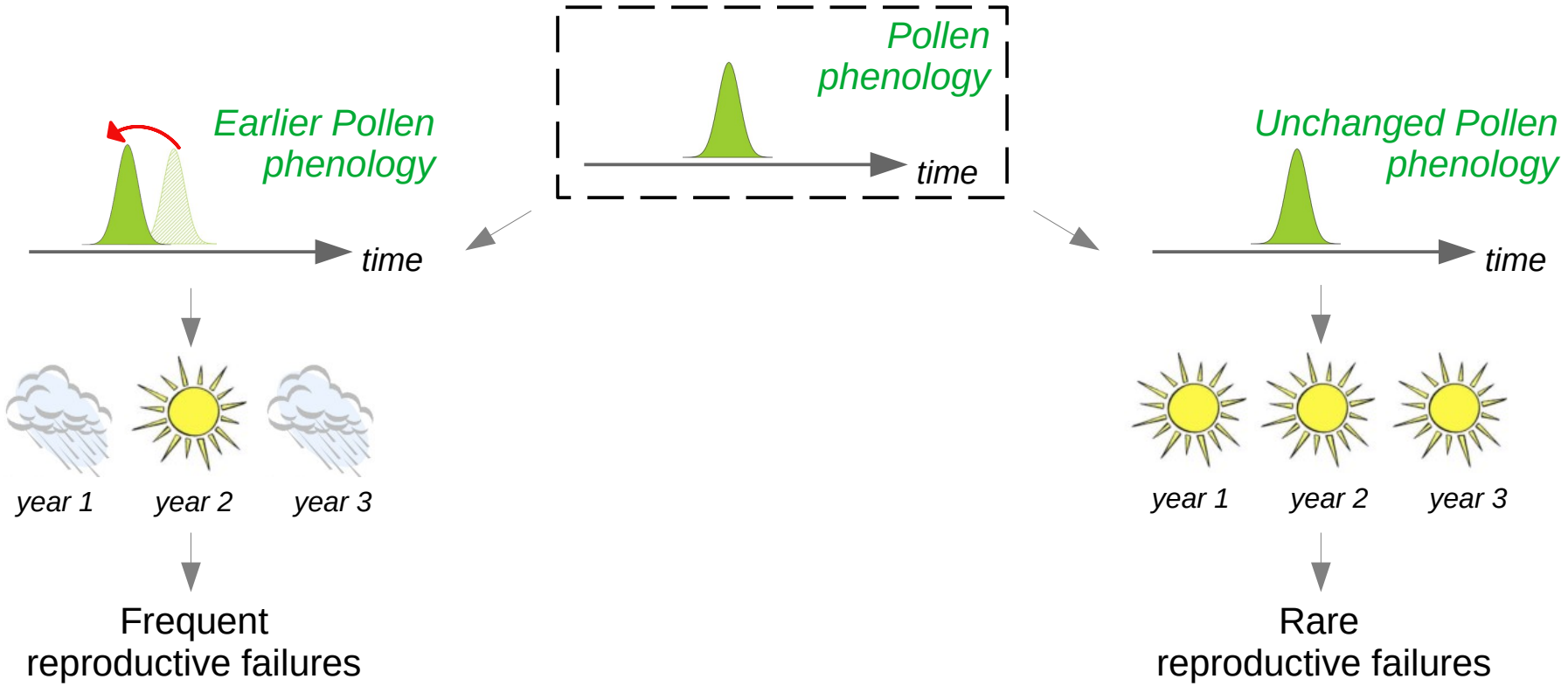

Using large datasets to detect changes in pollen phenology

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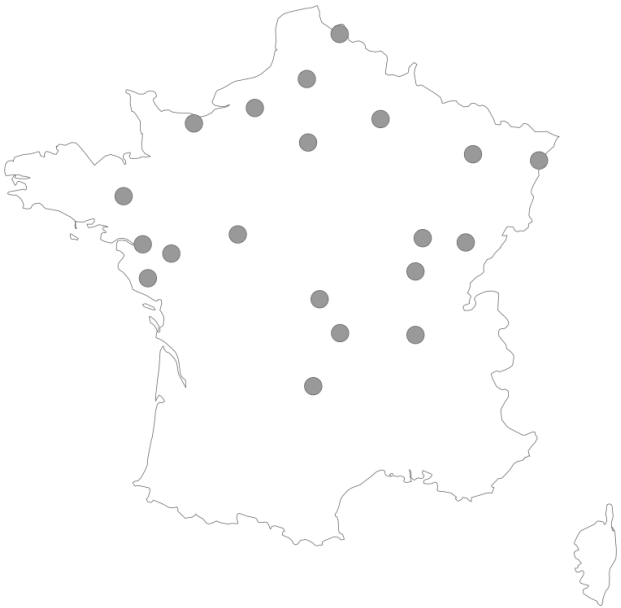
RÉSEAU NATIONAL DE SURVEILLANCE AÉROBIOLOGIQUE



33 years (1987 – 2020)
20 sites

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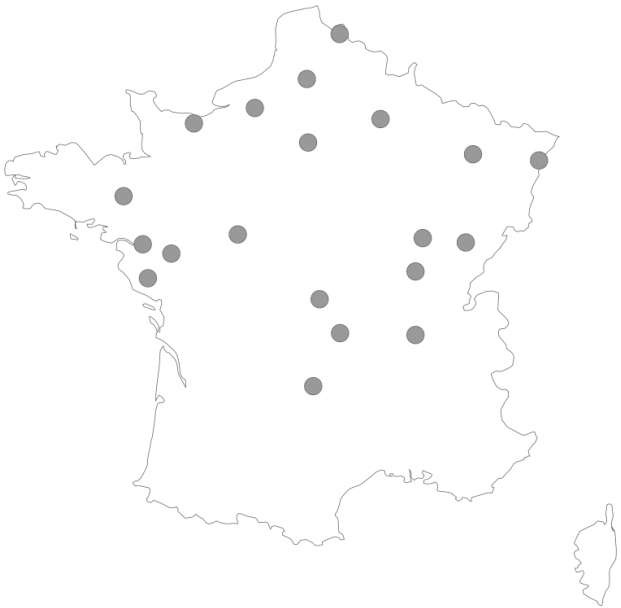

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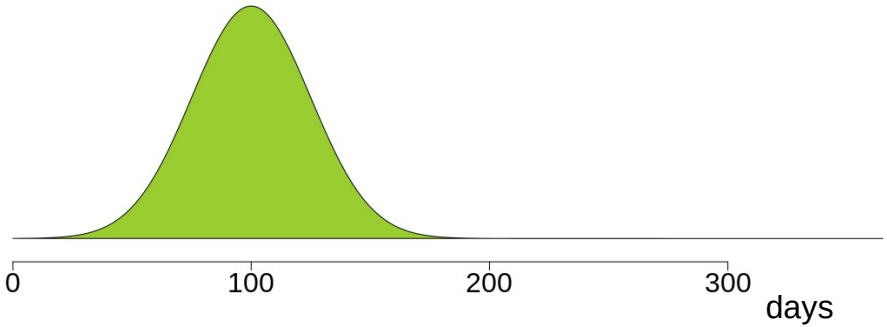

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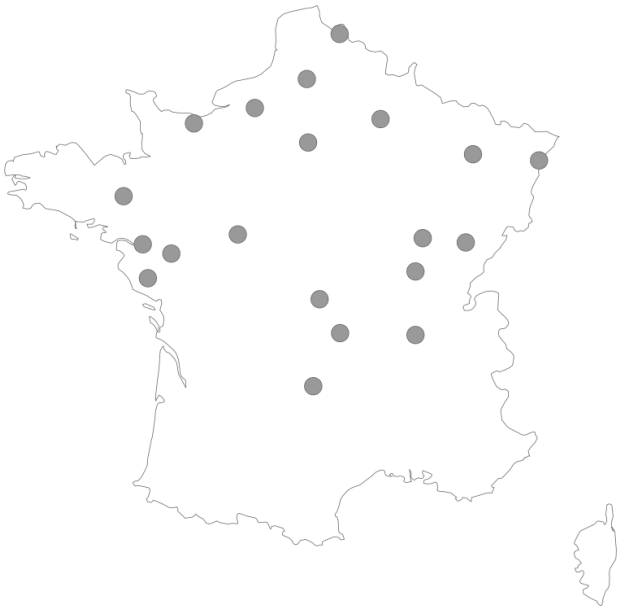

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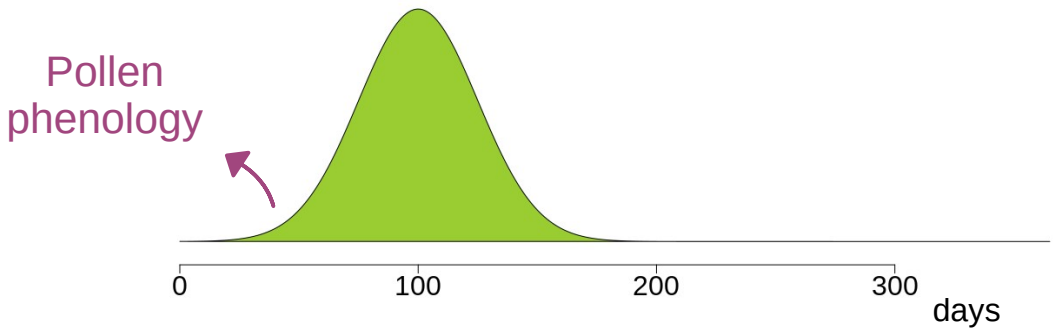

