

# Forests before *Homo sapiens*

Historical baselines of European vegetation

Elena A. Pearce







Review

## A review of natural vegetation openness in north-western Europe

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Perspective

### Biodiversity-rich European grasslands: Ancient, forgotten ecosystems

Angelica Feurdean<sup>a,c</sup>, Eszter Ruprecht<sup>b,c</sup>, Zsolt Molnár<sup>c</sup>, Simon M. Hutchinson<sup>d</sup>, Thomas Hickler<sup>a,c</sup>

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AND

### The Holocene vegetation cover of Britain and Ireland: overcoming problems of scale and discerning patterns of openness

Ralph M. Fyfe<sup>a,c</sup>, Claire Twiddle<sup>b</sup>, Shinya Sugita<sup>c</sup>, Marie-José Gaillard<sup>d</sup>, Philip Barratt<sup>e</sup>, Christopher J. Caseldine<sup>f</sup>, John Dodson<sup>g</sup>, Kevin J. Edwards<sup>b</sup>, Michelle Farrell<sup>h</sup>, Cynthia Froyd<sup>i</sup>, Michael J. Grant<sup>j,k</sup>, Elizabeth Huckerby<sup>l</sup>, James B. Innes<sup>m</sup>, Helen Shaw<sup>n</sup>, Martyn Waller<sup>k</sup>

F.W.M. Vera

Journal of Ecology

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## How open were European primeval forests? Hypothesis testing using palaeoecological data

FRASER J. G. MITCHELL

First published: 21 December 2004 | <https://doi.org/10.1111/j.1365-2745.2004.00964.x>

## Quantitative reconstructions of changes in regional openness in north-central Europe reveal new insights into old questions

Anne Birgitte Nielsen<sup>a,b,c,1,2</sup>, Thomas Giesecke<sup>a</sup>, Martin Theuerkauf<sup>c</sup>, Ingo Feeser<sup>d</sup>, Karl-Ernst Behre<sup>e</sup>, Hans-Jürgen Beug<sup>a</sup>, Su-Hwa Chen<sup>f</sup>, Jörg Christiansen<sup>a</sup>, Walter Dörfler<sup>d</sup>, Elisabeth Endtmann<sup>g</sup>, Susanne Jahns<sup>b</sup>, Pim de Klerk<sup>h</sup>, Norbert Kühl<sup>i</sup>, Małgorzata Latalowa<sup>k</sup>, Bent Vad Odgaard<sup>l</sup>, Peter Rasmussen<sup>m</sup>, Jette Raal Stockholm<sup>n</sup>, Ricarda Voigt<sup>a</sup>, Julian Wiethold<sup>o</sup>, Steffen Wolters<sup>e</sup>

## How fragmented was the British Holocene wildwood? Perspectives on the “Vera” grazing debate from the fossil beetle record

Nicki J. Whitehouse<sup>a,c</sup>, David Smith<sup>b</sup>

<sup>a</sup>Bioscience Centre, School of Geography, Archaeology and Palaeoecology, Queen's University Belfast, Belfast BT7 1NN, Northern Ireland, UK  
<sup>b</sup>Institute of Archaeology and Antiquity, University of Birmingham, Edgbaston, Birmingham B15 2TT, England, UK

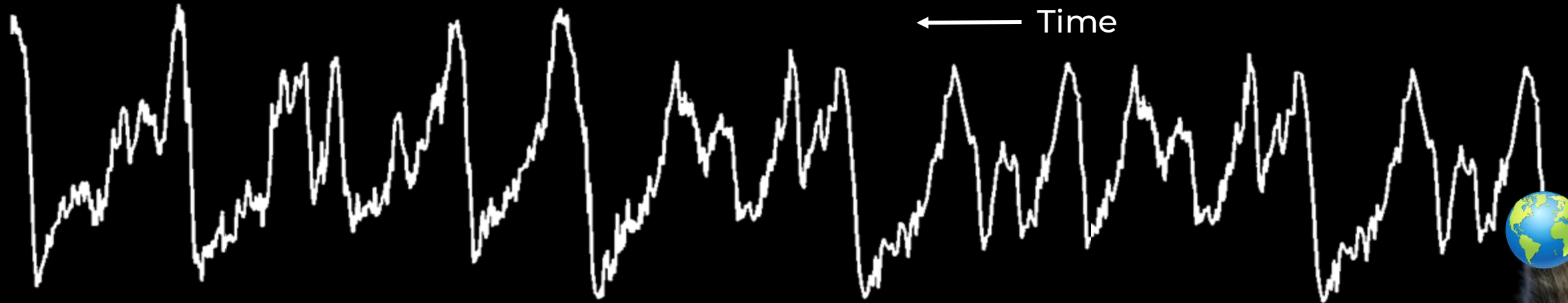


“Mosaic...  
maintained  
by the  
**grazing**  
of large  
herbivores  
and by **fire.**”

Navarro & Pereira, 2012

# Interglacial period

The Holocene (12,000 – 0 BP)  
~~–Present Day–~~



# Glacial period



The Holocene  
~~Present Day~~



RESEARCH ARTICLE | BIOLOGICAL SCIENCES | 



# People have shaped most of terrestrial nature for at least 12,000 years

Erle C. Ellis  , Nicolas Gauthier , Kees Klein Goldewijk ,  +14, and James E. M. Watson [Authors Info & Affiliations](#)

Edited by B. L. Turner, Arizona State University, Tempe, AZ, and approved March 4, 2021 (received for review November 13, 2020)

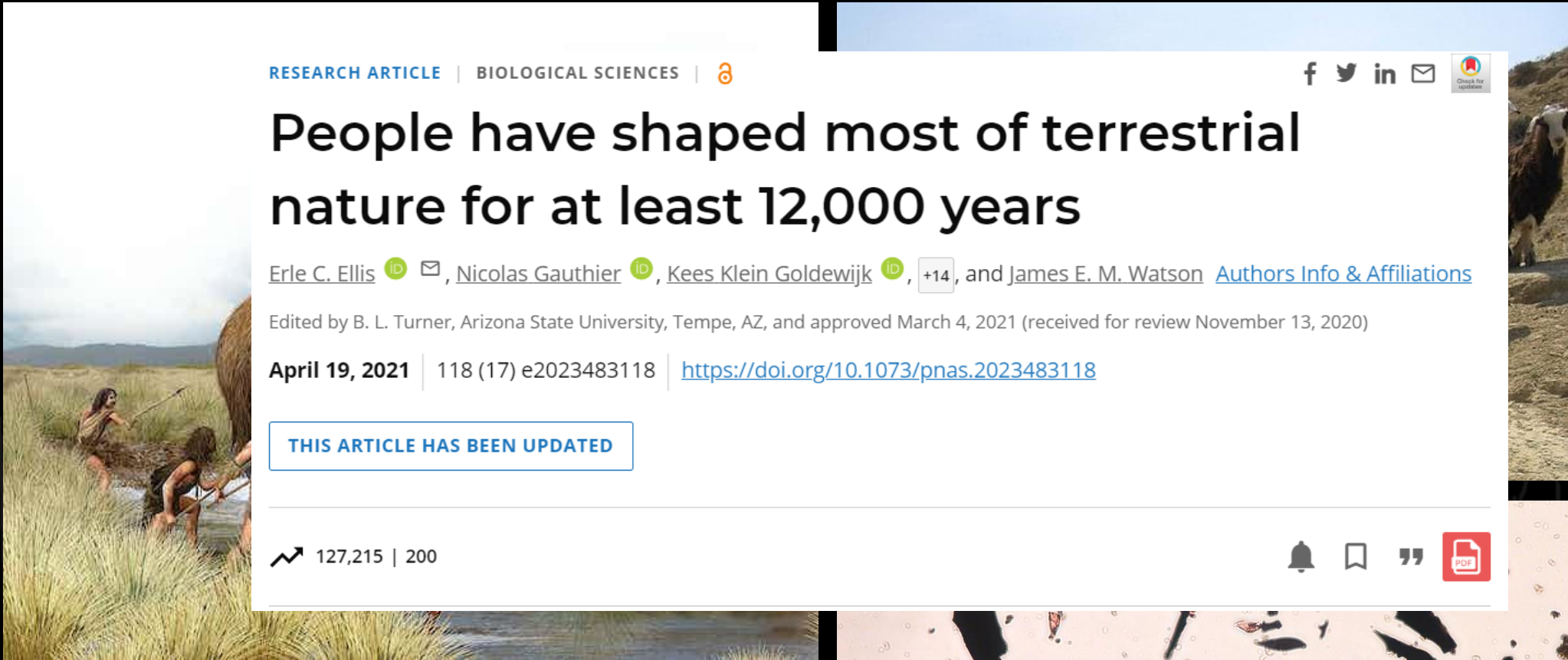
April 19, 2021 | 118 (17) e2023483118 | <https://doi.org/10.1073/pnas.2023483118>

THIS ARTICLE HAS BEEN UPDATED

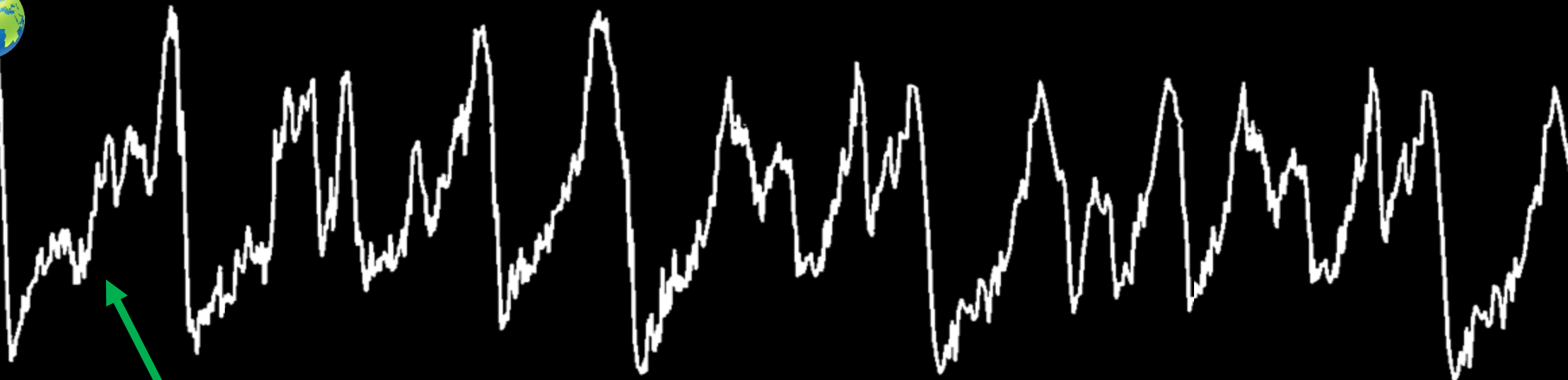
 127,215 | 200



3.9% of temperate woodlands were uninhabited wildlands as early as 12,000 BP



The Holocene The Last Interglacial



*Homo sapiens* arrive (~50,000 BP)

## The Last Interglacial (129,000 – 116,000 BP)



- Before *Homo sapiens* in Europe





## The Last Interglacial (129,000 – 116,000 BP)



- Before *Homo sapiens* in Europe
- Before widespread hominin-induced landscape change
- Before megafauna extinctions
- Geologically recent
- Climatically similar



How open were European  
landscapes before modern  
humans?

