

# Fires and forests: A reconstruction of Holocene fire-vegetation relationships in Central Yakutia, Siberia

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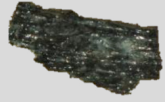


Glückler et al. 2022 [Preprint]

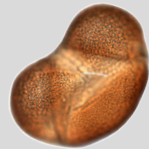


Photos:  
R. Glückler  
and  
R. Jackisch

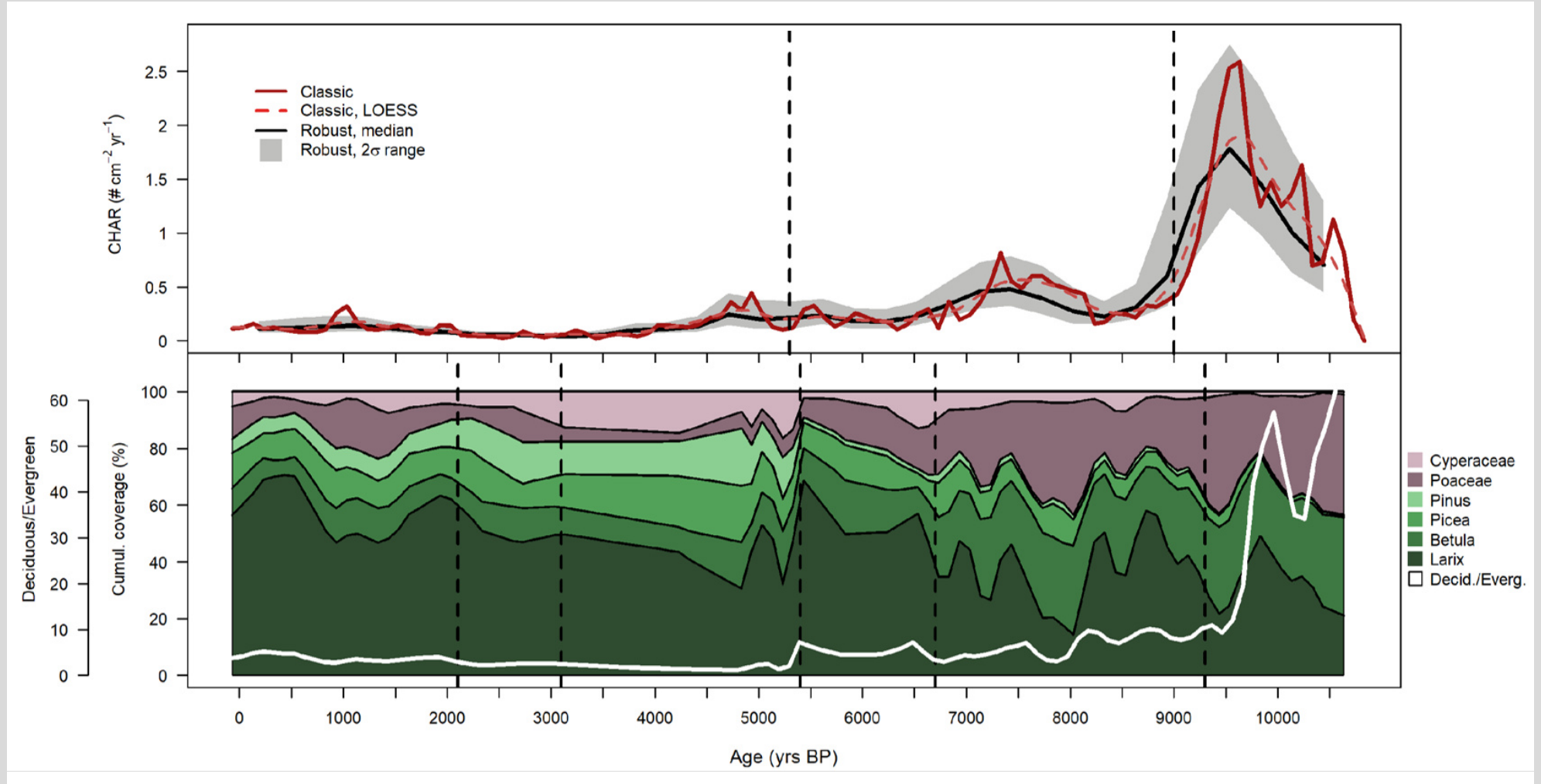




Macroscopic charcoal  
( $> 150 \mu\text{m}$ )



