Biodiversity and Disturbances long-term ecological studies

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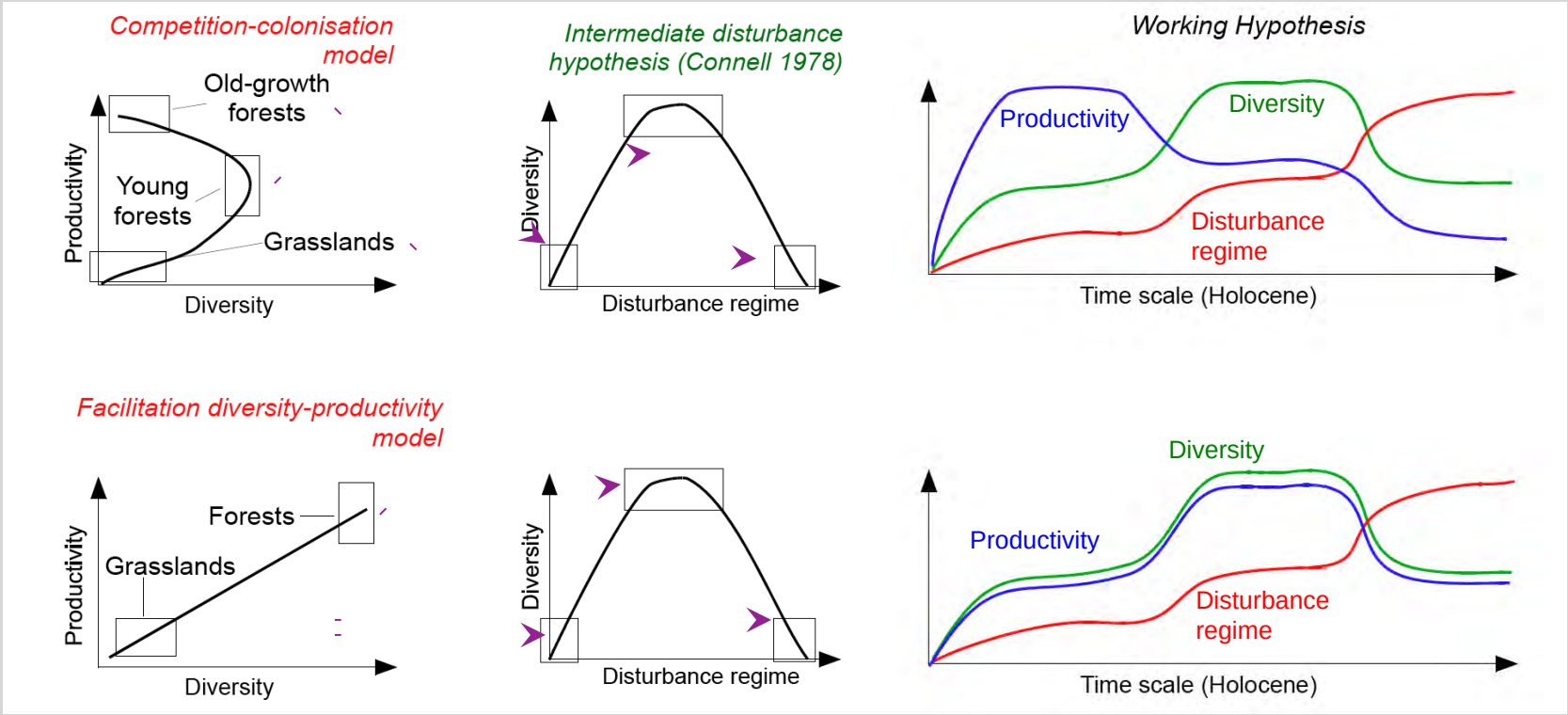
Questions

- How disturbance regimes control the diversity and the productivity and the diversity-productivity relationships

Aims

- To review methods to estimate the diversity of paleo-community
- To propose new pathways to assess correctly the paleo-diversity
- To test the relationships between paleo-fires and diversity in diverse European and North-American ecosystems
- To determine other forest disturbances that could be analyses on long-term ecological studies (avalanches, insect outbreaks)

Establishing a theoretical framework



Conceptual sources: Connell, 1978, Science
Hector et al., 1999, Science
Mouquet et al., 2002, Ecology Letters
Willis et al., 2010, Trends Ecol. Evol.

Problems to solve

- To assess community diversity:
  solving the problem of low-counts
  of bio-proxies, the sampling effort, etc.