What dynamics shaped these  
landscapes?



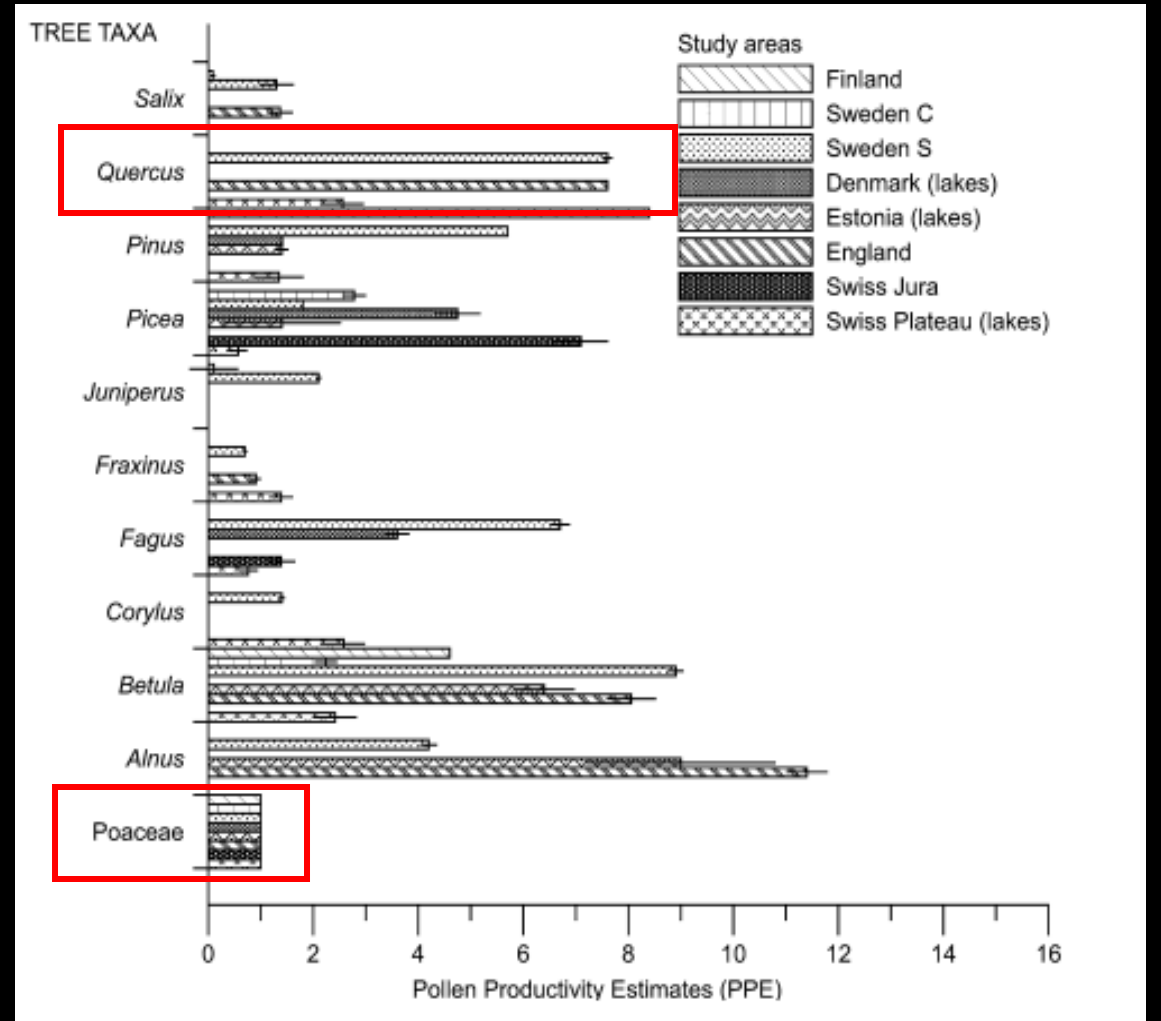
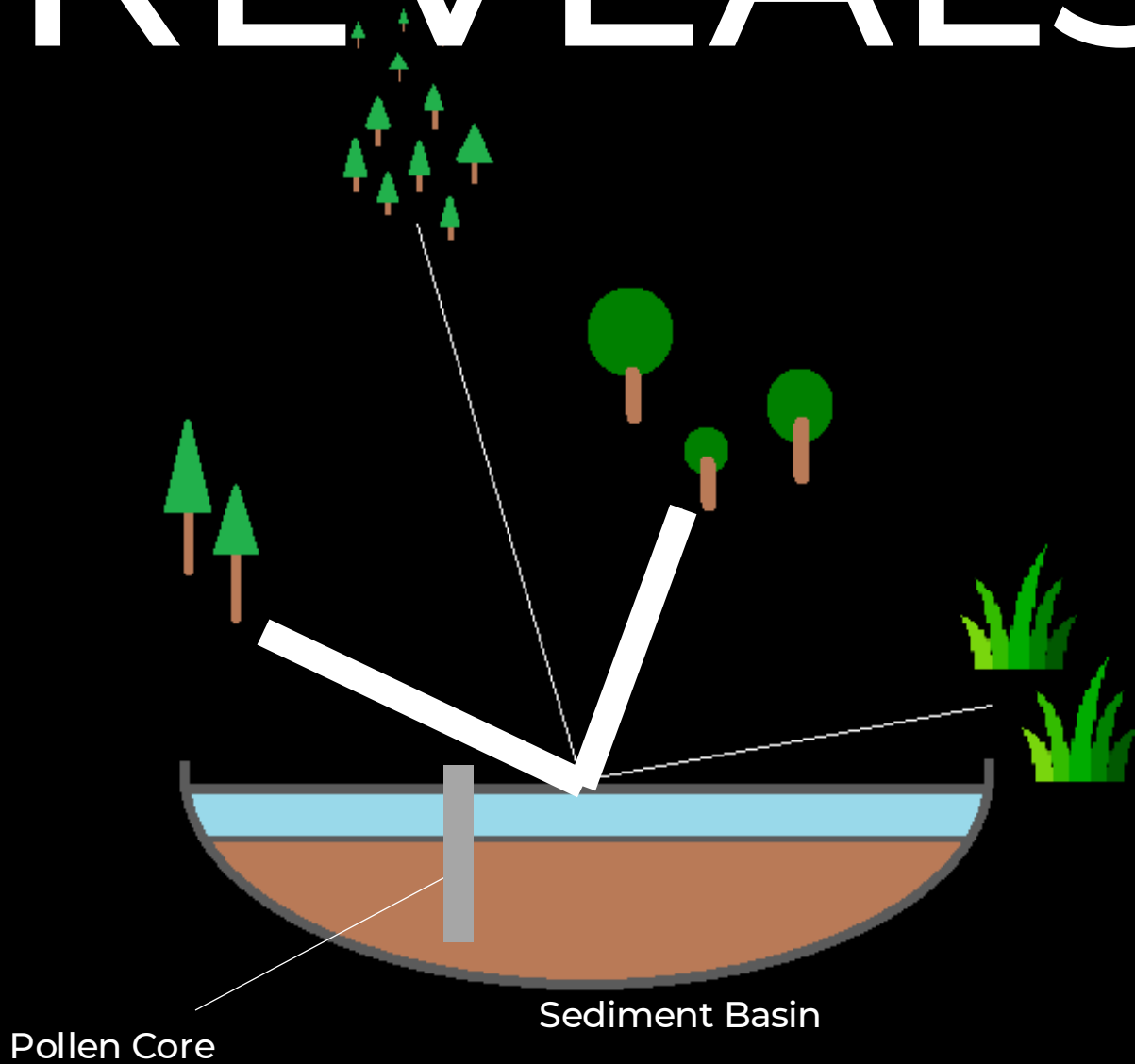




100 μm

# REVEALS

(Sugita, 2007)