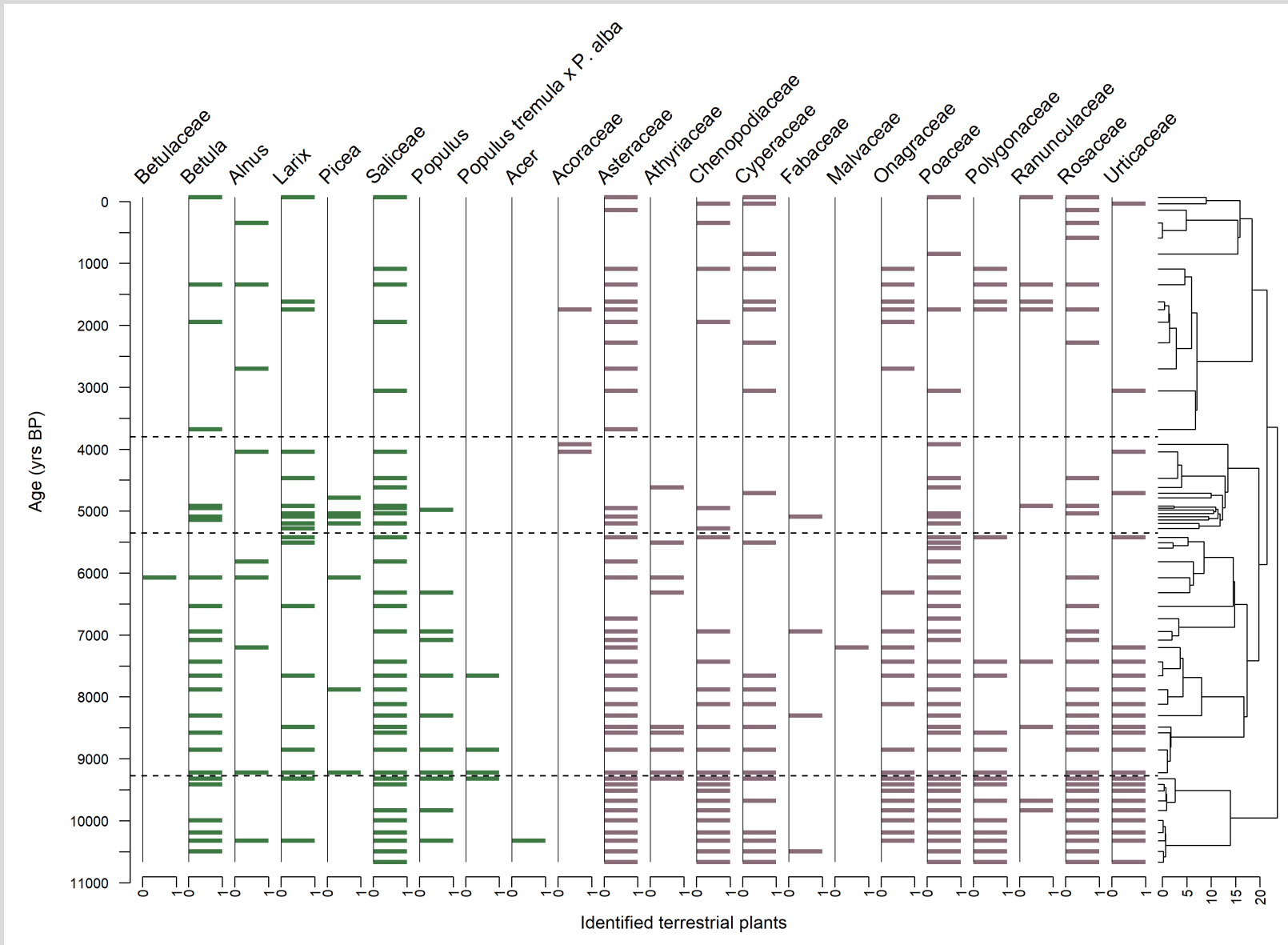
Pollen-based  
quantitative  
vegetation coverage



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## Terrestrial plant DNA metabarcoding