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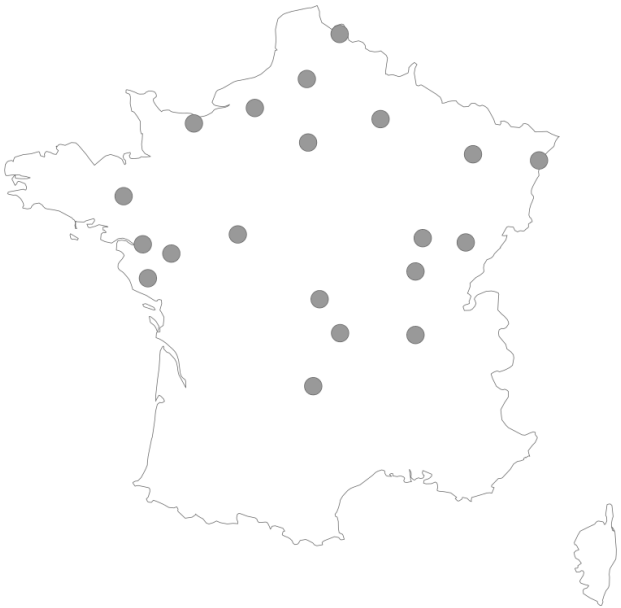

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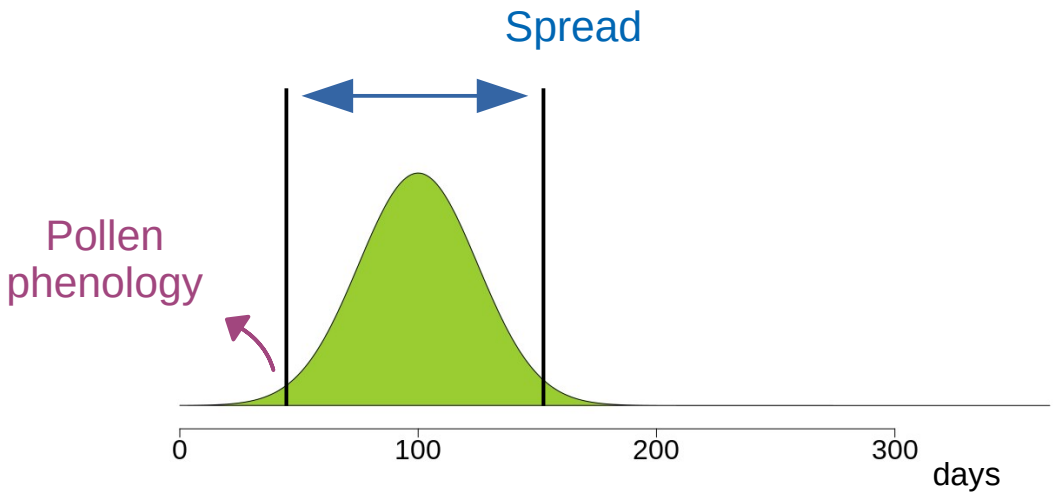

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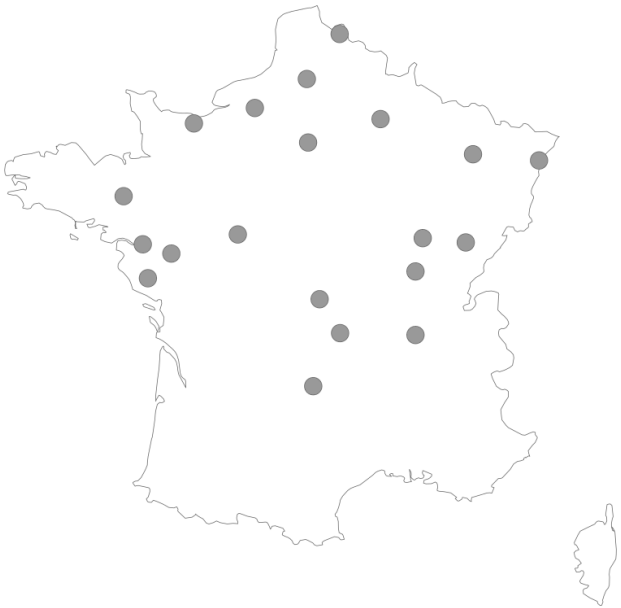

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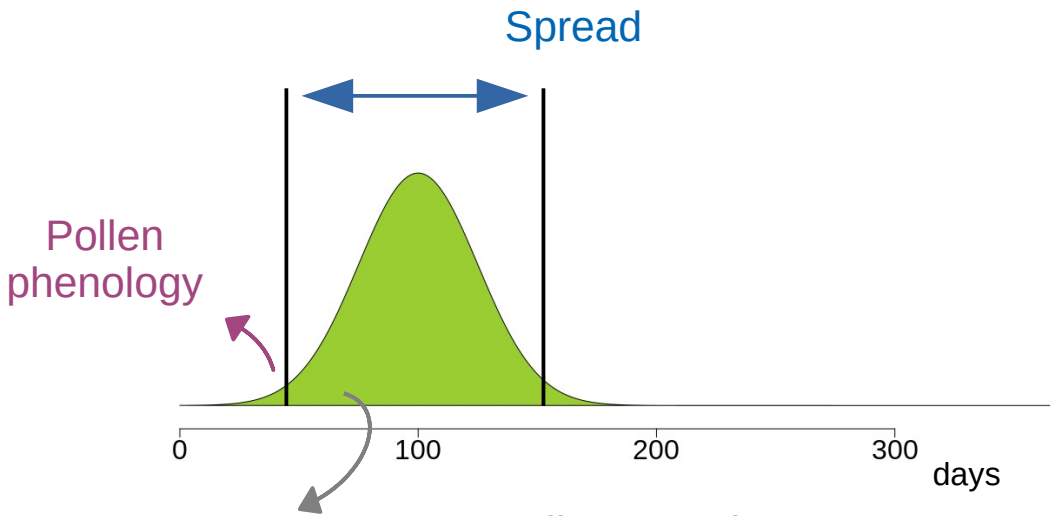

Pollen concentration = $\frac{\text{Pollen quantity}}{\text{Spread}}$

How has pollen phenology evolved ?

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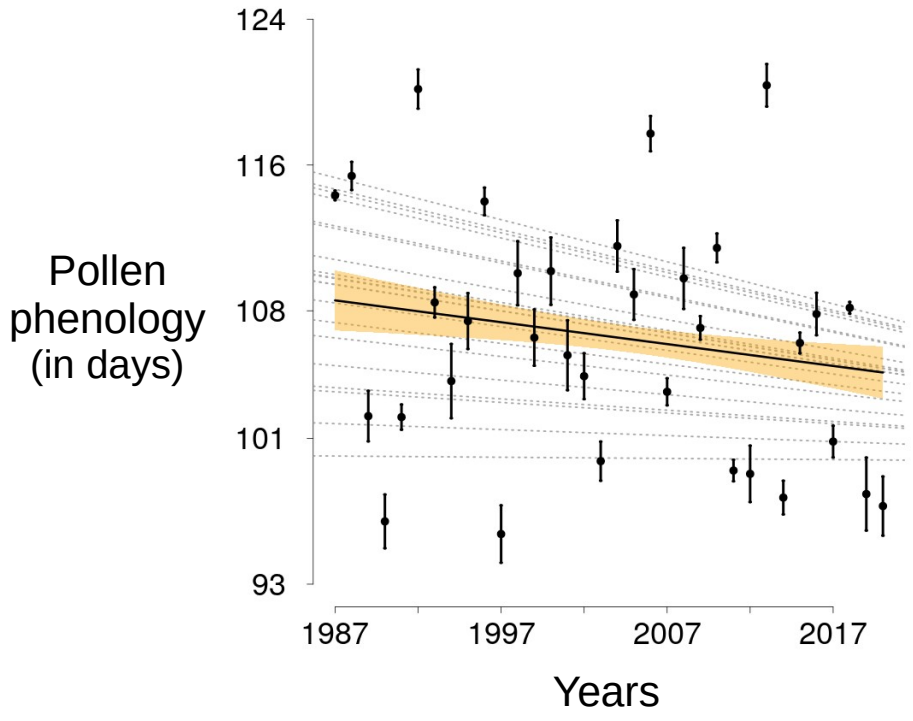

