Variazioni del limite della foresta nelle Alpi negli ultimi 15.000 anni

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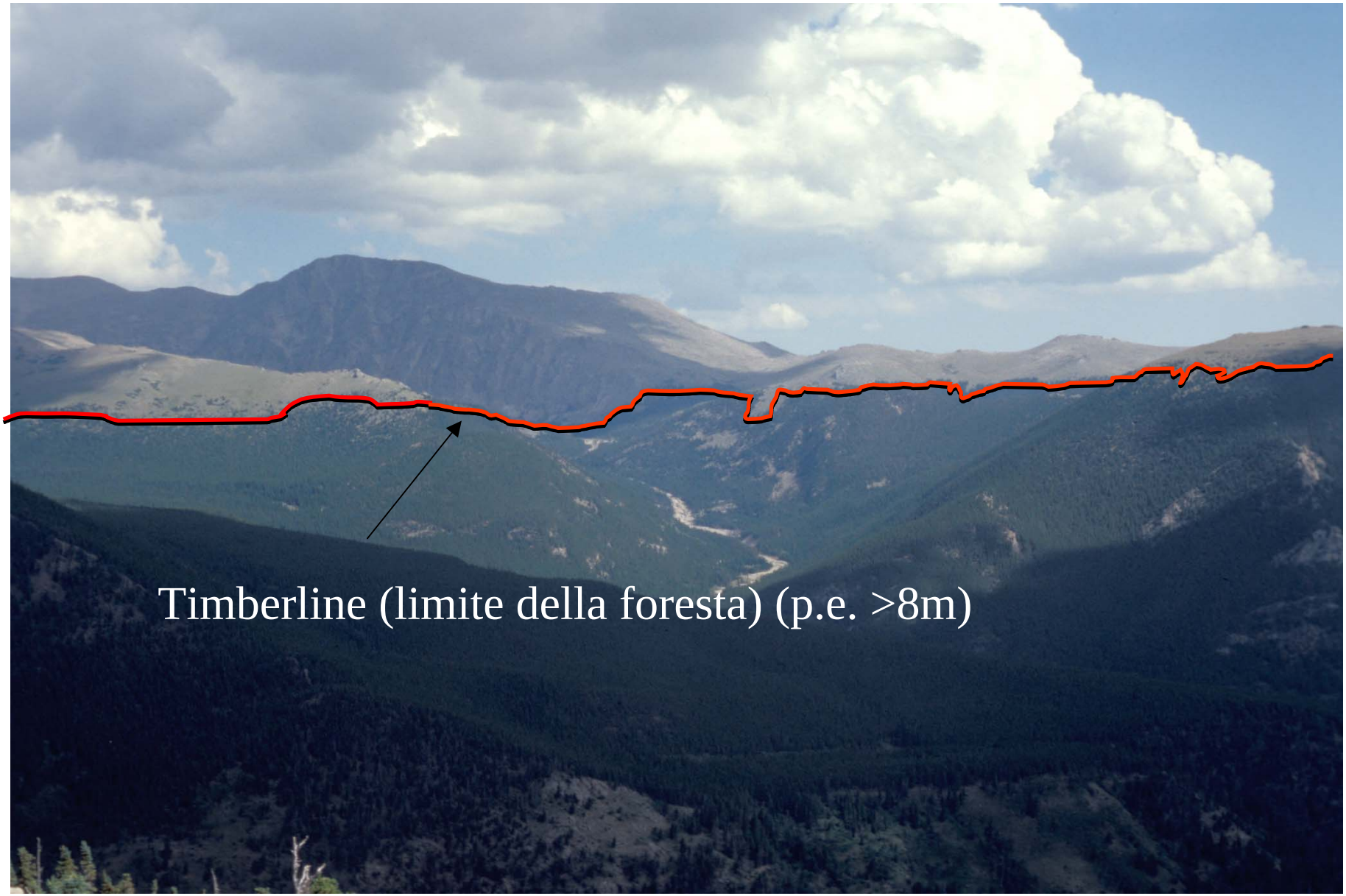
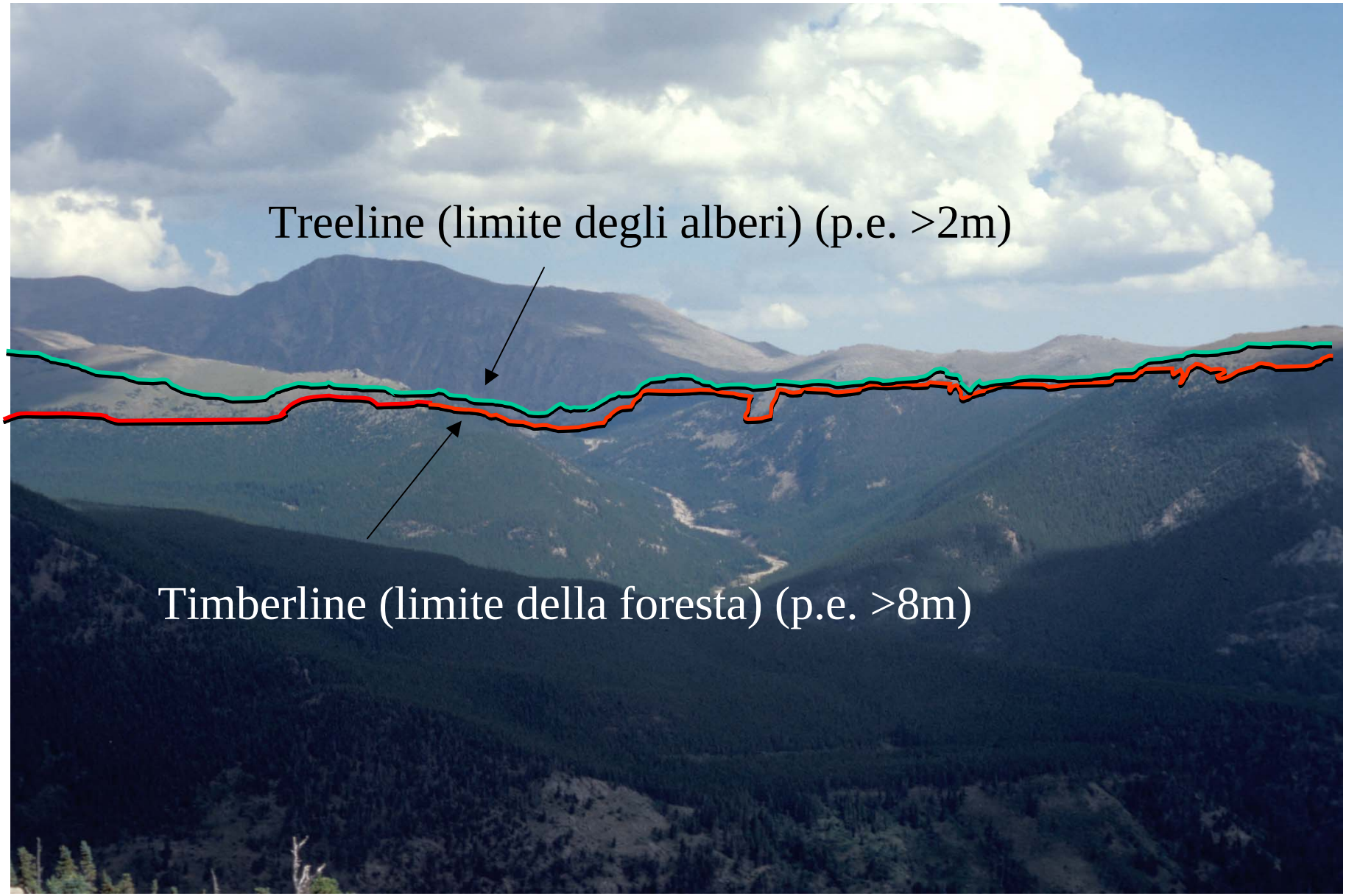
Rocky Mountain National Park, Colorado, USA