# Open vegetation



Herbaceous

Heath



# Light woodland



Shade intolerant trees

Intermediate trees

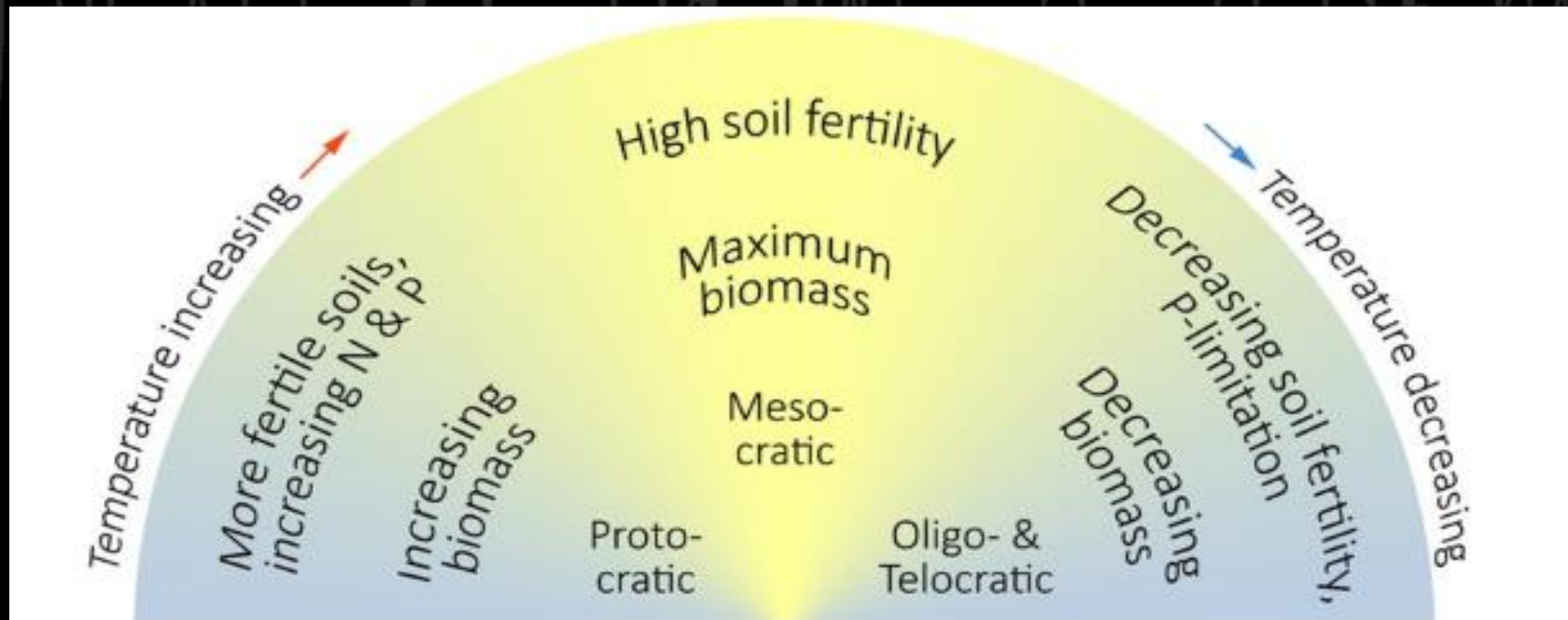


# Closed forest



Shade tolerant trees

# Openness in the “high forest” temperate period



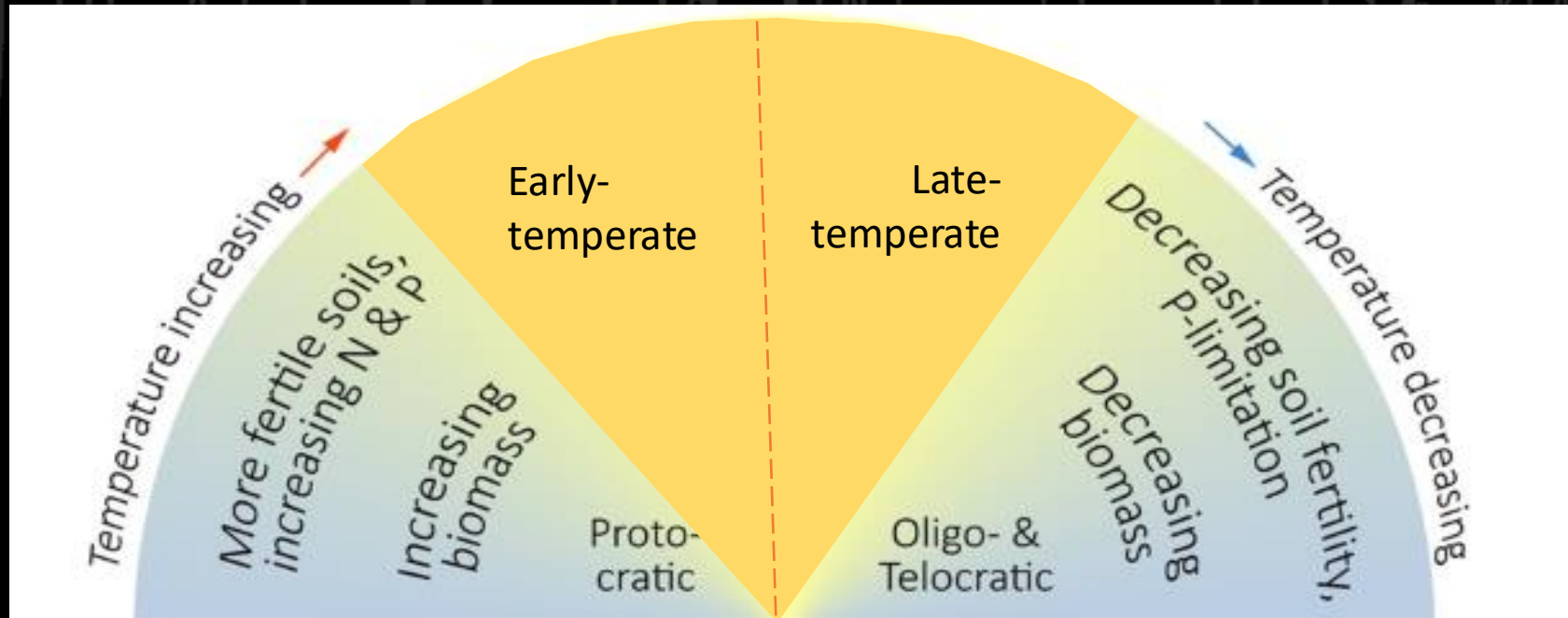
Start

End

Adapted from Felde *et al.*, 2020



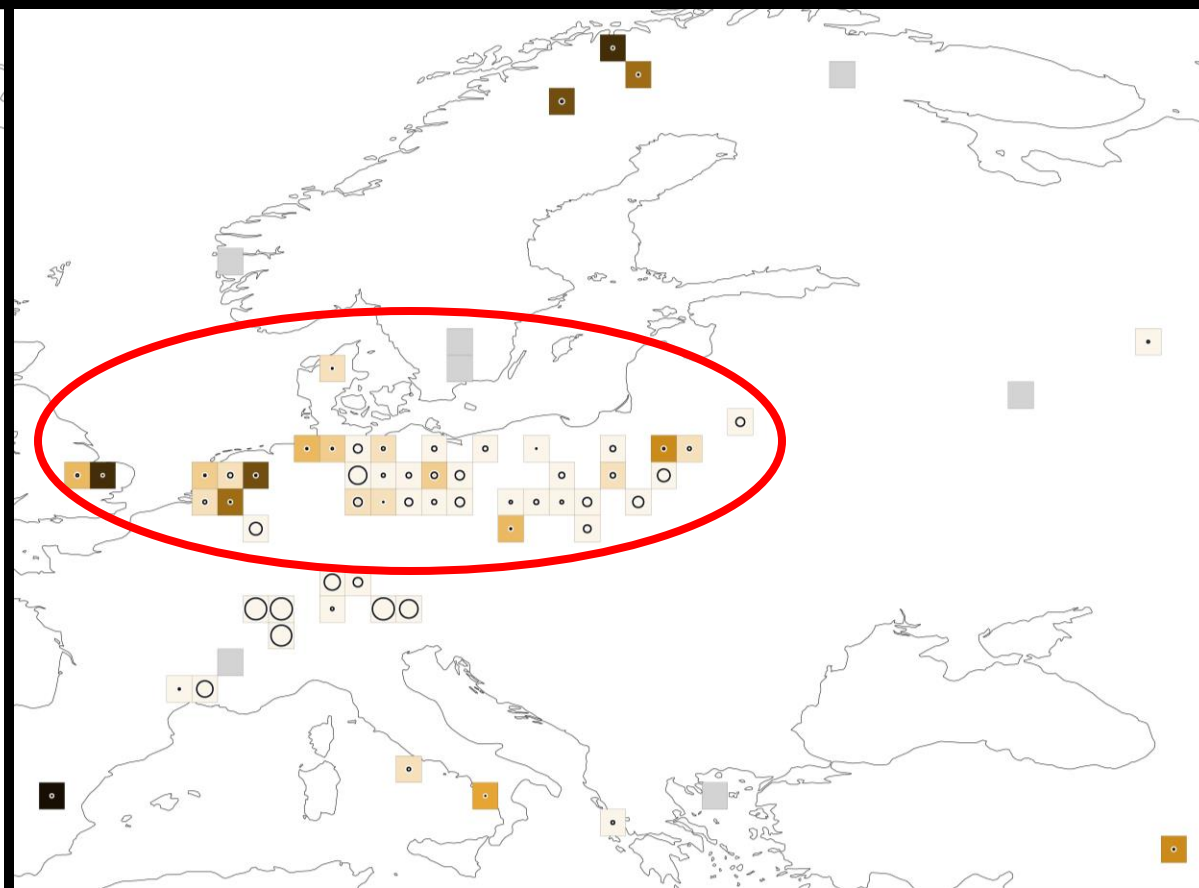
# Openness in the “high forest” temperate period