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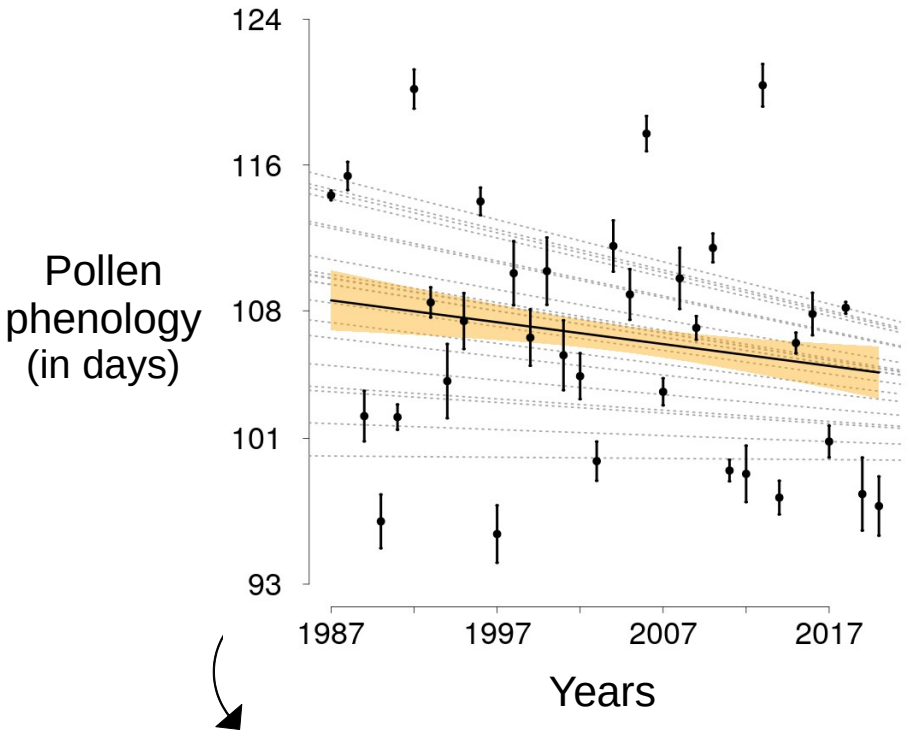

→ **Global Evolution** toward **earlier phenology** (p-value : 1.99^{-3})

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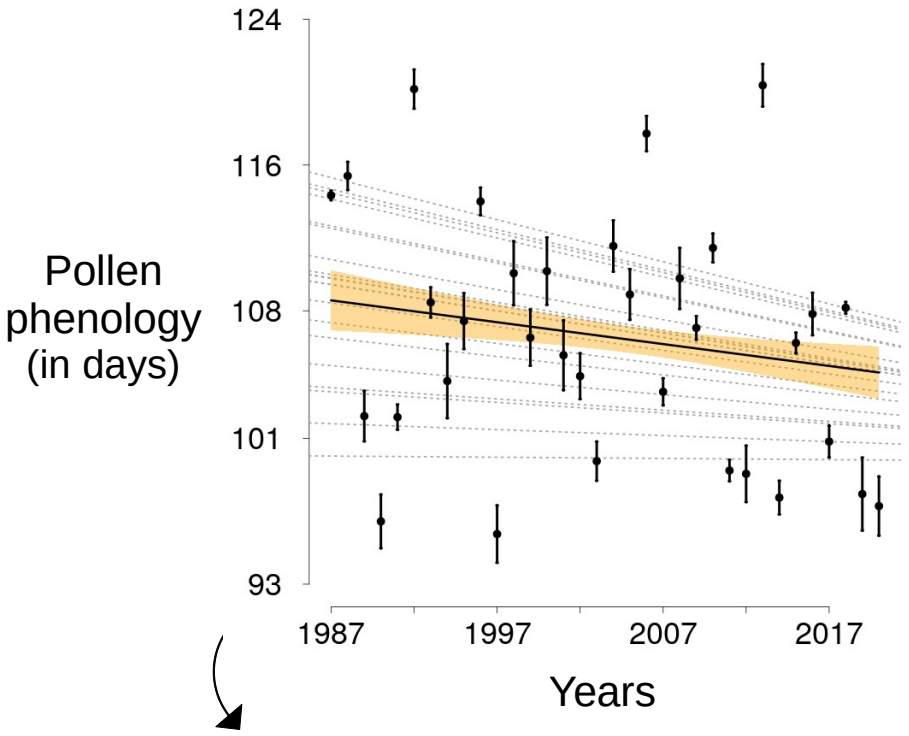

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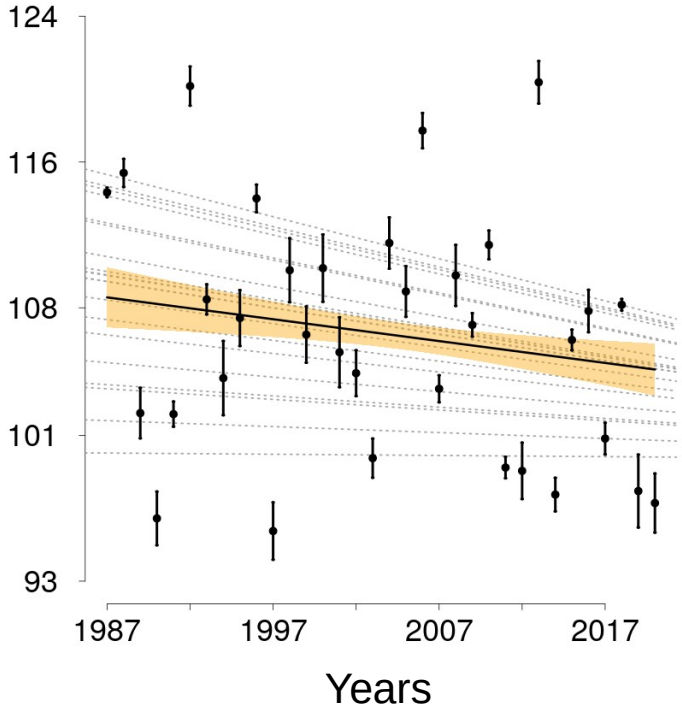
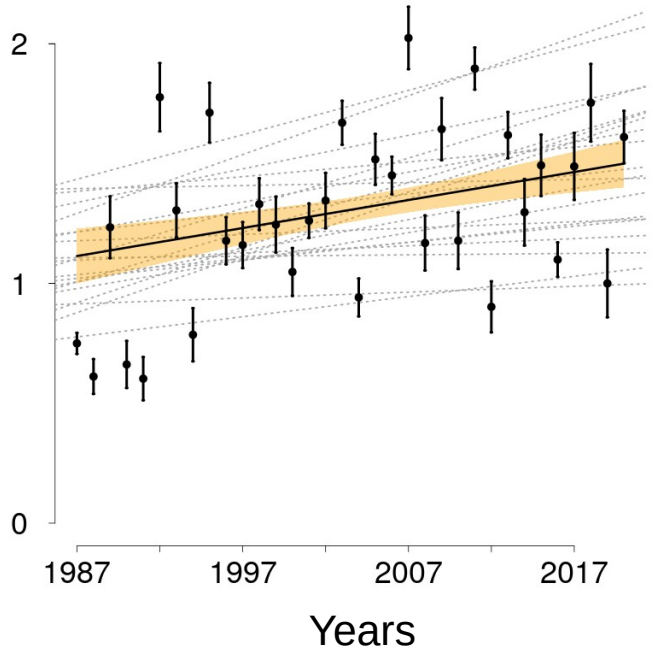
→ **Pollen phenology** has advance **4 days** on the last **three decades**

Impacts of shifting pollen phenology on pollen concentration ?

Pollen phenology (in days)



Pollen Concentration log(x+1)



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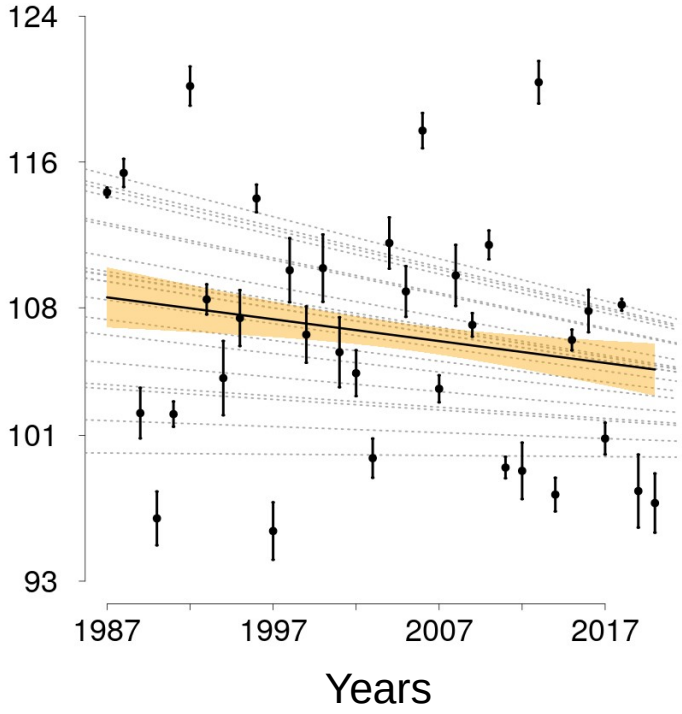

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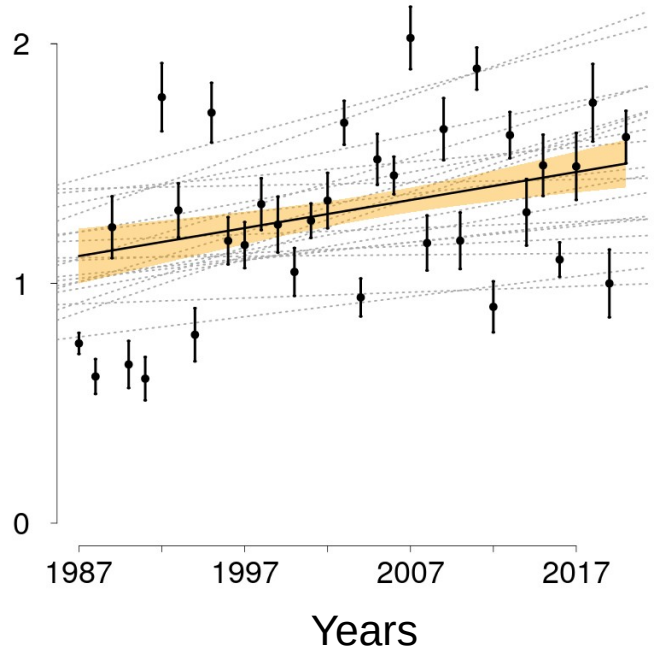