Rarefaction analysis

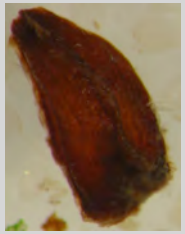
$$E(T_n) = \sum_{i=1}^{T} 1 - \left[\frac{\binom{N - N_i}{n}}{\binom{N}{n}} \right]$$

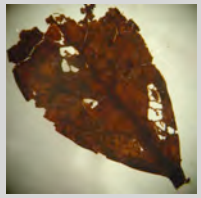
Heck et al. (1975) Ecology
Birks & Line (1992) Holocene

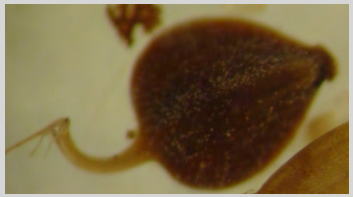
- pollen *vs* macroremains: redundancy or complementarity?

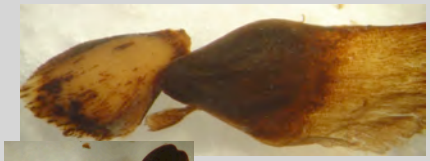
- Scaling the diversity in space and time

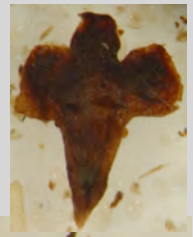