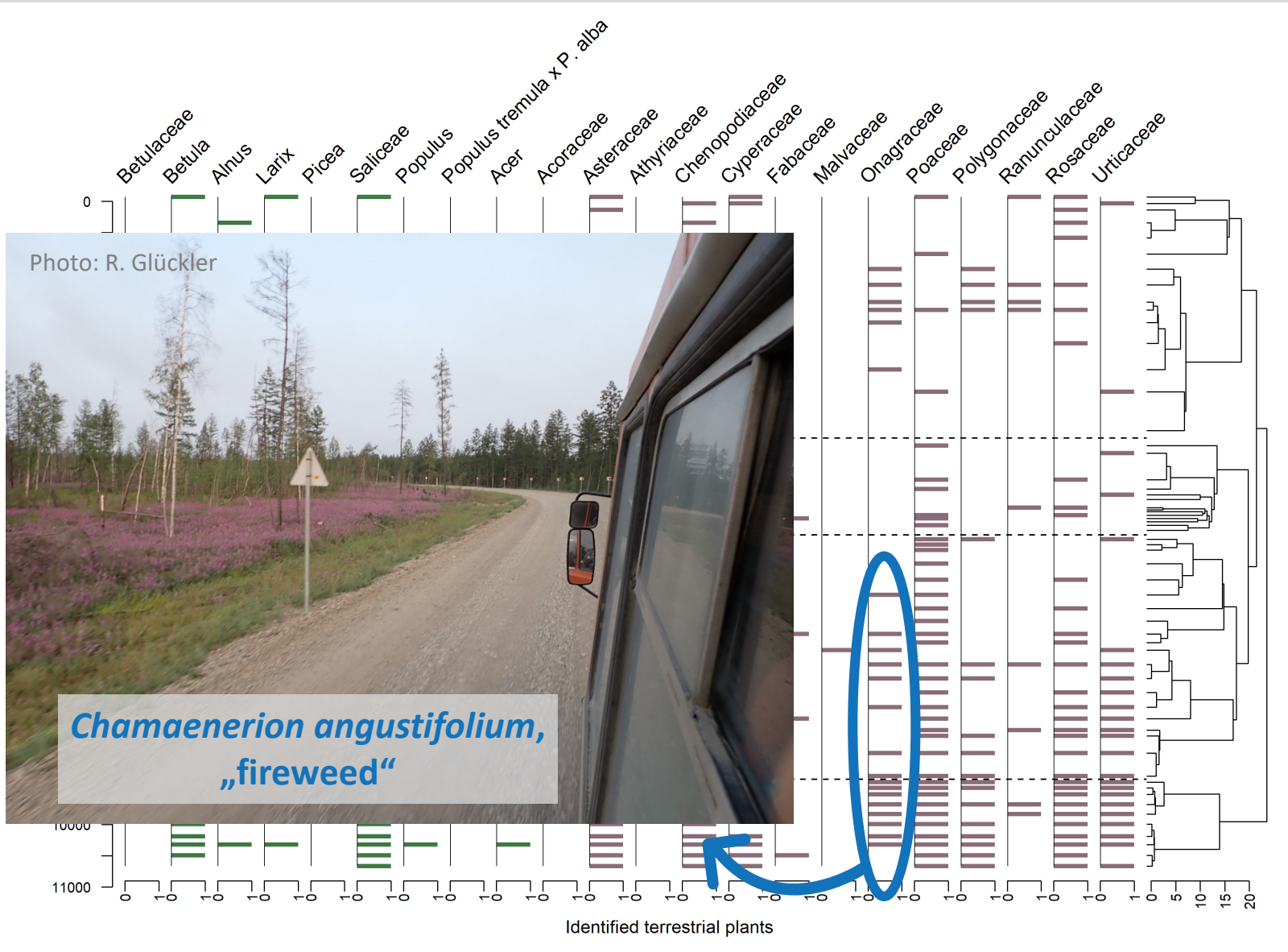


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## Terrestrial plant DNA metabarcoding