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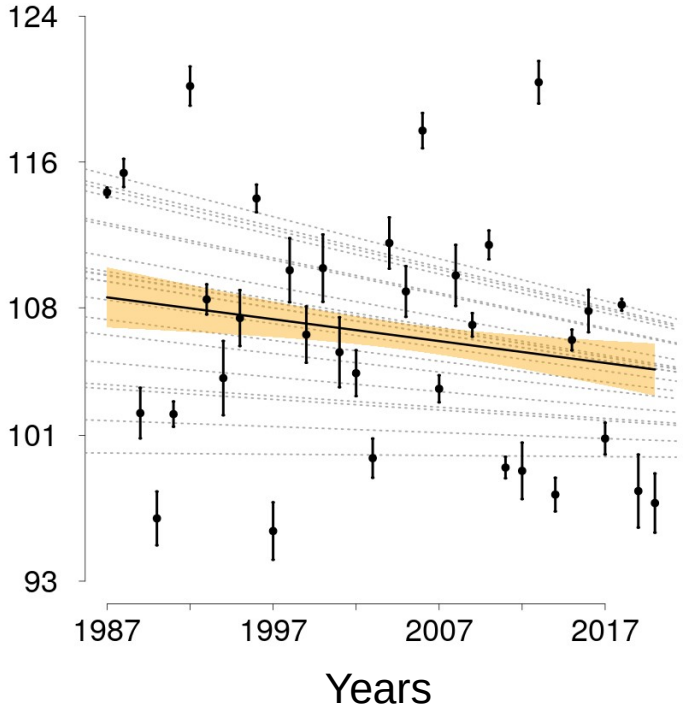

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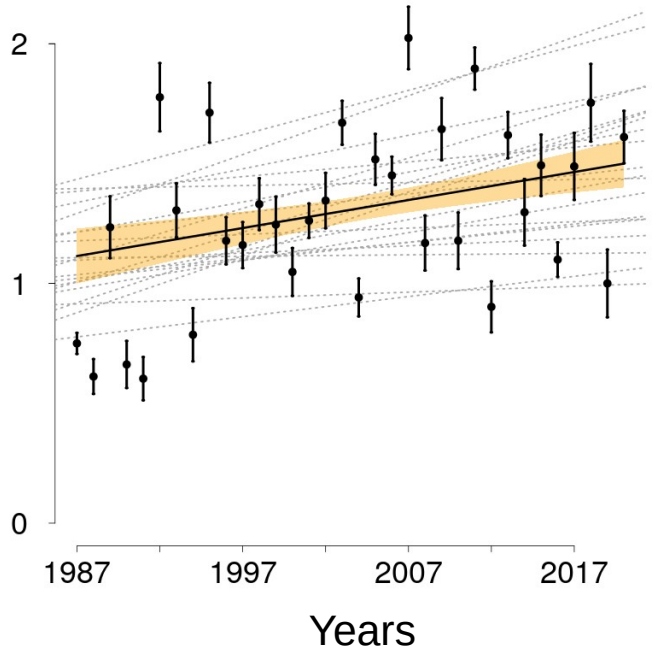

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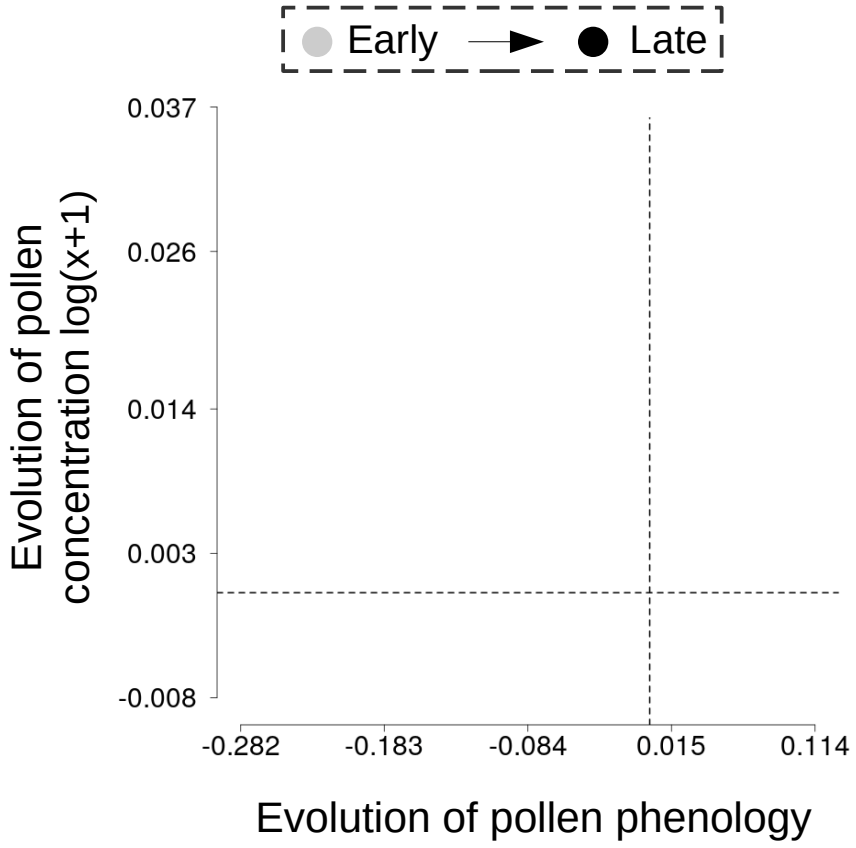
→ Pollen concentration remained **unchanged** in several sites

Two distinct responses of sites to climate change



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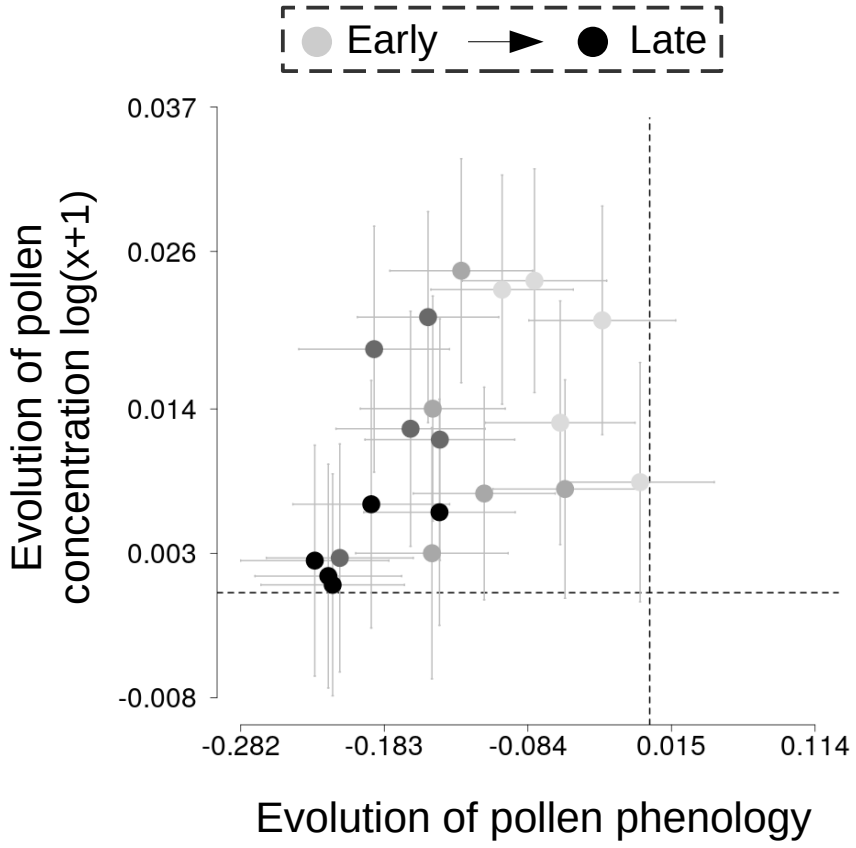