Adapted from Felde *et al.*, 2020

Early-temperate

Late-temperate



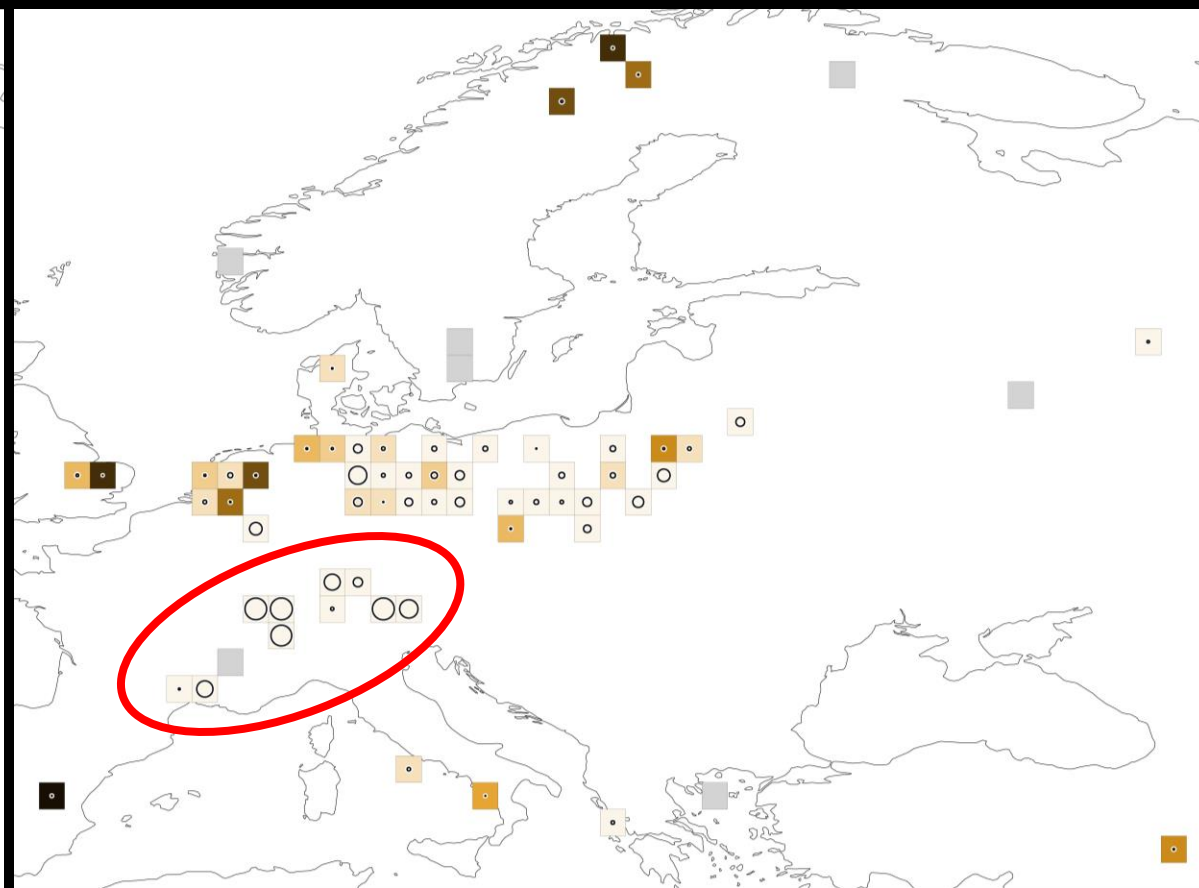
# Open vegetation

Pearce *et al.* 2023, *Sci. Adv.*



Early-temperate

Late-temperate



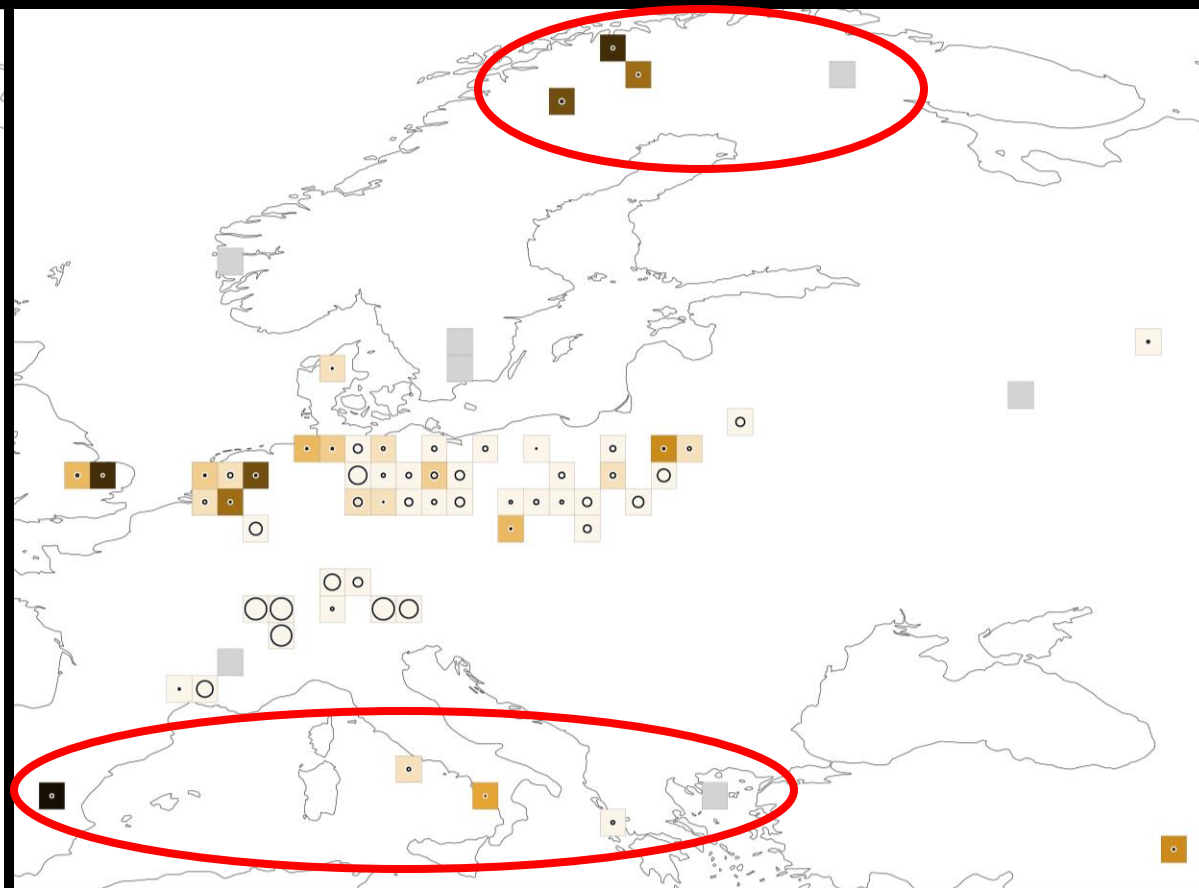
Open vegetation

Pearce *et al.* 2023, *Sci. Adv.*



Early-temperate

Late-temperate

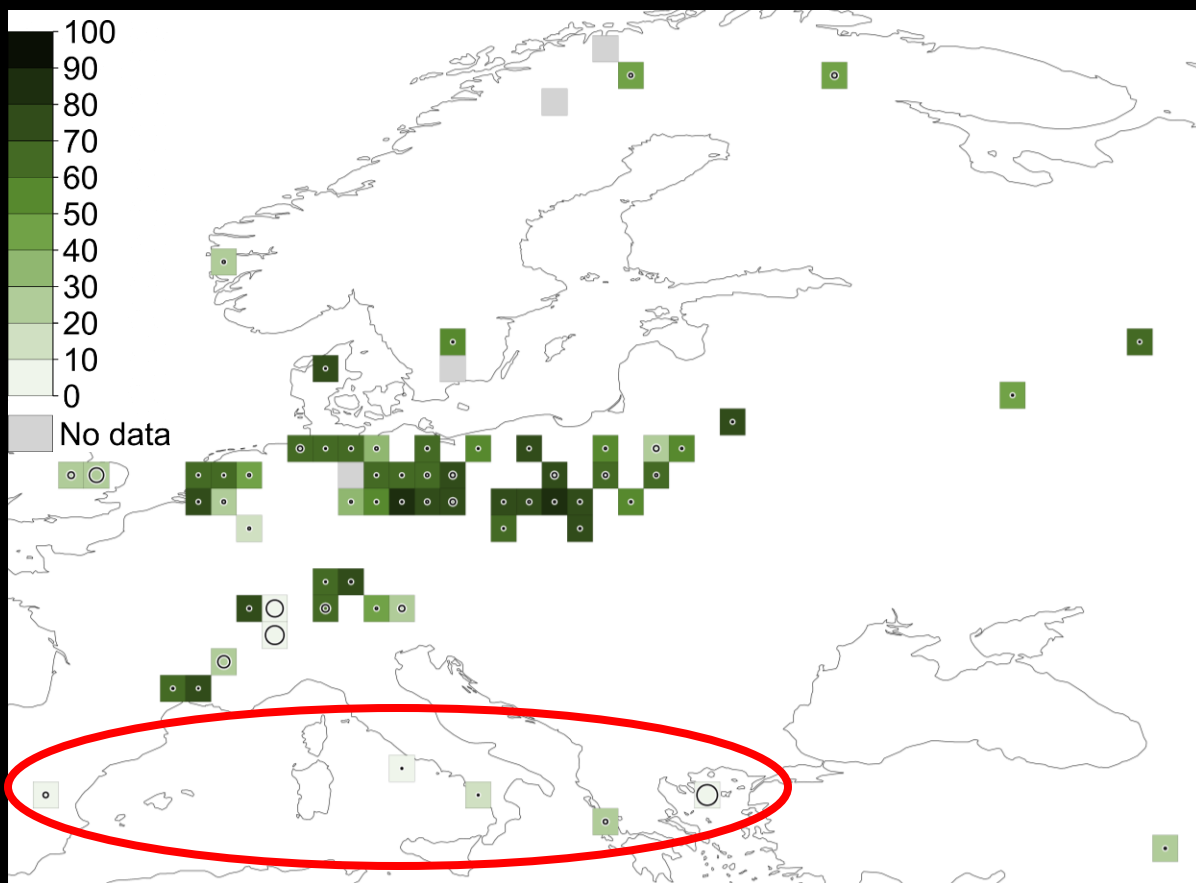


Open vegetation

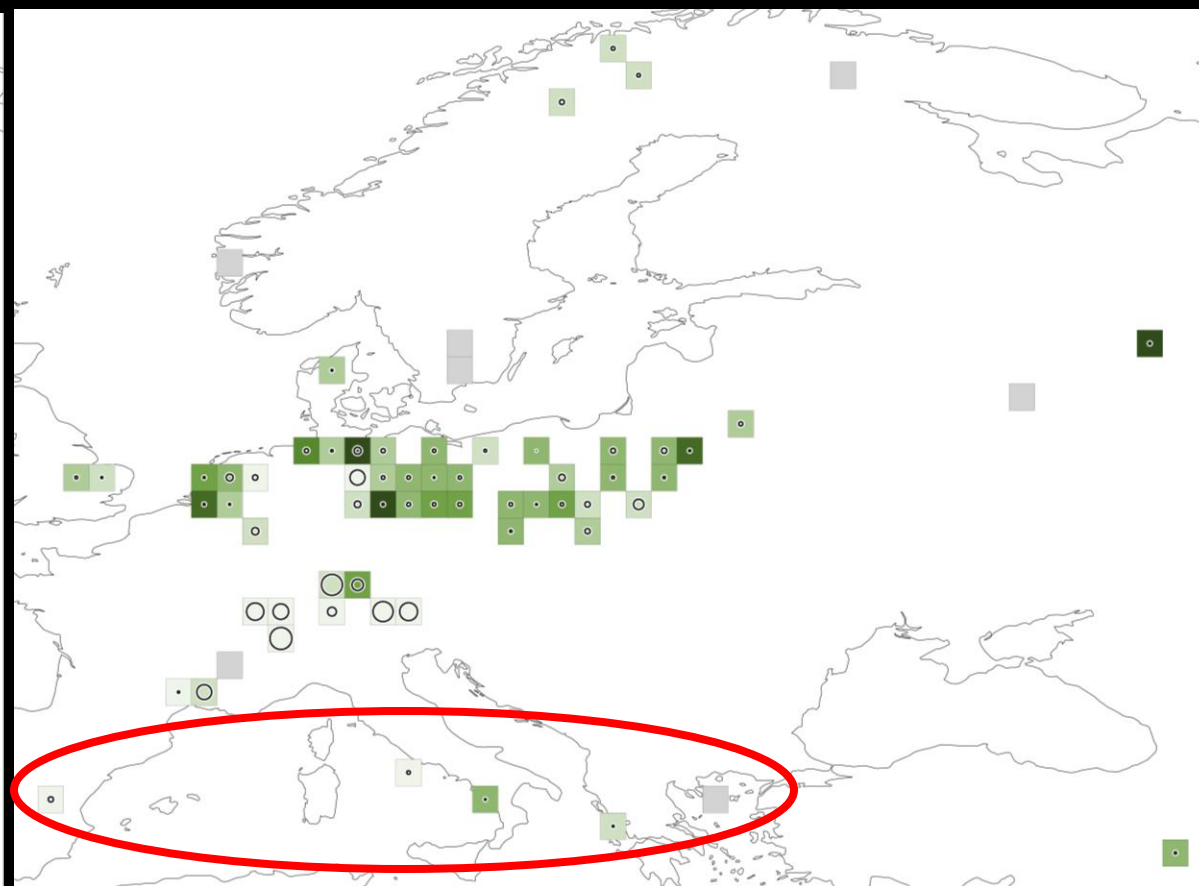
Pearce *et al.* 2023, *Sci. Adv.*



Early-temperate



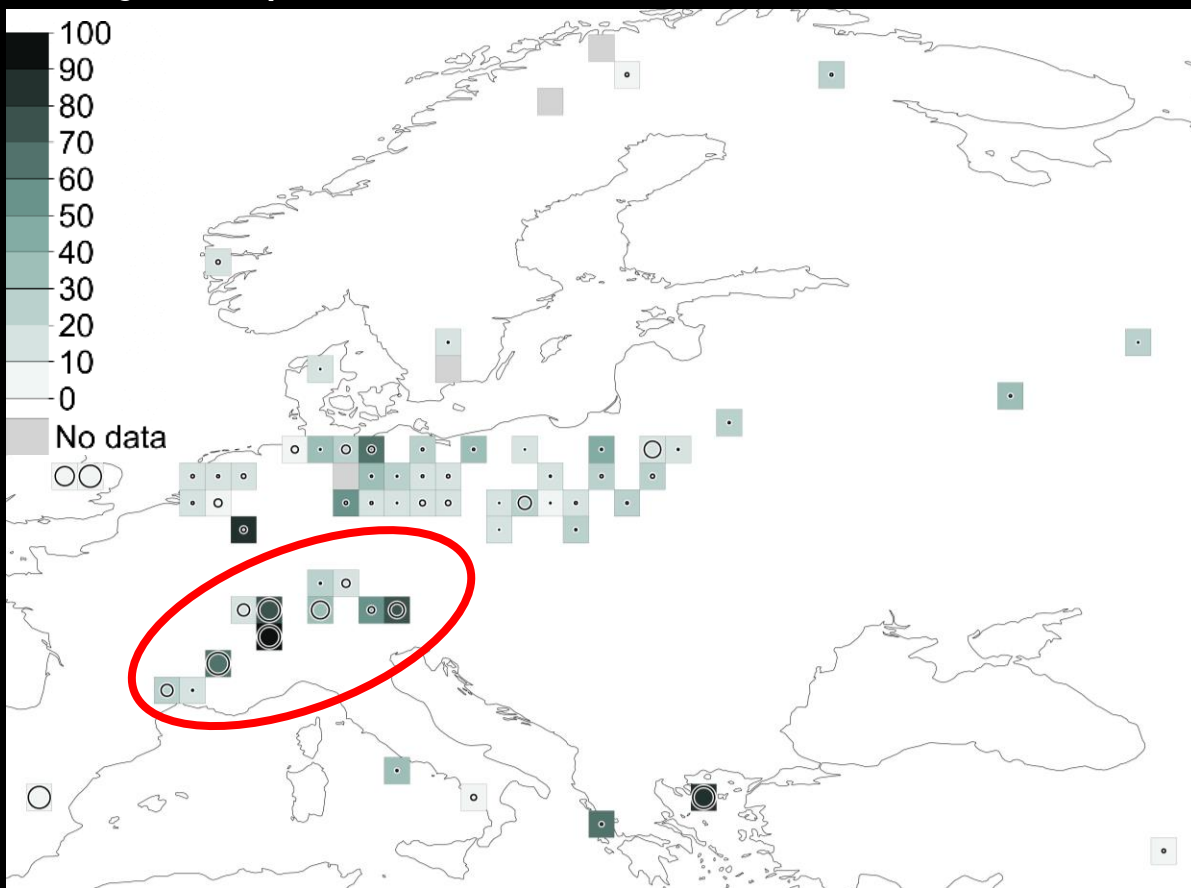
Late-temperate



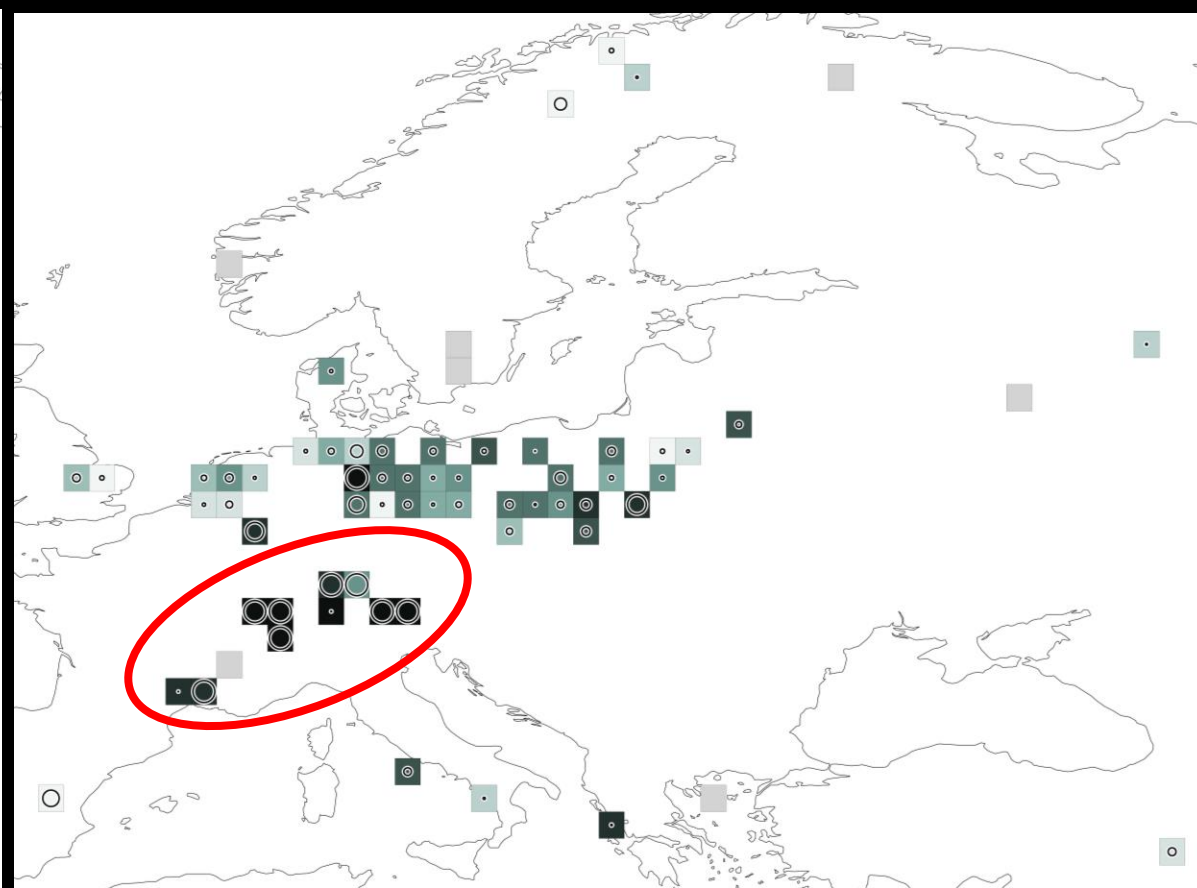
# Light woodland



Early-temperate



Late-temperate

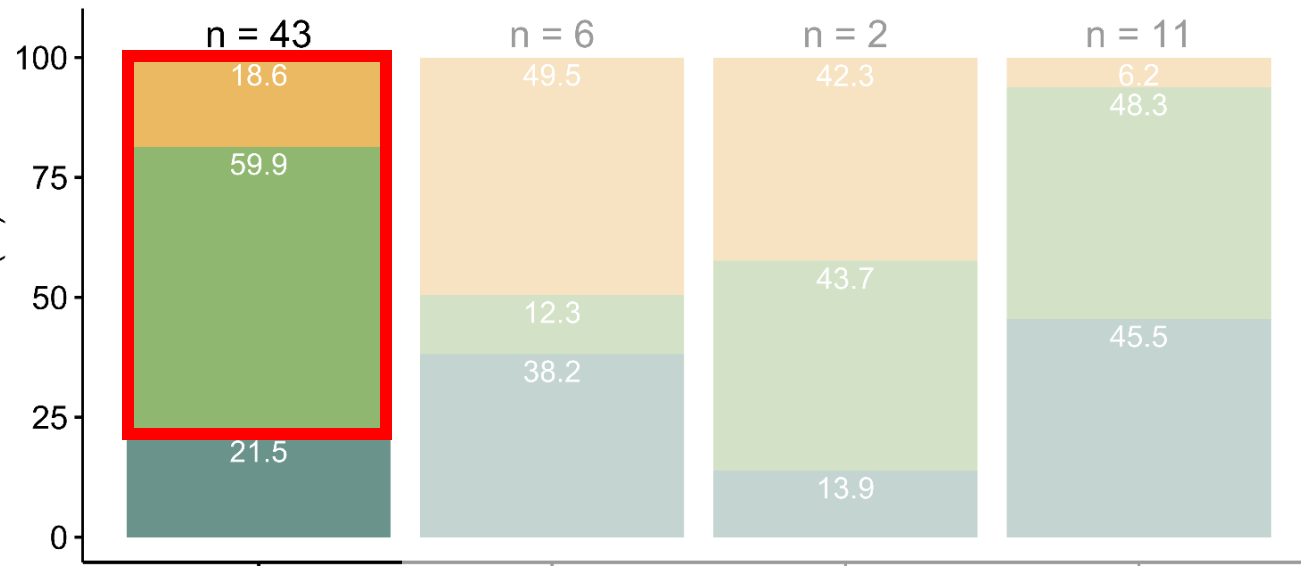


Closed forest

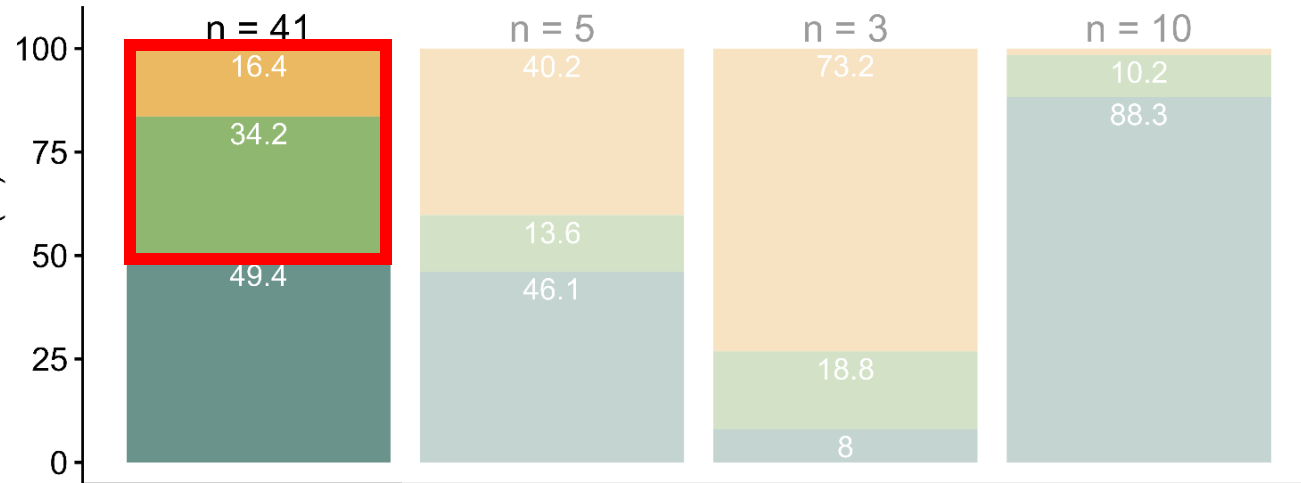


Over  
**50%**  
open  
vegetation  
& light  
woodland

### Early-temperate



### Late-temperate

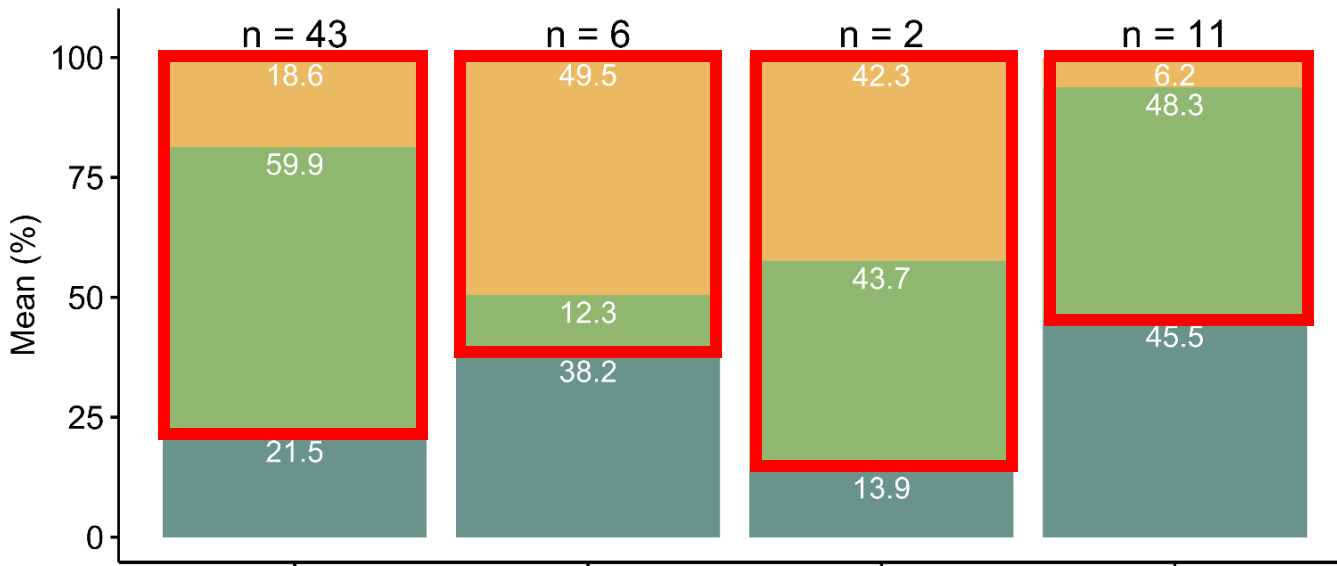