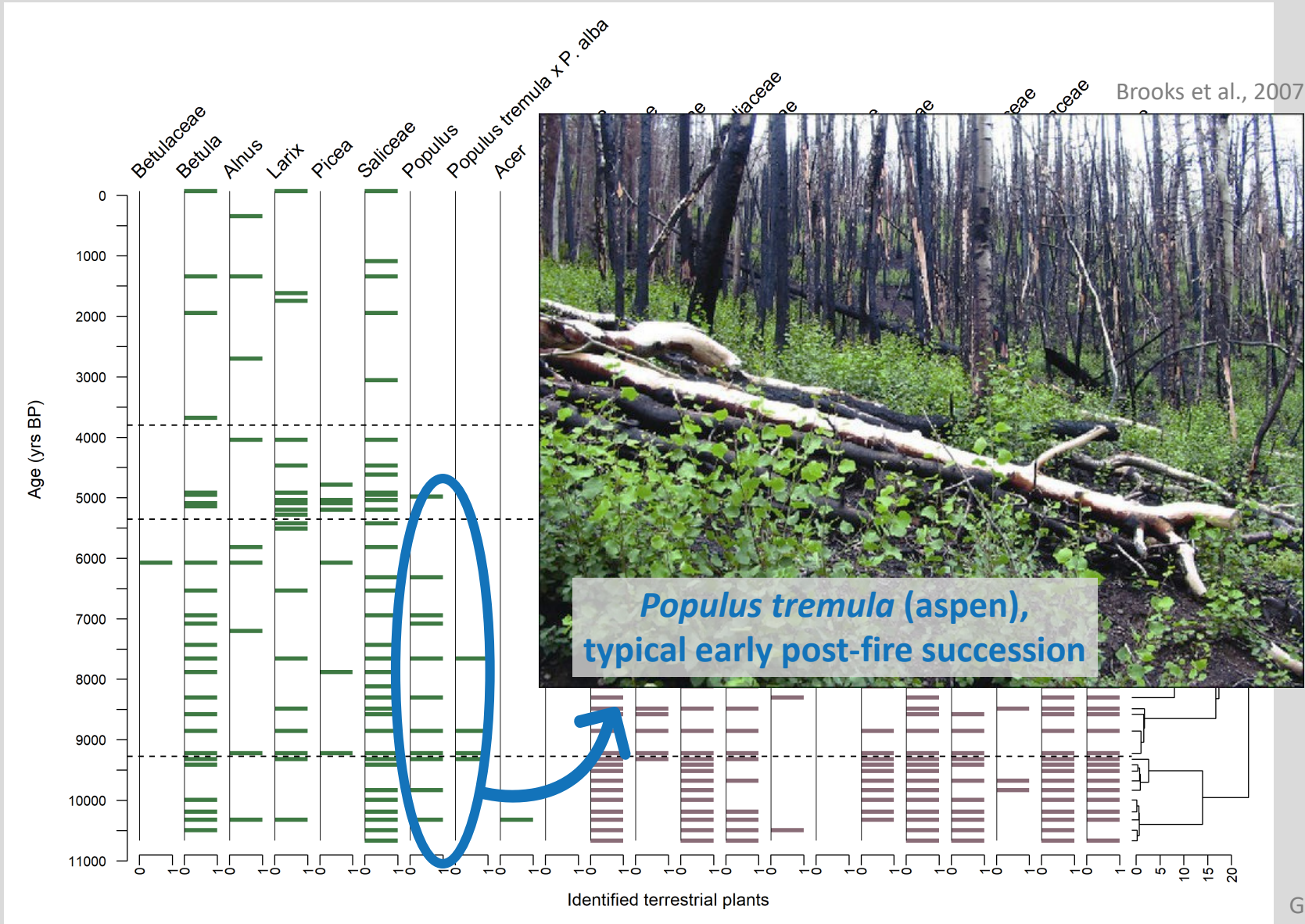


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### Terrestrial plant DNA metabarcoding





|                                | Early Holocene                | Late Holocene                     |
|--------------------------------|-------------------------------|-----------------------------------|
| <b>Amount of biomass burnt</b> | High                          | Low                               |
| <b>Forest structure</b>        | Open woodlands                | Dense forest                      |
| <b>Forest composition</b>      | <i>Larix/Betula + Populus</i> | <i>Larix + Picea/Pinus/Betula</i> |
| <b>Grassland composition</b>   | More Poaceae, fireweed        | More Cyperaceae                   |
| <b>Temperature</b>             | Warmer                        | Colder                            |





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## Fires and forests: A reconstruction of Holocene fire vegetation relationships in Central Yakutia, Siberia

EGU22-499 – Session CL5.1.3

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### Background

- After extreme fire seasons, Central Yakutia is now among the most fire-prone regions of eastern Siberia and the whole boreal zone. It is predicted that fire regimes will further intensify.
- The unique deciduous and larch-dominated boreal forest of eastern Siberia provides many important ecosystem services. It protects permafrost from degradation, conserves resources and infrastructure, and is home to millions of people, including indigenous communities.
- Long-term feedbacks between changes in fire regimes and forest structure and composition are not yet well understood. Data on long timescales is scarce, but needed for thorough evaluation of: Can we identify long-term regional relationships between changing fire regimes and boreal forest structure?

### Methods

- Sediment core (120 cm) from thermokarst lake Saragay, spanning the last c. 10,000 years
- For reconstructing wildfires: 1) Macroscopic charcoal particles (>50 µm) extracted by wet-sieving on pollen slides (for 12 samples)
- For reconstructing vegetation composition: 1) REVEALS-transformed pollen record (2, 3) (for 48 samples); 2) Sedimentary ancient DNA (sedDNA) of forestal plant metabarcoding (for 61 samples)

### Results and Discussion

- Reconstructed wildfire activity: High amounts of biomass burned in Early Holocene (c. 9600 yrs BP), followed by intermediate phase, with modern, low-severity fire regime since c. 4500 yrs BP.
- Reconstructed vegetation composition: Early Holocene dominated by larch/birch woodland and forest composition becomes more mixed with introduction of Pinus c. 5400 yrs BP and more Cypripaceae. Late Holocene is characterized by fewer grasses and a dense, larch-dominated forest modified by short-term fire weather variations. In modern forest state, climate becomes main driver.

| Early Holocene state   | Late Holocene state  |
|------------------------|----------------------|
| High                   | Low                  |
| Open woodlands         | Dense forest         |
| Larch/Betula + Pinus   | Larch + Pinus/Betula |
| More Poaceae, fireweed | Forest structure     |
| Warmer                 | Amount biomass burnt |
|                        | Forest composition   |