Bio-proxies for community diversity

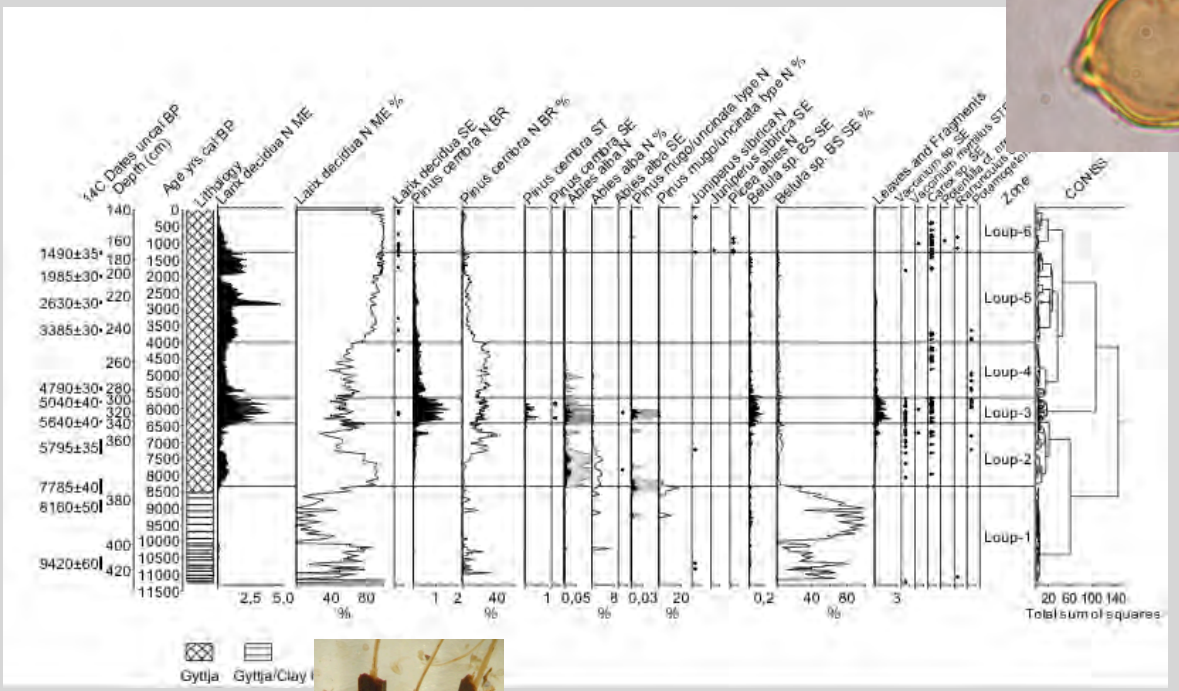


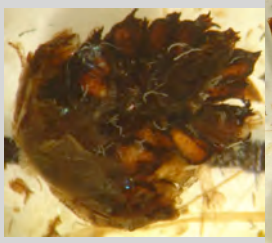


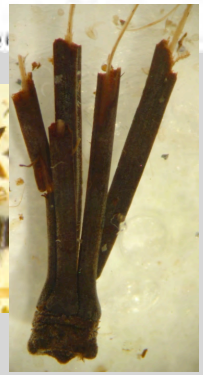


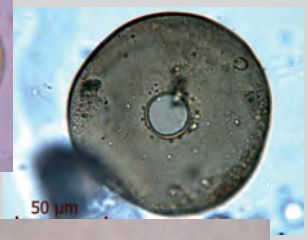


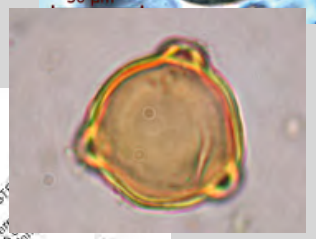








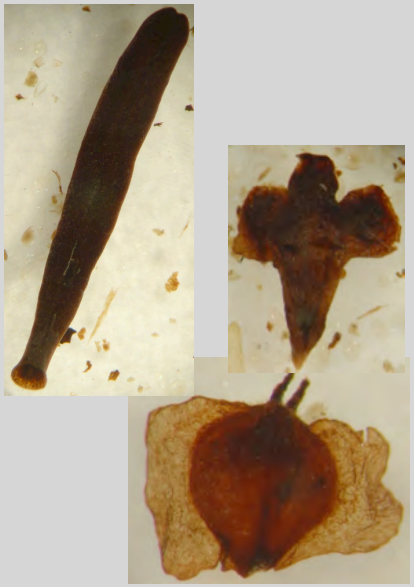


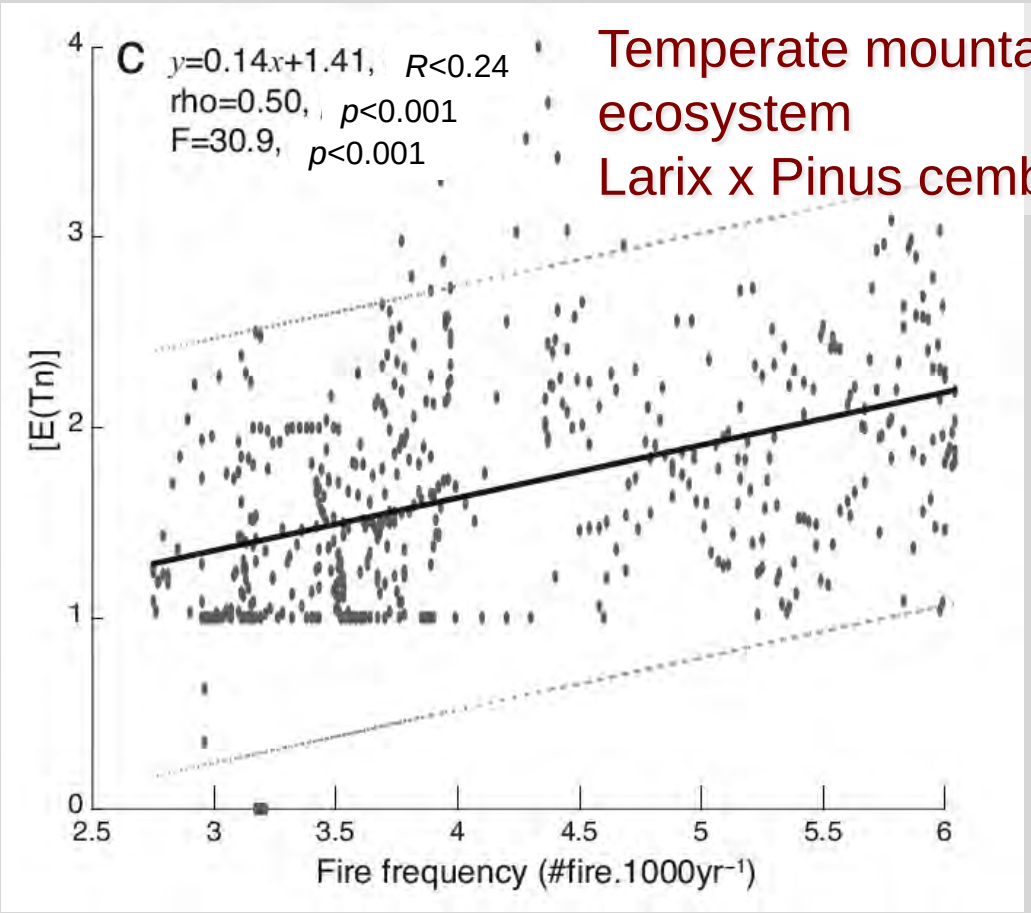


Alpha-diversity ~ Fire frequency ?

Rarefaction analysis

$$E(T_n) = \sum_{i=1}^{T} 1 - \left[\frac{\binom{N - N_i}{n}}{\binom{N}{n}} \right]$$