Land cover type

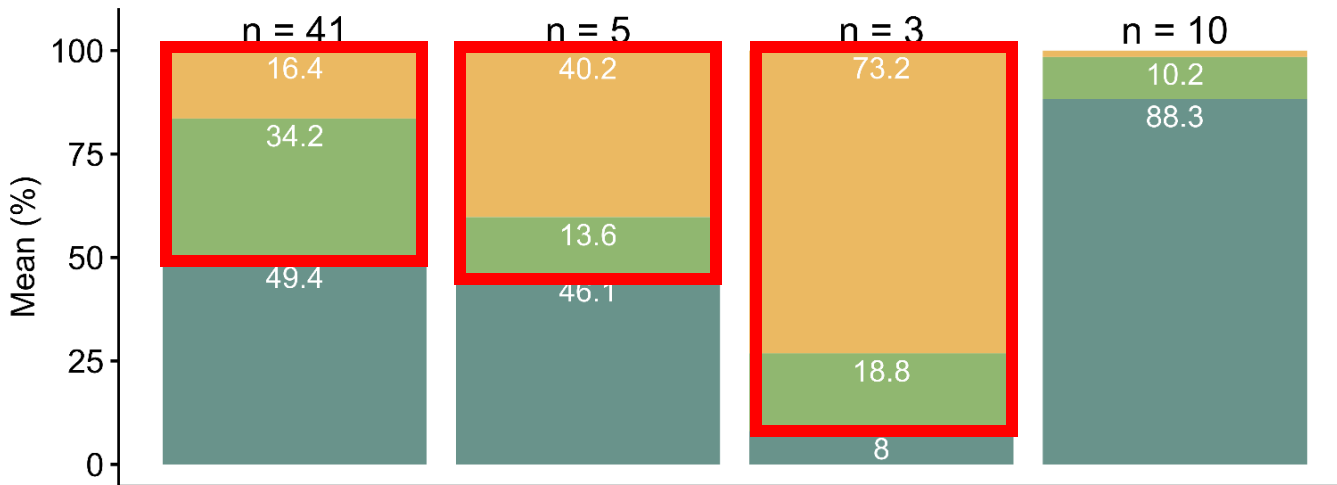
- Open vegetation
- Light woodland
- Closed forest

Over  
**50%**  
open  
vegetation  
& light  
woodland

### Early-temperate



### Late-temperate



Land cover type

- Open vegetation
- Light woodland
- Closed forest



Early-temperate

*Corylus*  
*Quercus*

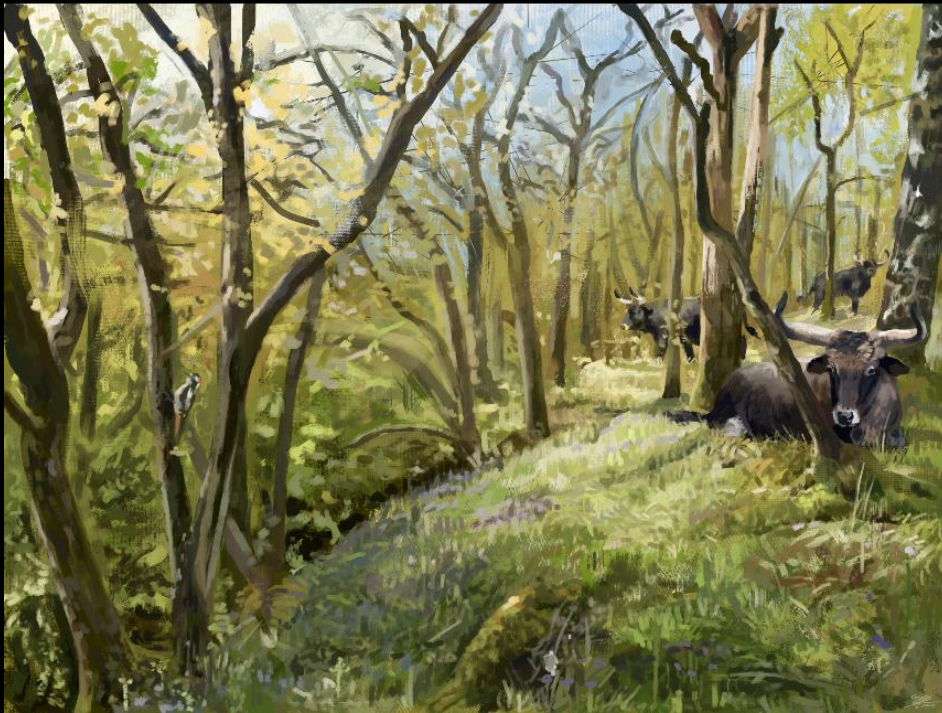
*Hassel*  
*Eg*



Late-temperate

*Carpinus*  
*Corylus*

*Avnbøg*  
*Hassel*



Early-temperate

*Poaceae*  
*Cyperaceae*

*Græsser*  
*Siv*



Late-temperate

*Poaceae*  
*Cyperaceae*

*Græsser*  
*Siv*

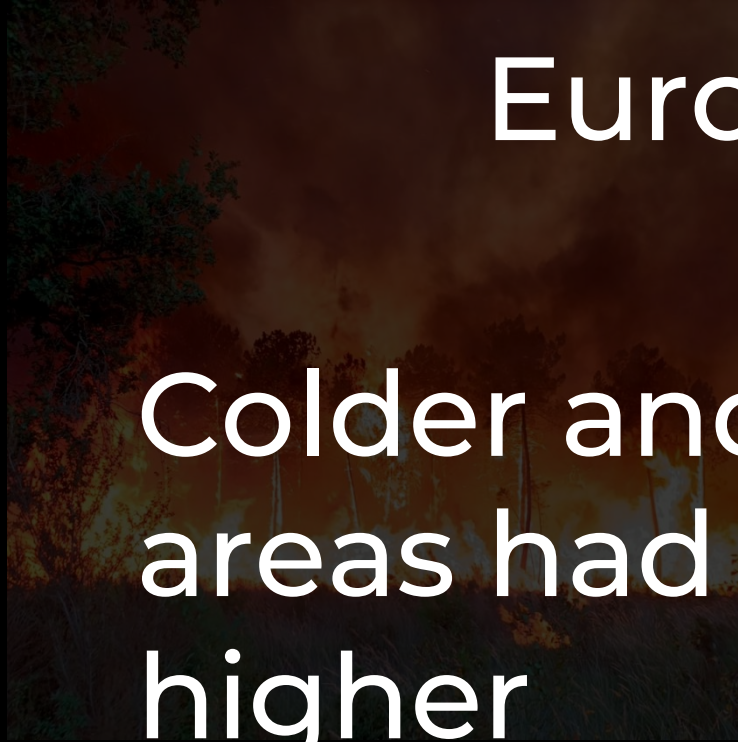


How open were European  
landscapes before modern  
humans?

What dynamics shaped these  
landscapes?



# More openness in oceanic Europe



Colder and drier  
areas had  
higher  
vegetation  
openness





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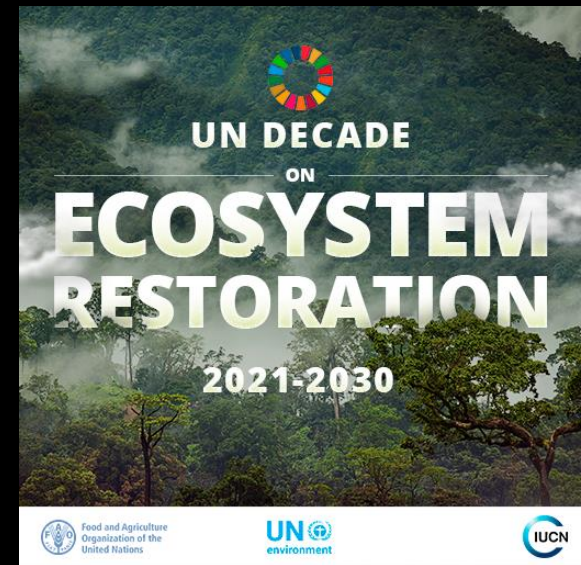