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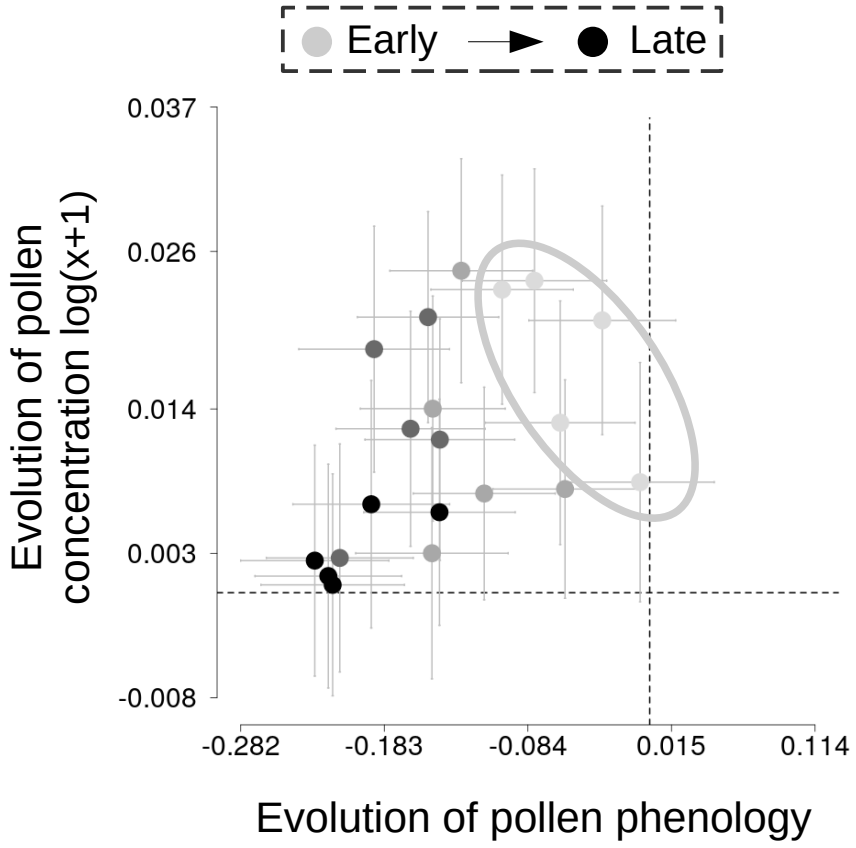

≈ *Phenology*

Pollen concentration

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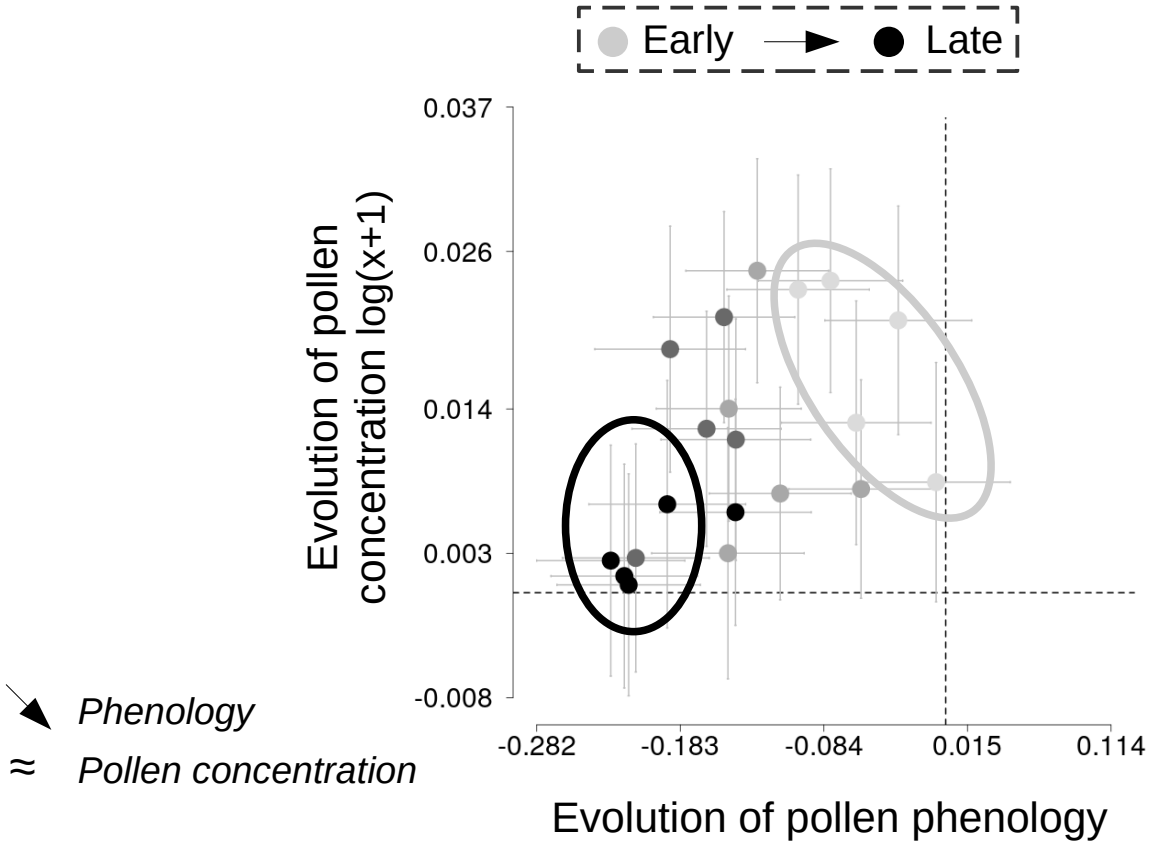

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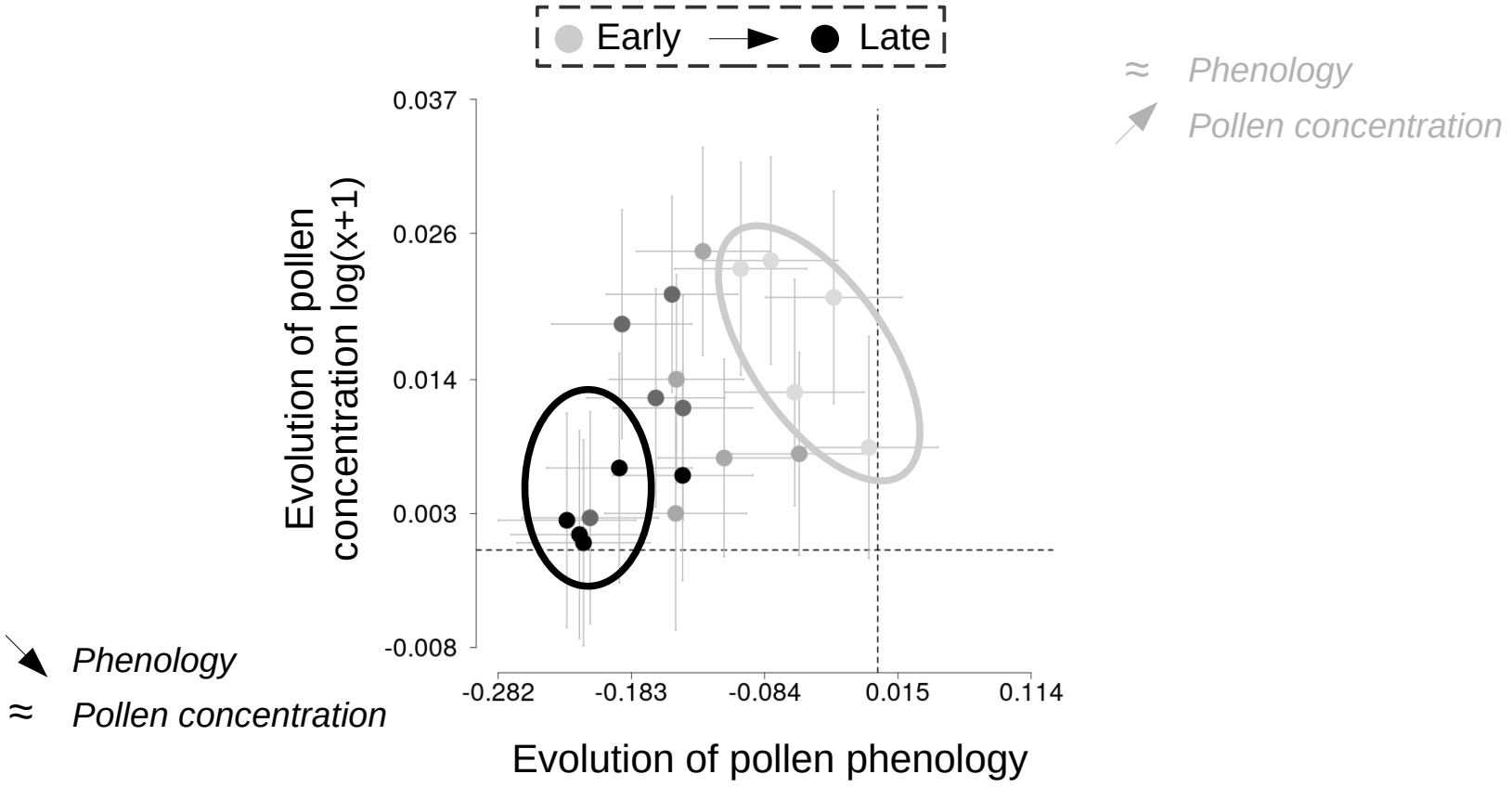