Temperate mountain ecosystem
Larix x Pinus cembra

Blarquez et al. (2010) Journal of Ecology

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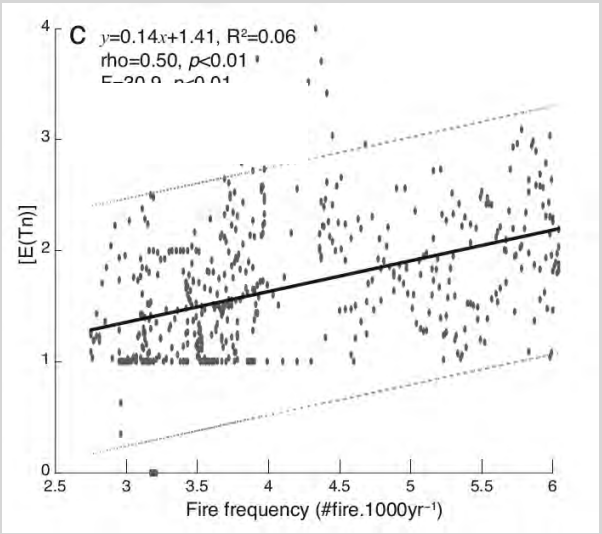
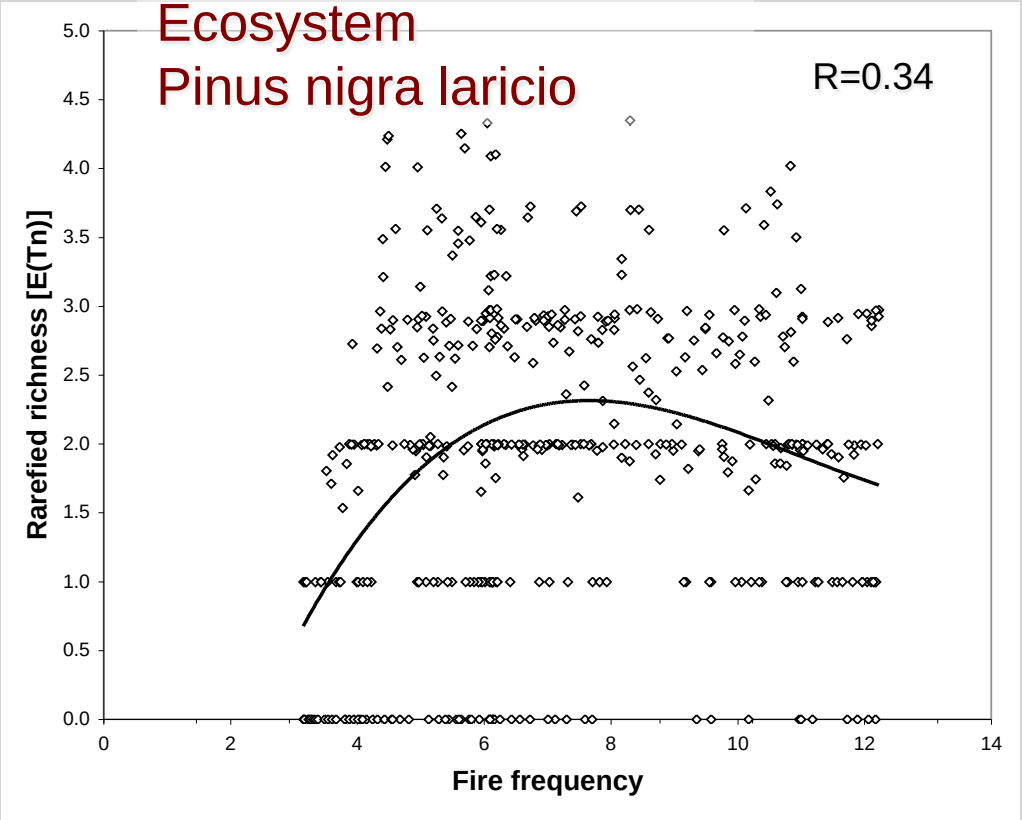
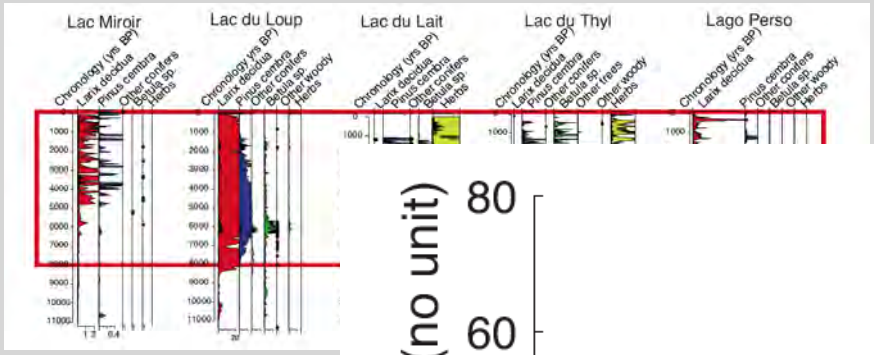