# Conclusions

- Open vegetation and light woodland were substantial
- Driven by disturbance regimes beyond climate
- Baseline choice matters
- Support for rewilding



# In practice?

- Rethink land-use
- Reintroduce keystone species
- Restore lost processes



# Thank you!



Jens-Christian Svenning



Signe Normand



Florence Mazier



TERRANOVA

# Forests before *Homo sapiens*

Historical baselines of European vegetation

Elena A. Pearce



# The European bison

a keystone species





Bee wolf with  
Honeybee

stard

Where the  
erosion ca

Heating spot for e.g.  
butterflies and dragonflies

re sanded  
e coat  
back  
erout

Halic  
scib

Dark-edged  
Bee-fly  
(p) pupa

# The bull pit

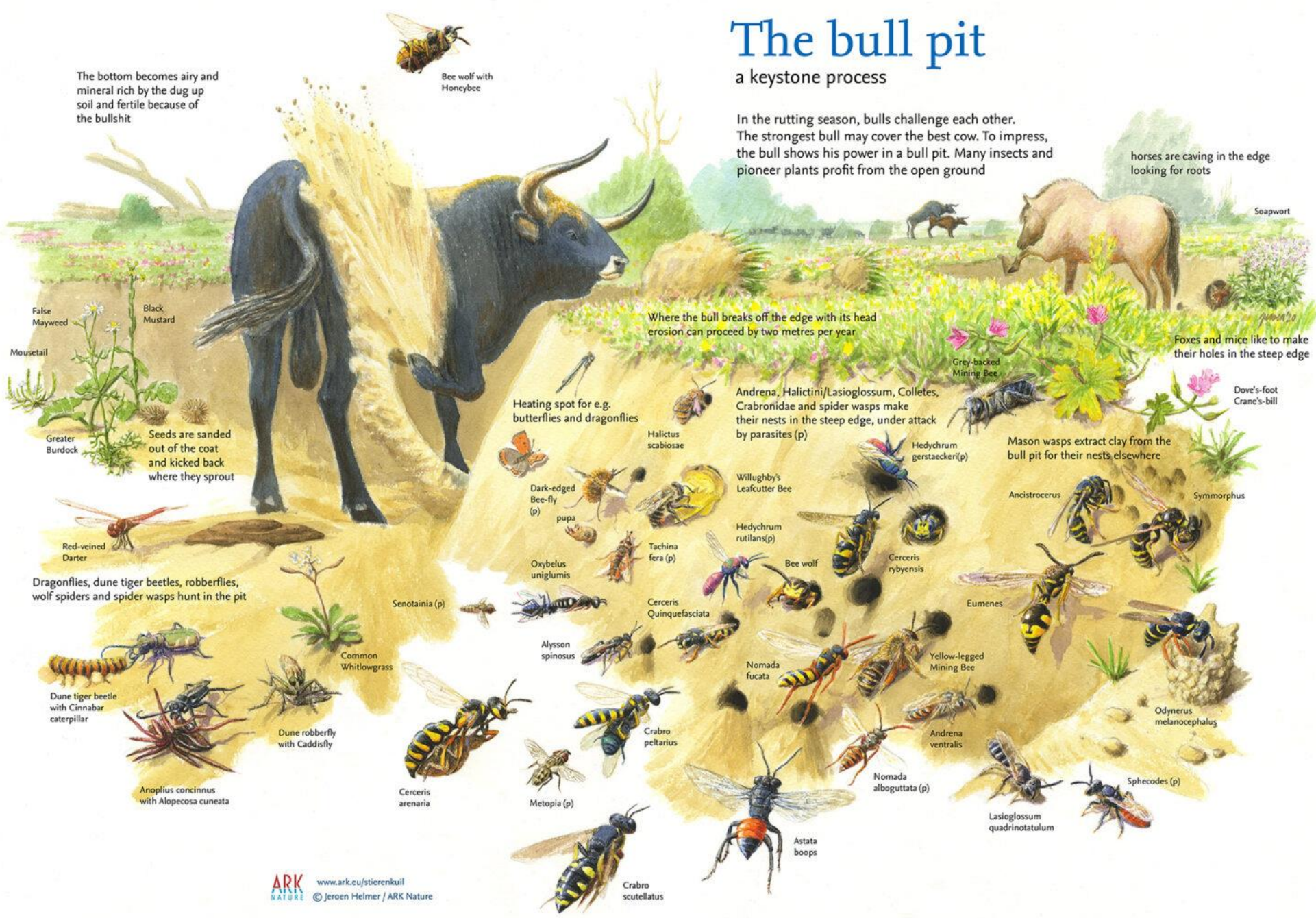
## a keystone process

The bottom becomes airy and mineral rich by the dug up soil and fertile because of the bullshit