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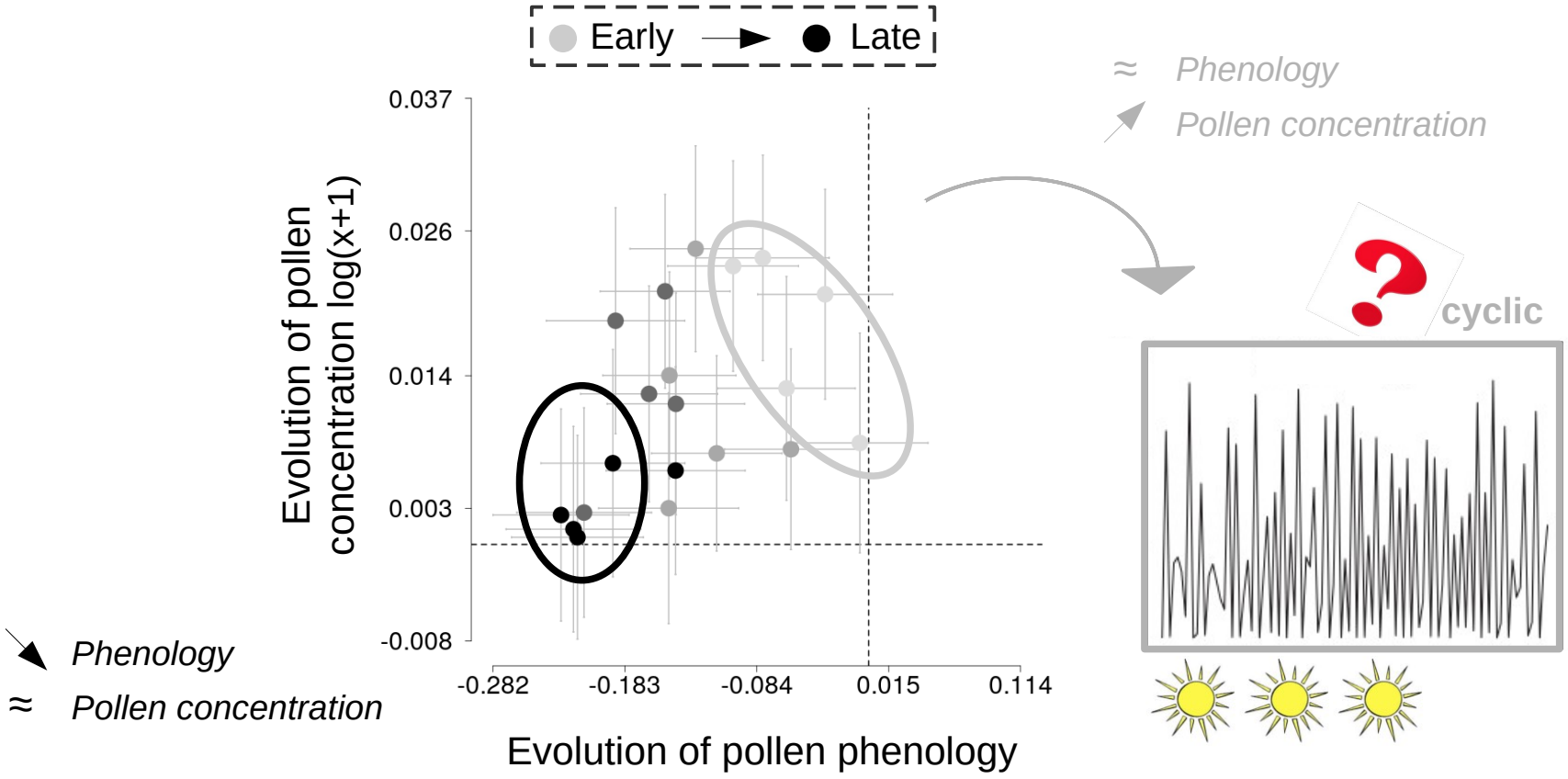
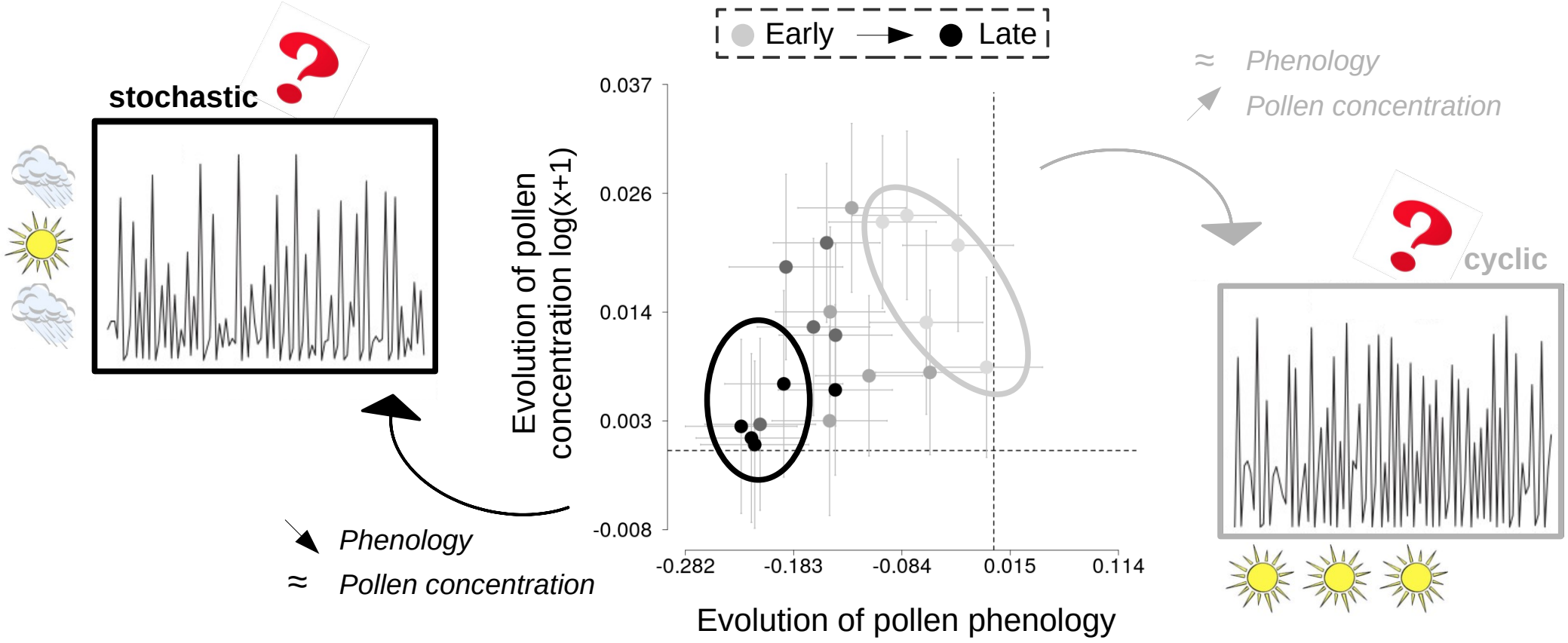


Schermer *et al.*, 2020

Will shift in pollen phenology influence fruiting dynamic ?

→ Use **Resource Budget Model (RBM)** to predict the evolution of fruiting dynamic



Schermer *et al.*, 2020

In a nutshell

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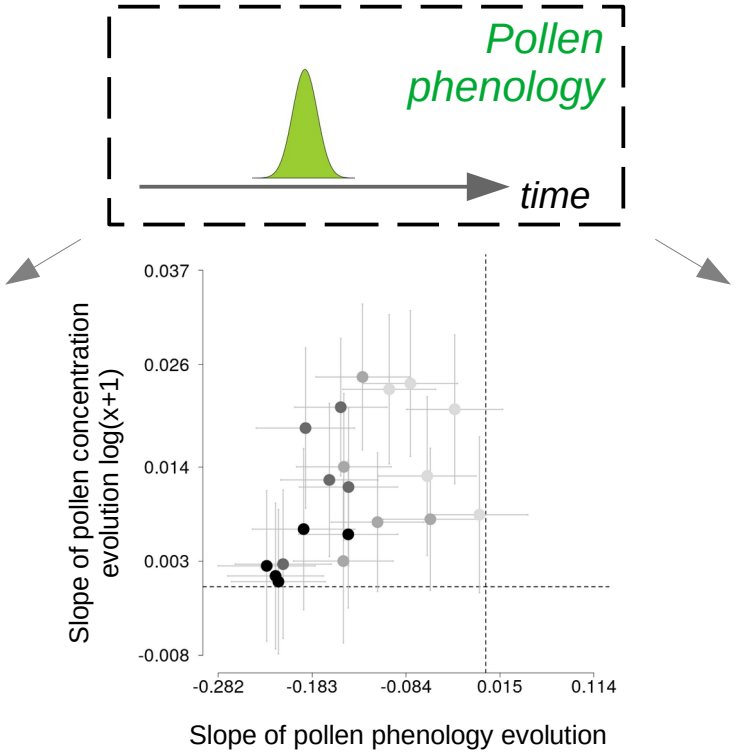