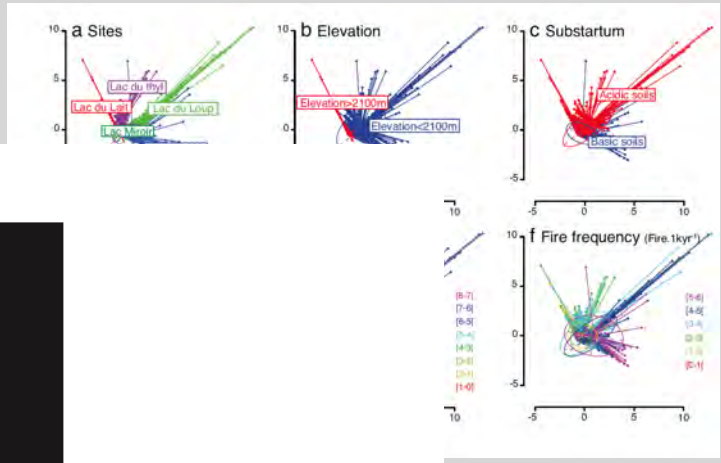
Mediterranean mountain Ecosystem
Pinus nigra laricio

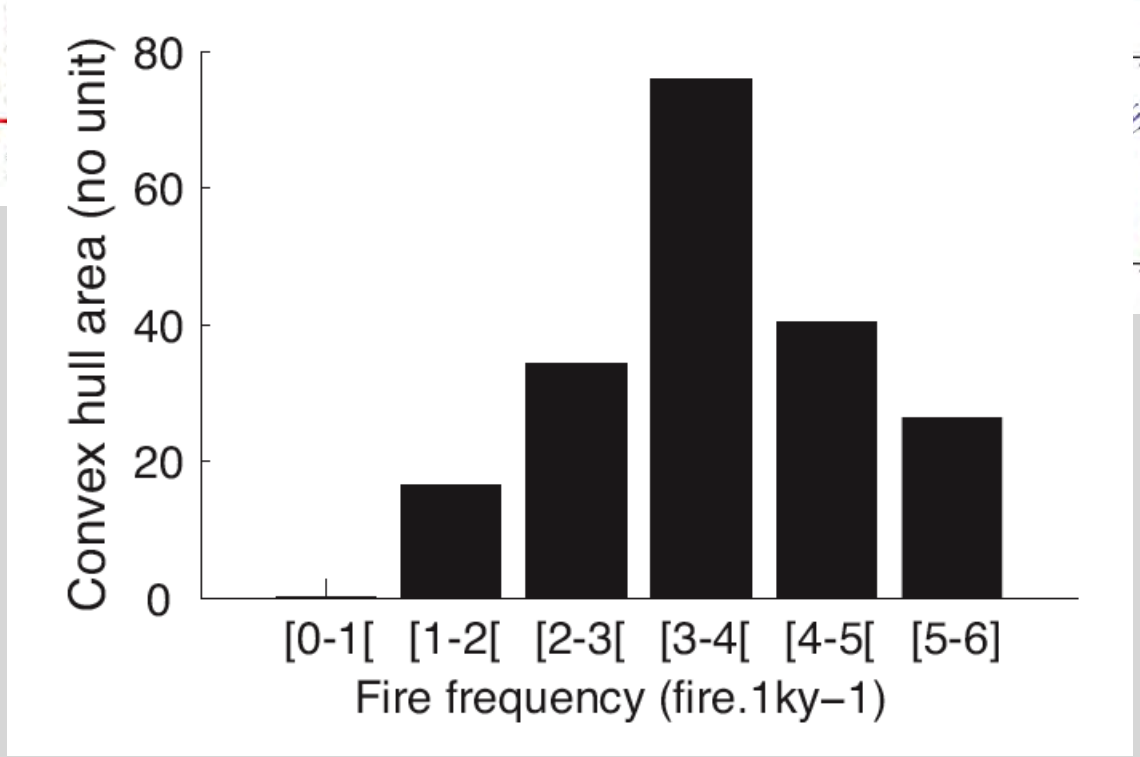


Leys et al. (2012) PhD Thesis
Leys et al. (2014) Journal of Ecology

Landscape (beta) diversity and fire







Blarquez (2010) PhD thesis
Blarquez & Carcaillet (in review)