Bee wolf with Honeybee

In the rutting season, bulls challenge each other. The strongest bull may cover the best cow. To impress, the bull shows his power in a bull pit. Many insects and pioneer plants profit from the open ground

horses are caving in the edge looking for roots



False Mayweed  
Black Mustard  
Mousetail  
Greater Burdock

Seeds are sanded out of the coat and kicked back where they sprout

Where the bull breaks off the edge with its head erosion can proceed by two metres per year

Foxes and mice like to make their holes in the steep edge

Heating spot for e.g. butterflies and dragonflies

Andrena, Halictini/Lasioglossum, Colletes, Crabronidae and spider wasps make their nests in the steep edge, under attack by parasites (p)

Mason wasps extract clay from the bull pit for their nests elsewhere

Dragonflies, dune tiger beetles, robberflies, wolf spiders and spider wasps hunt in the pit

Common Whitlowgrass

Senotainia (p)

Alysson spinosus

Cerceris Quinquefasciata

Nomada fucata

Yellow-legged Mining Bee

Odynerus melanocephalus

Dune tiger beetle with Cinnabar caterpillar

Dune robberfly with Caddisfly

Cerceris arenaria

Metopia (p)

Crabro peltarius

Nomada alboguttata (p)

Sphecodes (p)

Red-veined Darter

Dark-edged Bee-fly (p) pupa

Oxybelus uniglumis

Willughby's Leafcutter Bee

Hedychrum gerstaeckeri (p)

Symmorphus

Halictus scabiosae

Tachina fera (p)

Hedychrum rutilans (p)

Bee wolf

Dove's-foot Crane's-bill

Senotainia (p)

Cerceris Quinquefasciata

Nomada fucata

Yellow-legged Mining Bee

Odynerus melanocephalus

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Odynerus melanocephalus

Metopia (p)

Crabro peltarius

Nomada alboguttata (p)

Andrena ventralis

Odynerus melanocephalus

Metopia (p)

Crabro peltarius

Nomada alboguttata (p)

Andrena ventralis

Odynerus melanocephalus

Astata boops

Lasioglossum quadrinotatum

Sphecodes (p)

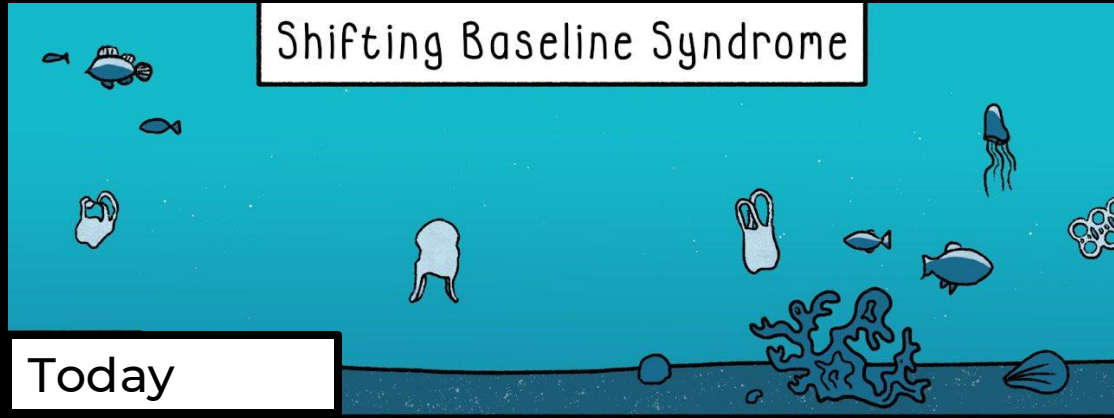
Crabro scutellatus



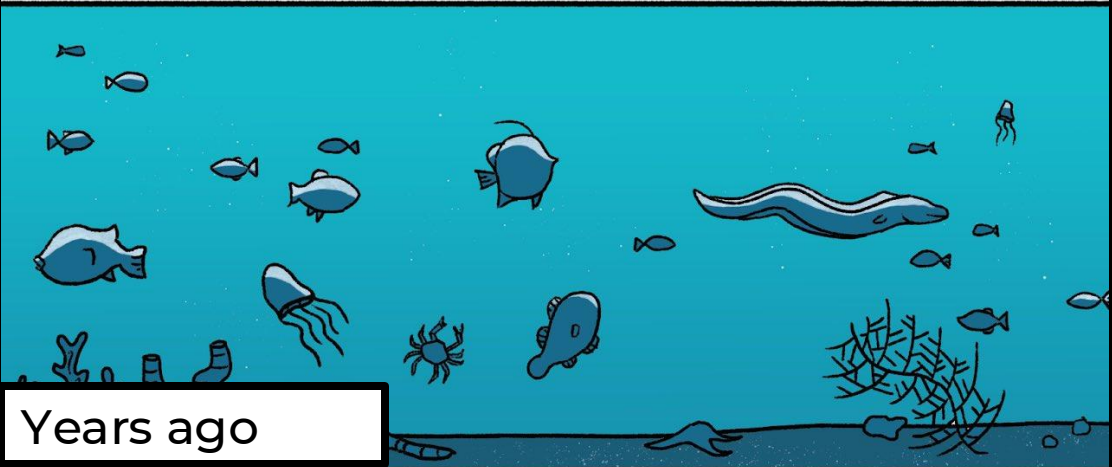
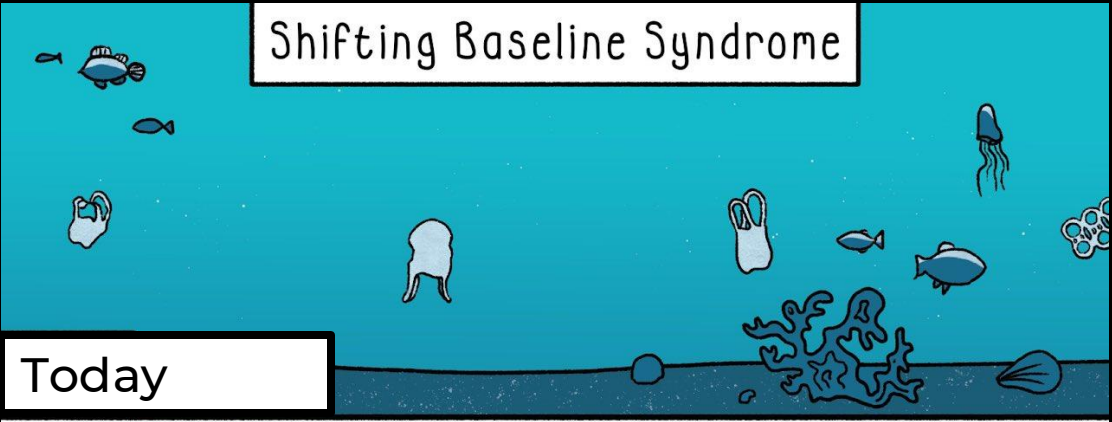




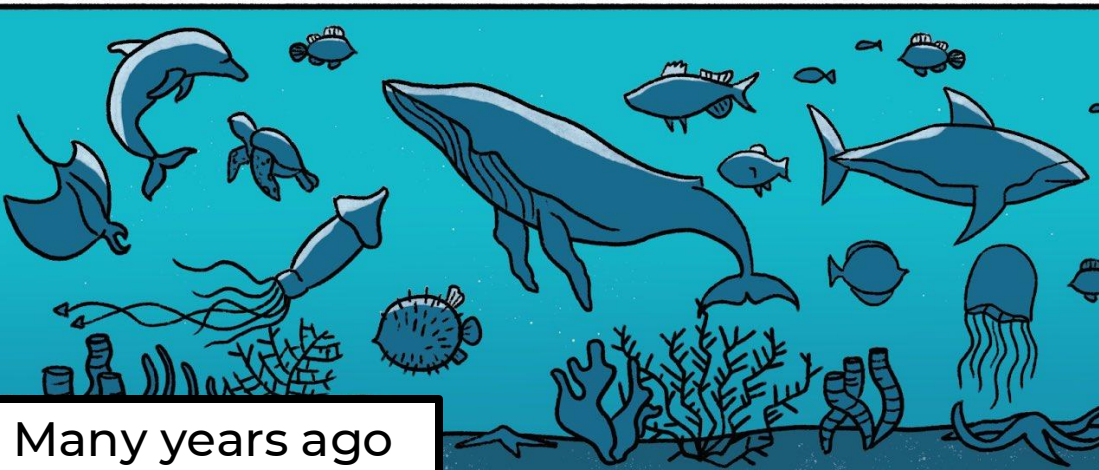
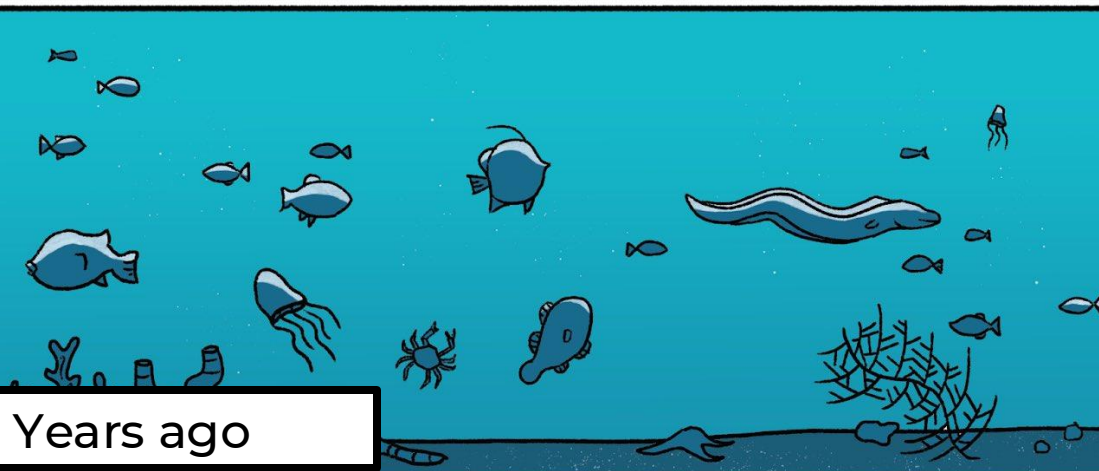
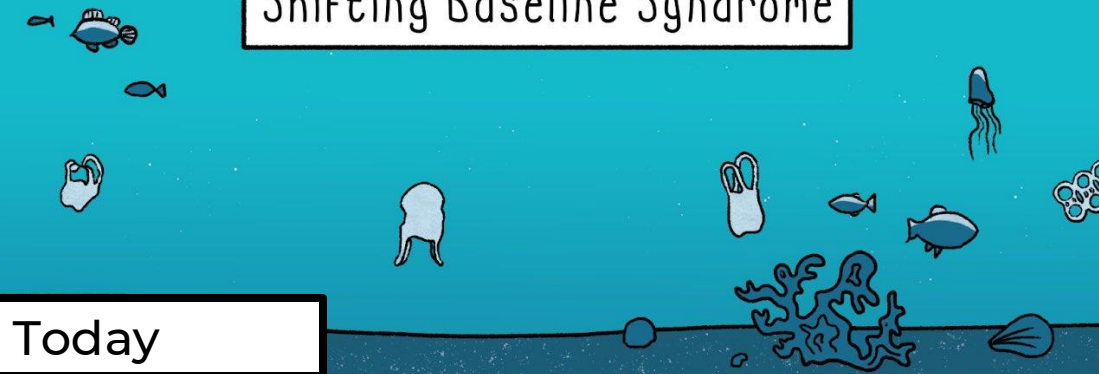