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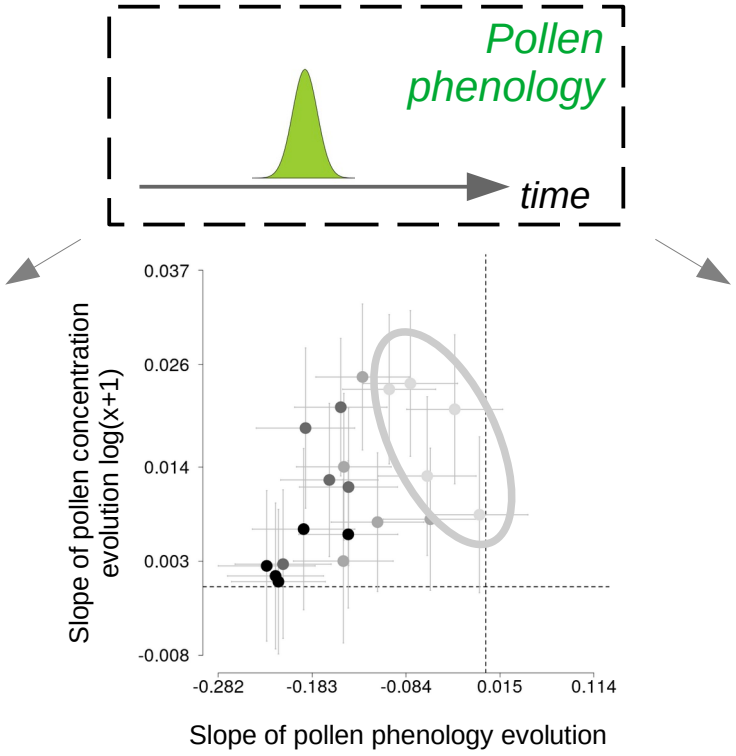

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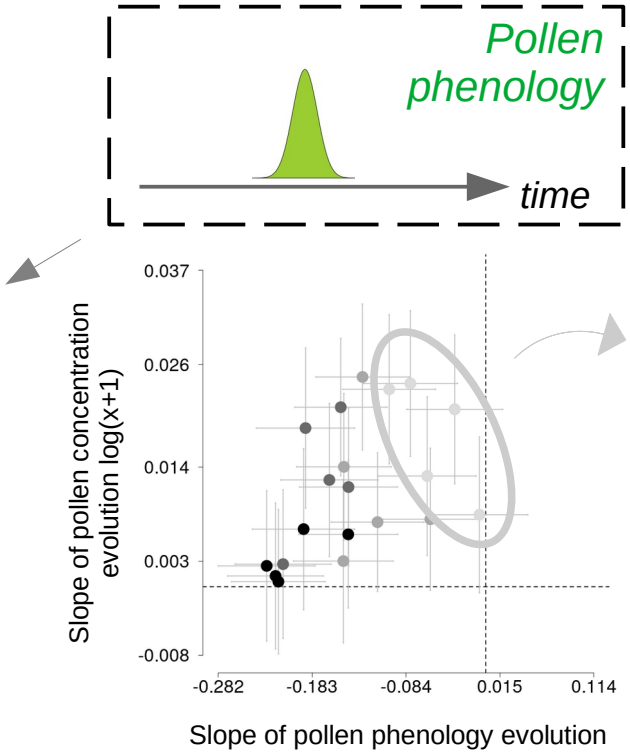

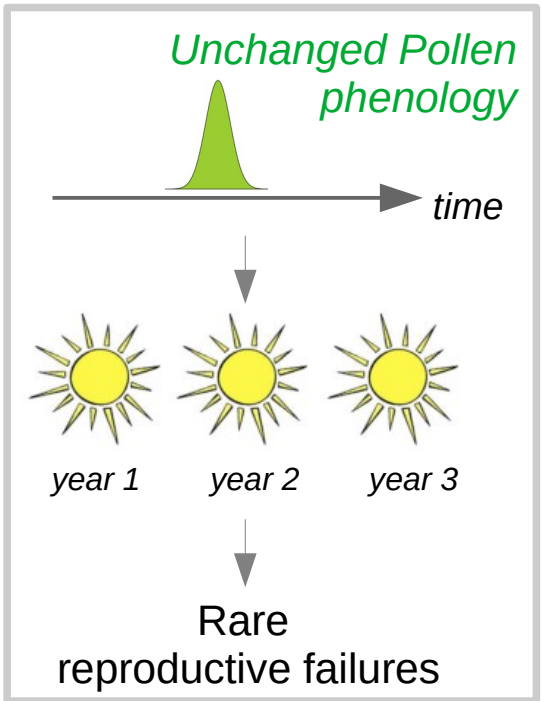

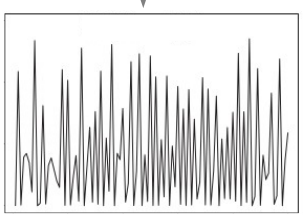

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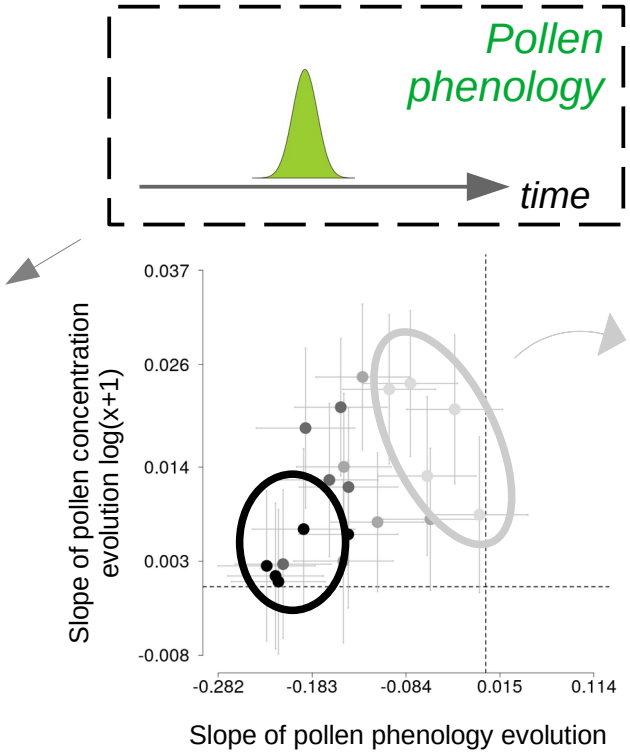