Scaling the paleo-diversity

Rarefaction analyses

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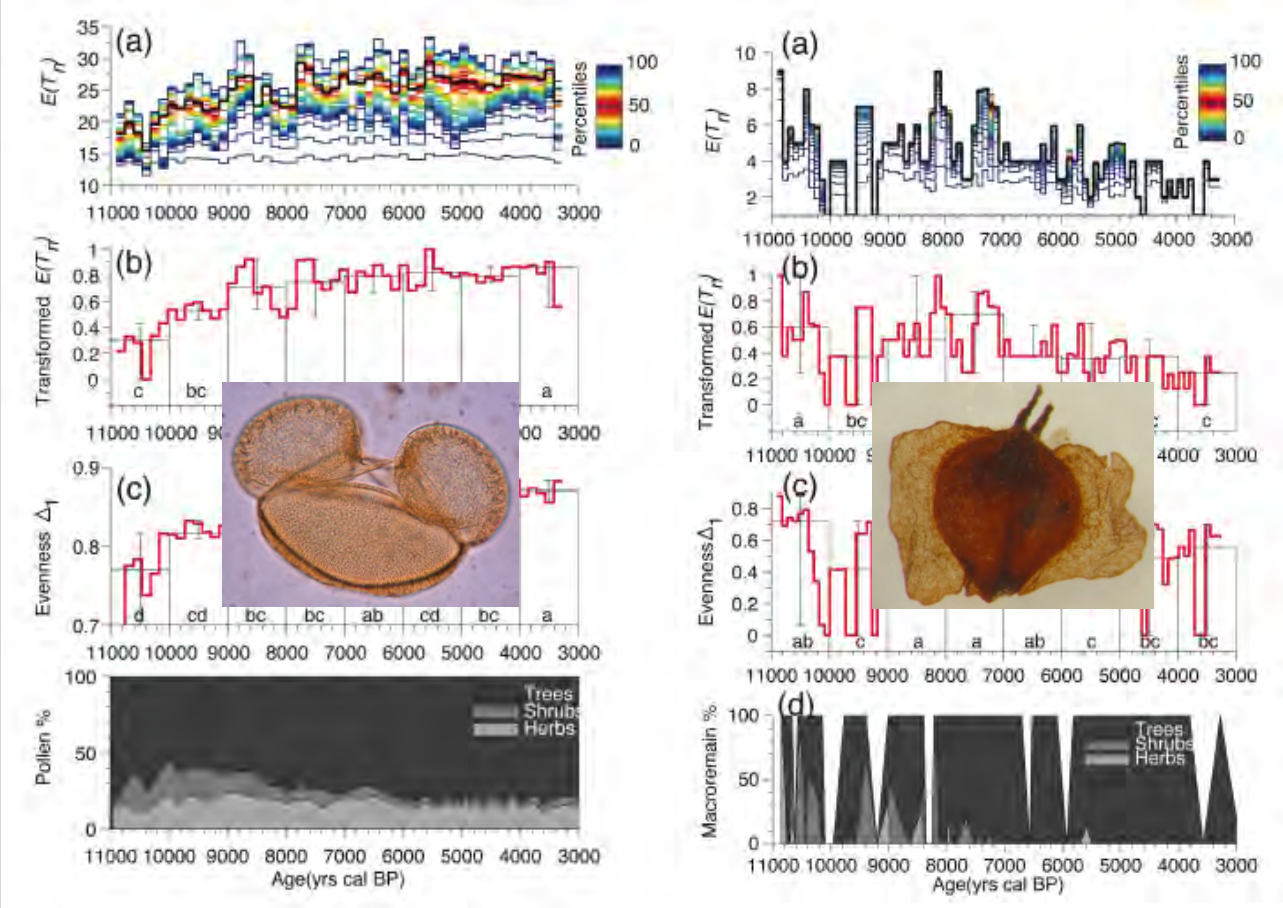
Heck et al. (1975) Ecology
Birks & Line (1992) Holocene