# Shifting Baseline Syndrome

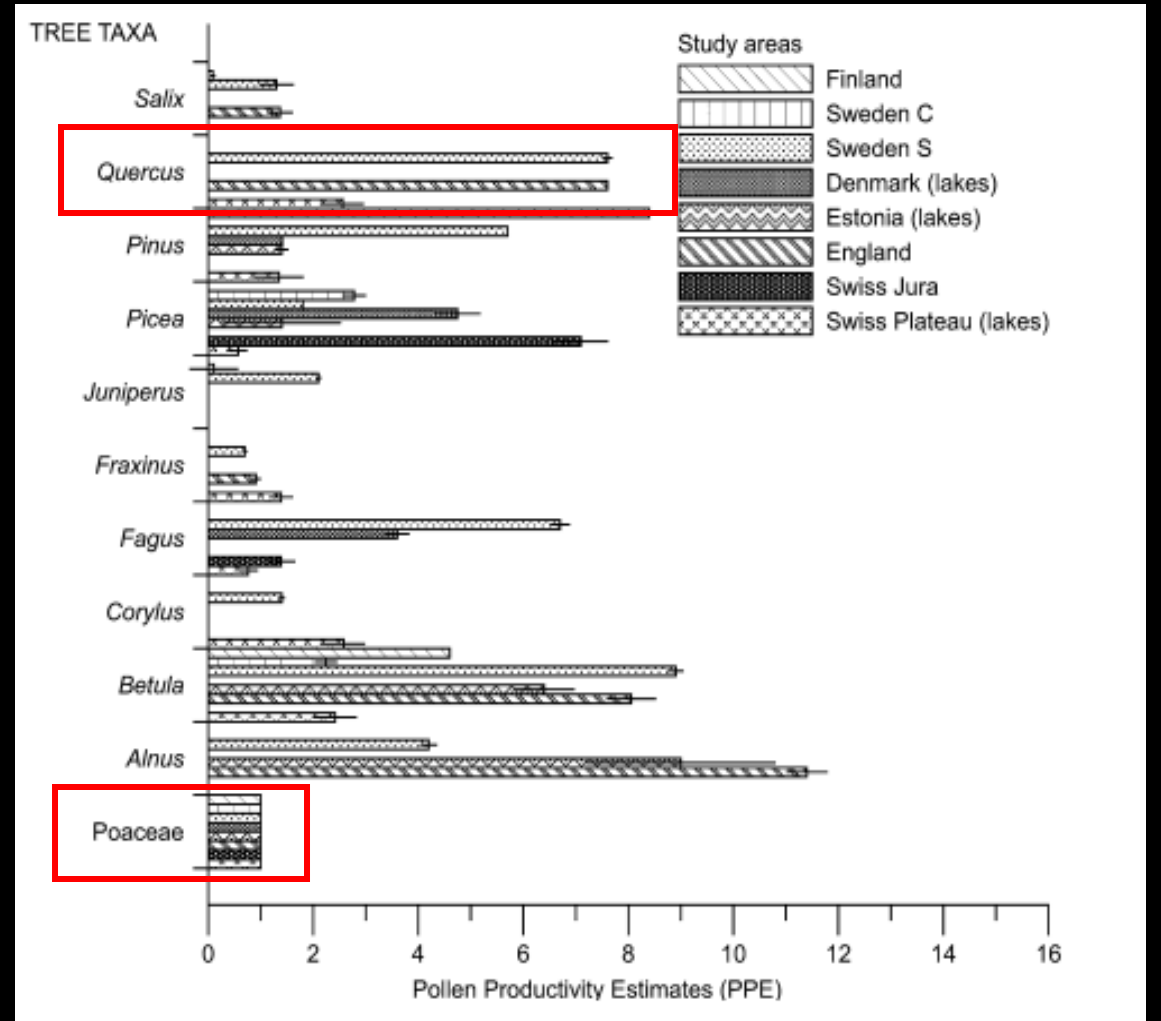
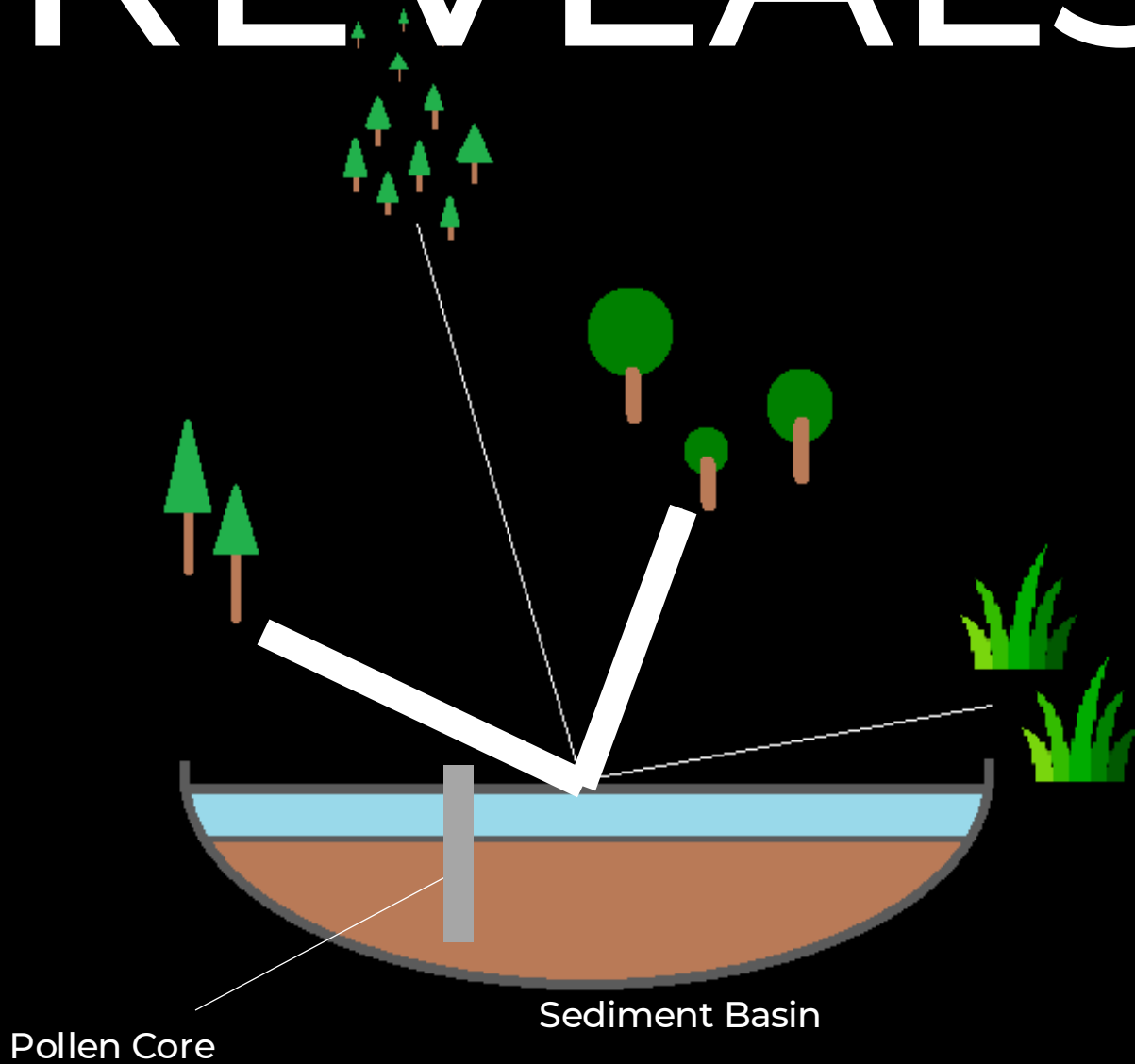


# Shifting Baseline Syndrome



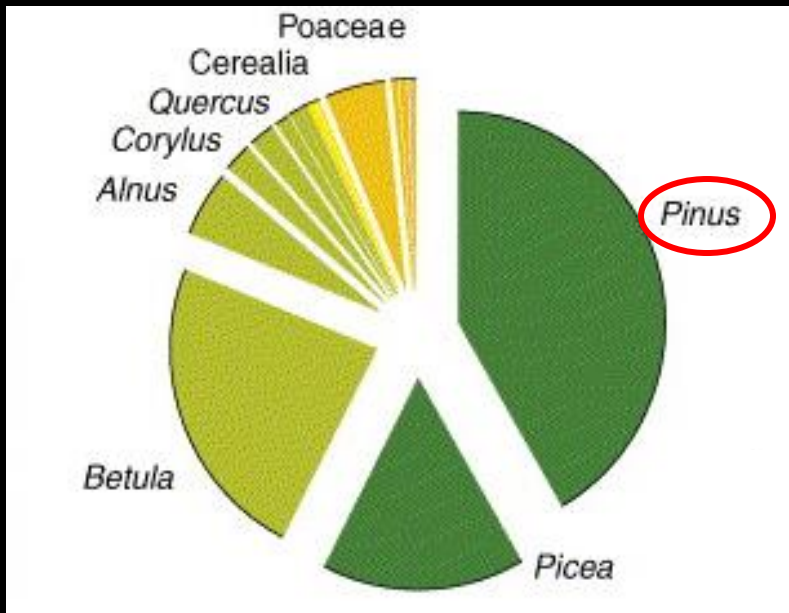
# REVEALS

(Sugita, 2007)



# REVEALS

Sugita (2007)



Original Pollen Percentages

# REVEALS (Sugita, 2007)

Regional Estimates of VEgetation Abundance from Large Sites