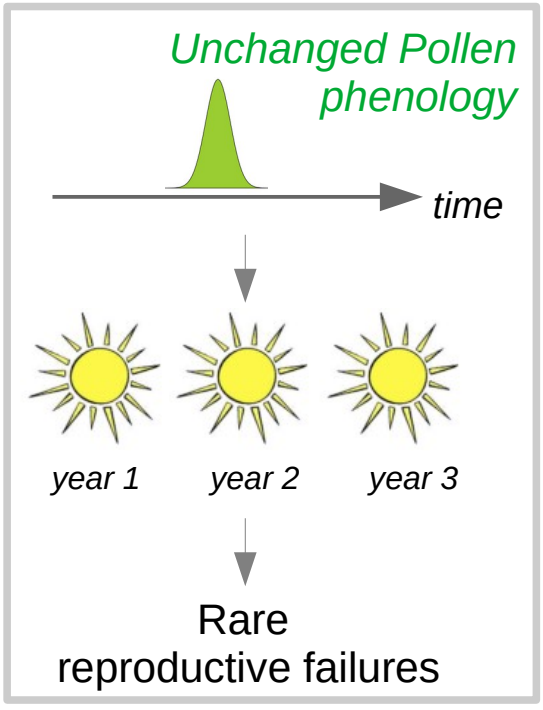

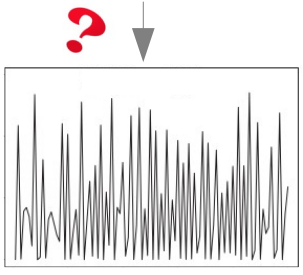

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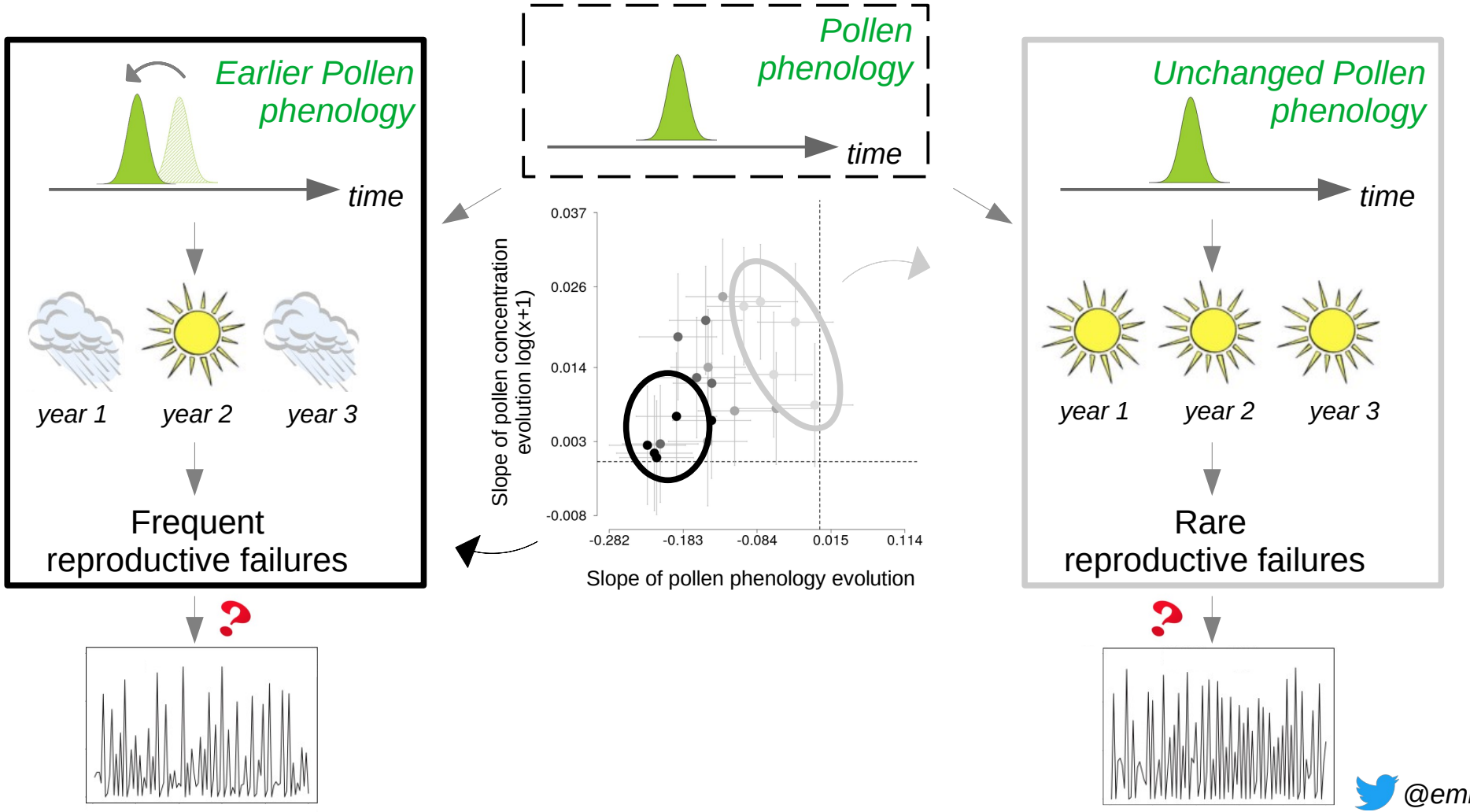
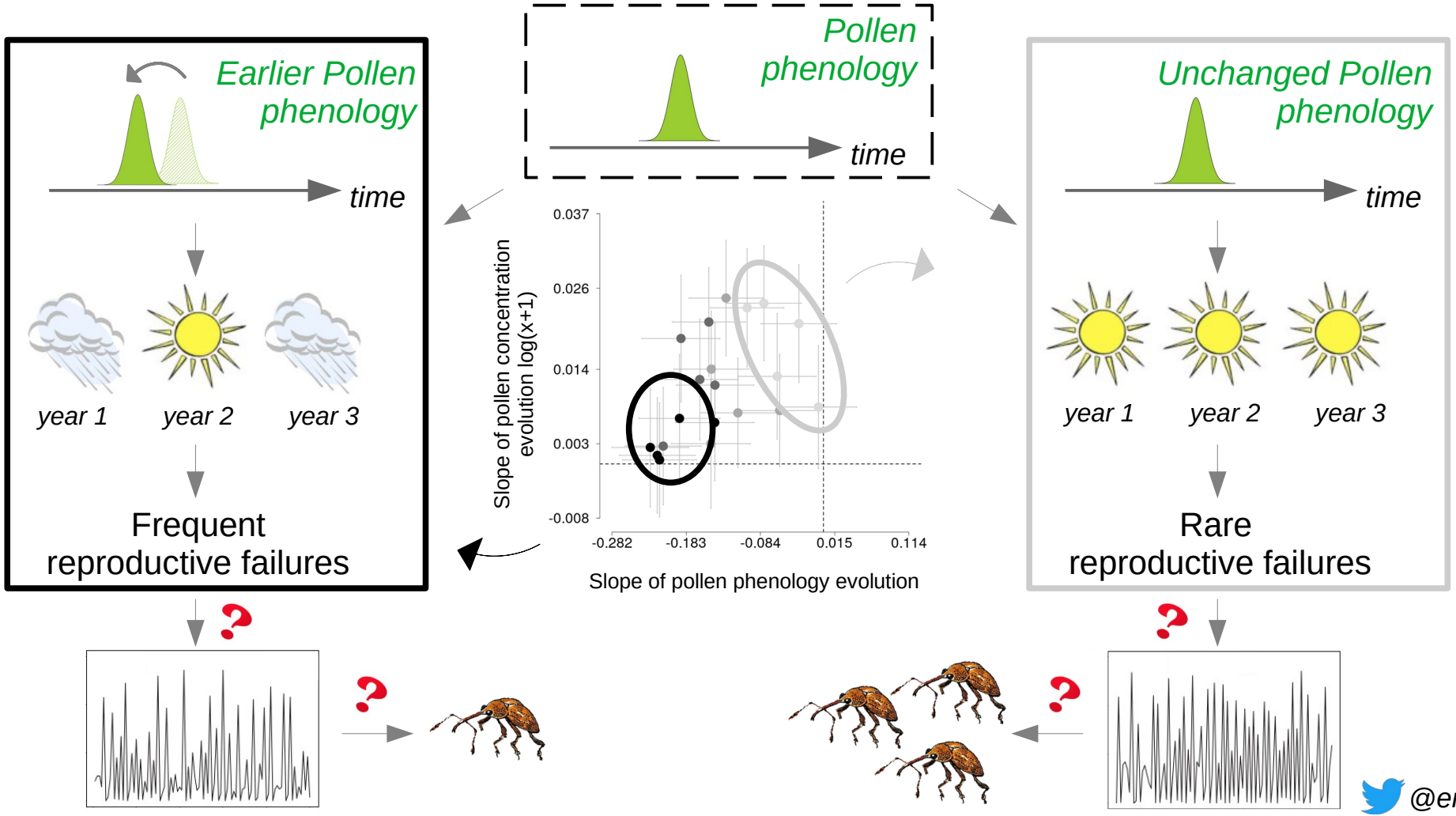


In a nutshell



Thanks for your attention !

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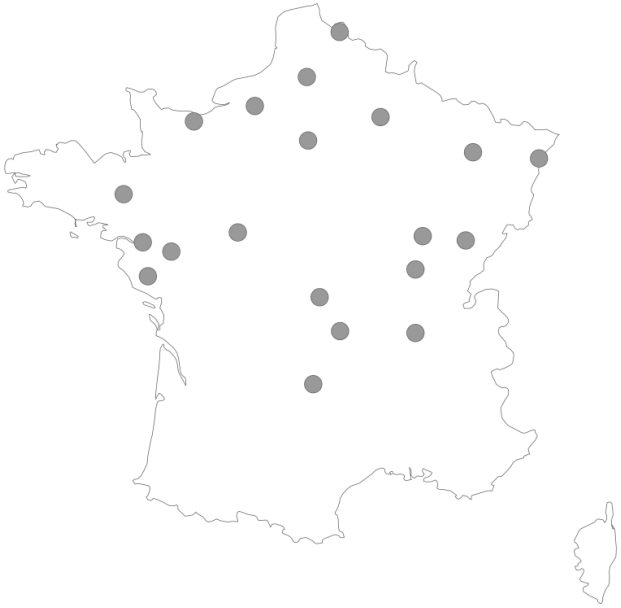
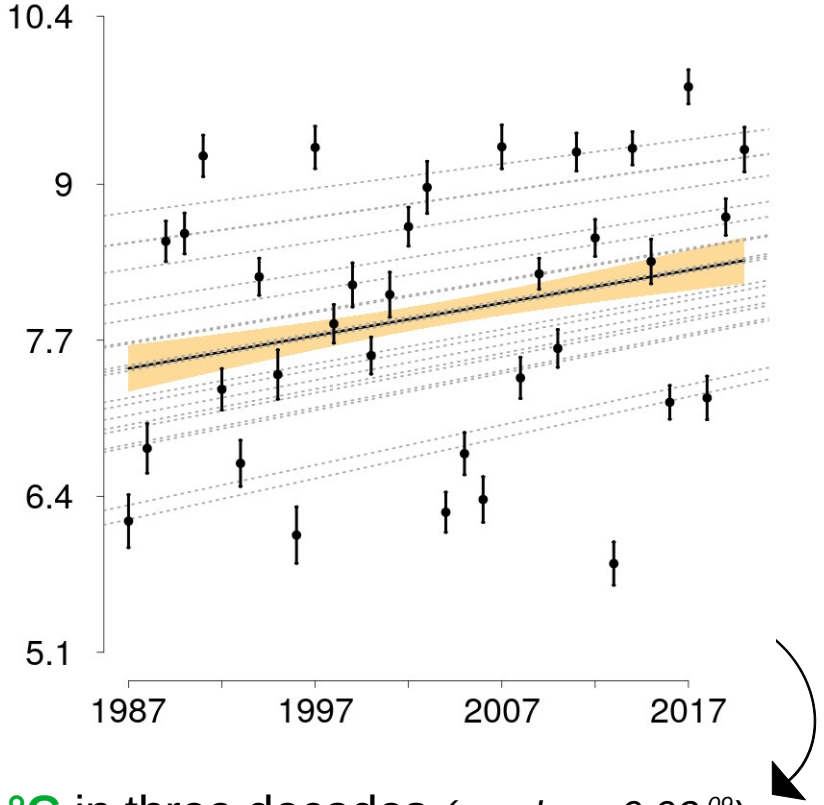
@emiliefleurot

Spring temperatures are warming up



Mean T° in early spring



+ 0,90 °C in three decades *(p-value : 9.93^{-09})*