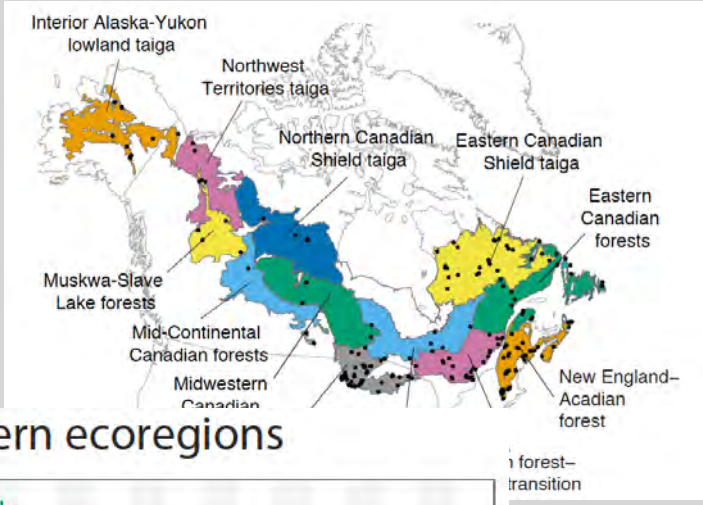
Pollen

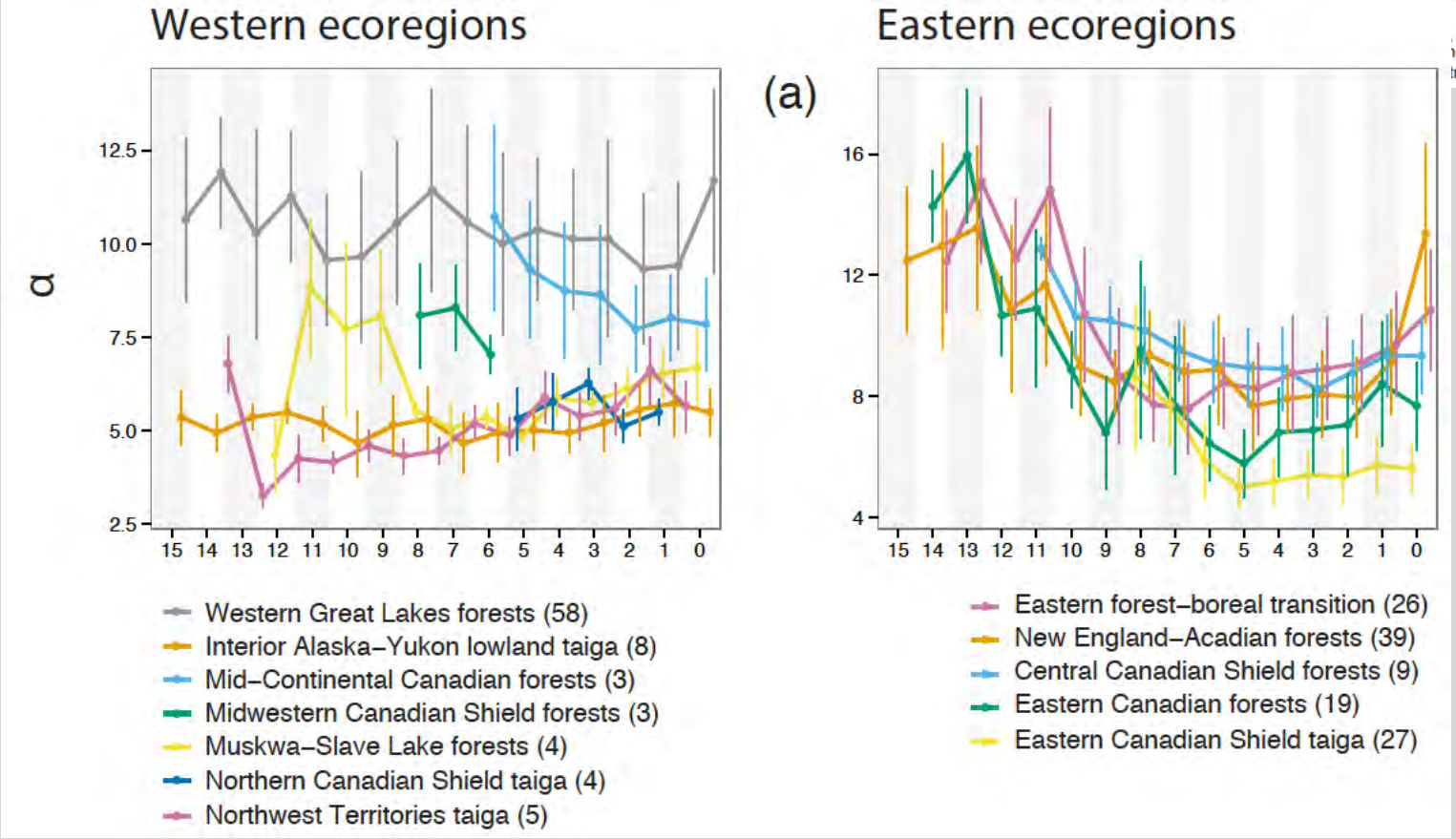
Plant macroremains



Blarquez, Finsinger, Carcaillet (2013) PLoS ONE

Pollen diversity dynamics: a biome-scale analysis





Blarquez, Carcaillet, Frejaville & Bergeron (in review)

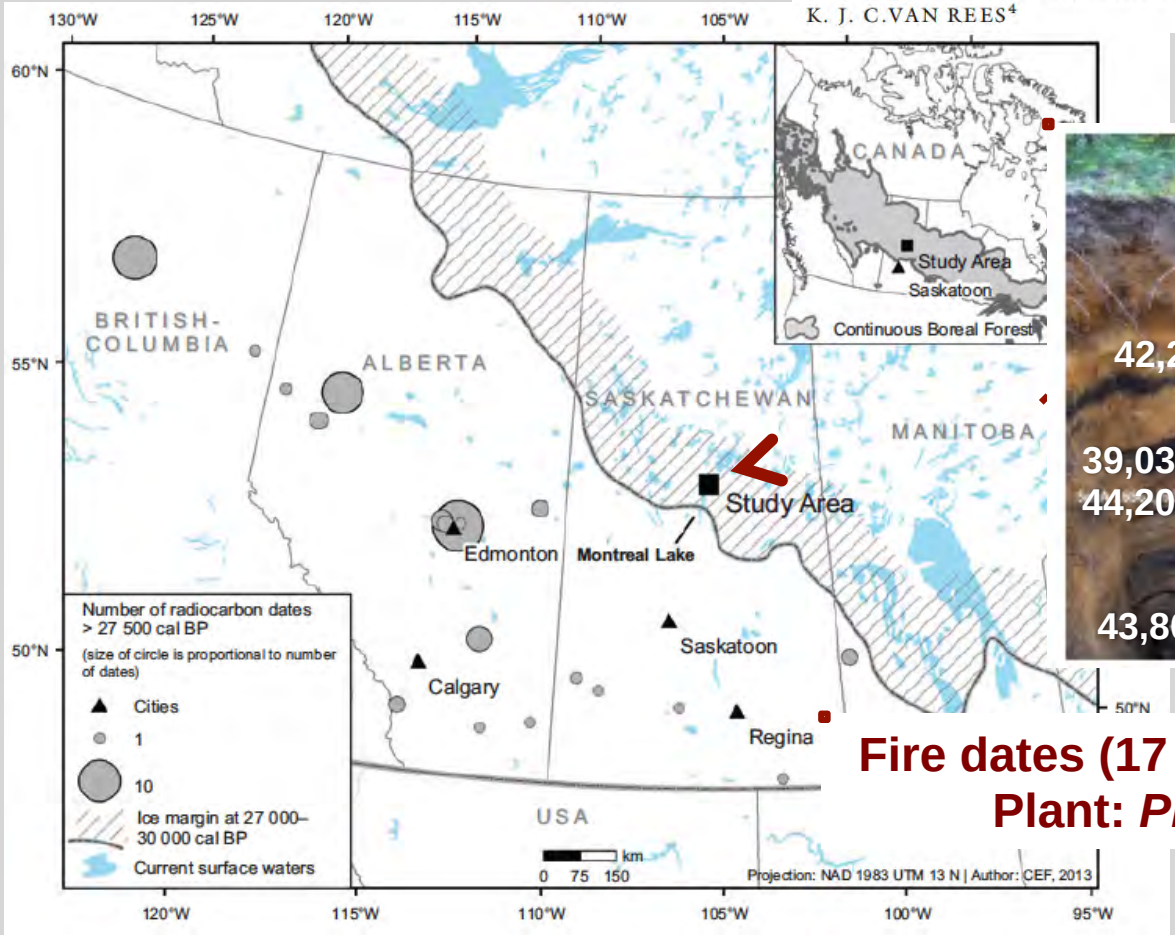
The origin of the modern diversity

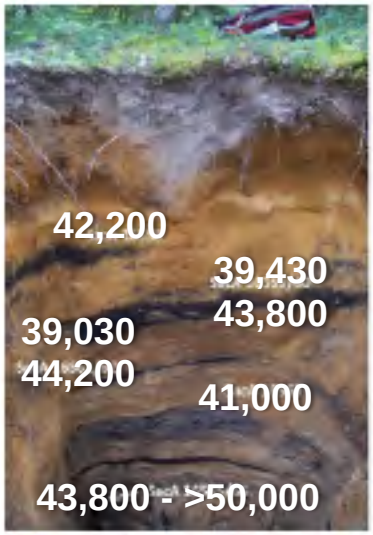
Geobiology

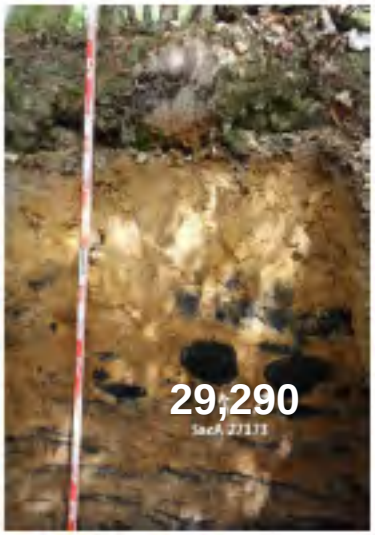
Geobiology (2014) DOI: 10.1111/gbi.12076

Periglacial fires and trees in a continental setting of Central Canada, Upper Pleistocene

N. BÉLANGER,[1,2] C. CARCAILLET,[2,3] G. A. PADBURY,[4] A. N. HARVEY-SCHAFER[4] AND K. J. C.VAN REES[4]







Fire dates (17 ^{14}C): [50,000-27,000 cal BP]
Plant: *Pinus*, *Picea* and *Abies*

Thanks to students, post-docs & colleagues