Rocky Mountain National Park, Colorado, USA



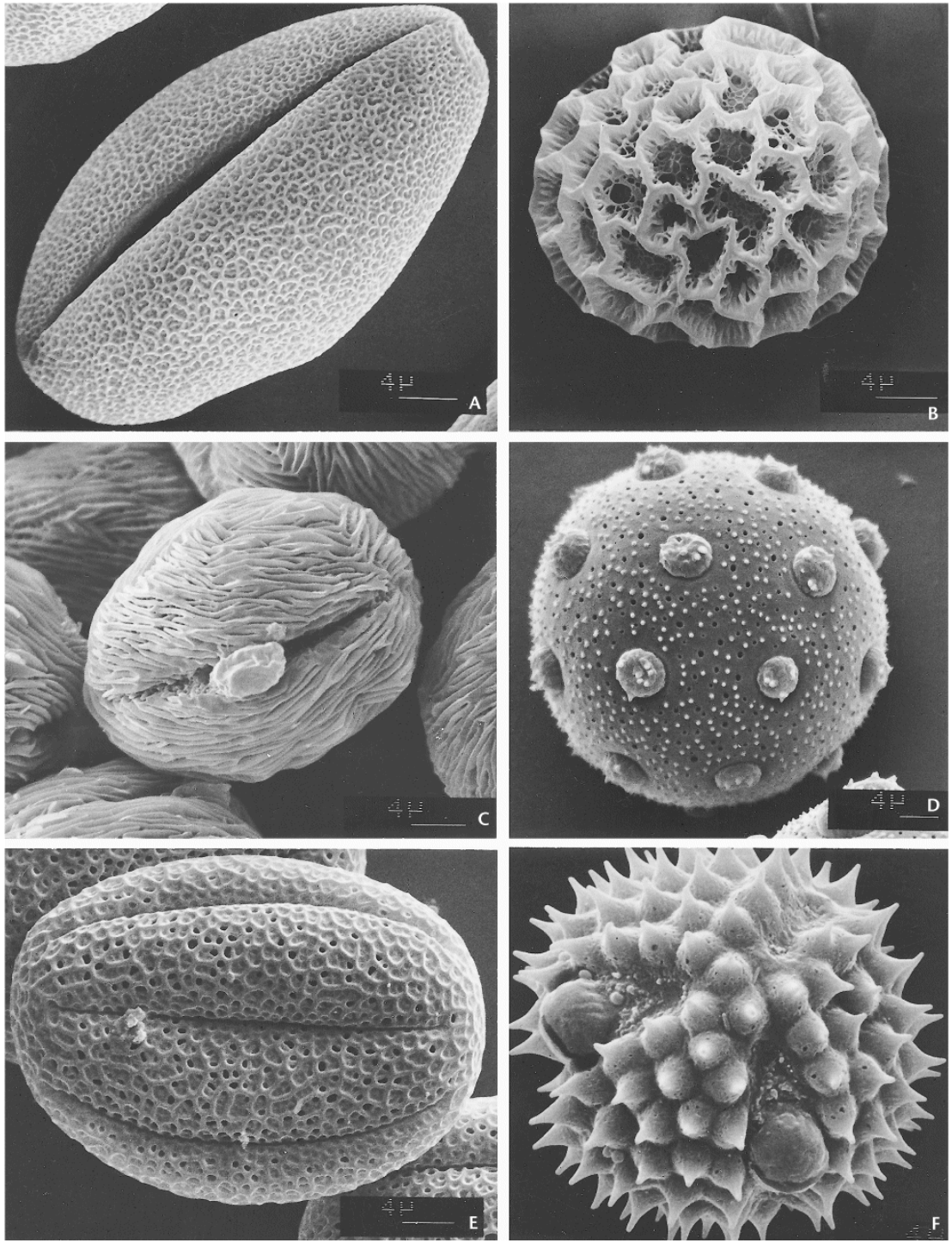
Rocky Mountain National Park, Colorado, USA

a) Approccio paleoclimatico:
Treeline usata come proxy per
i cambiamenti climatici

b) Approccio paleoecologico:
Confronto con proxies paleoclimatici independenti per studiare le risposte dinamiche

Metodi:

Macrofossili nei sedimenti di laghi, torbiere.
(Provenienza = dm)



Polline
Provenienza: km (!)

Stachys recta
Lamiaceae,

Phlox

Polemoniaceae,

Centaurium erythraea

Gentianaceae

Silene nutans

Caryophyllaceae

Thymus pulegioides

Lamiaceae

Aster linosyris,

Asteraceae,

Gouillé Rion, Vallese, Svizzera

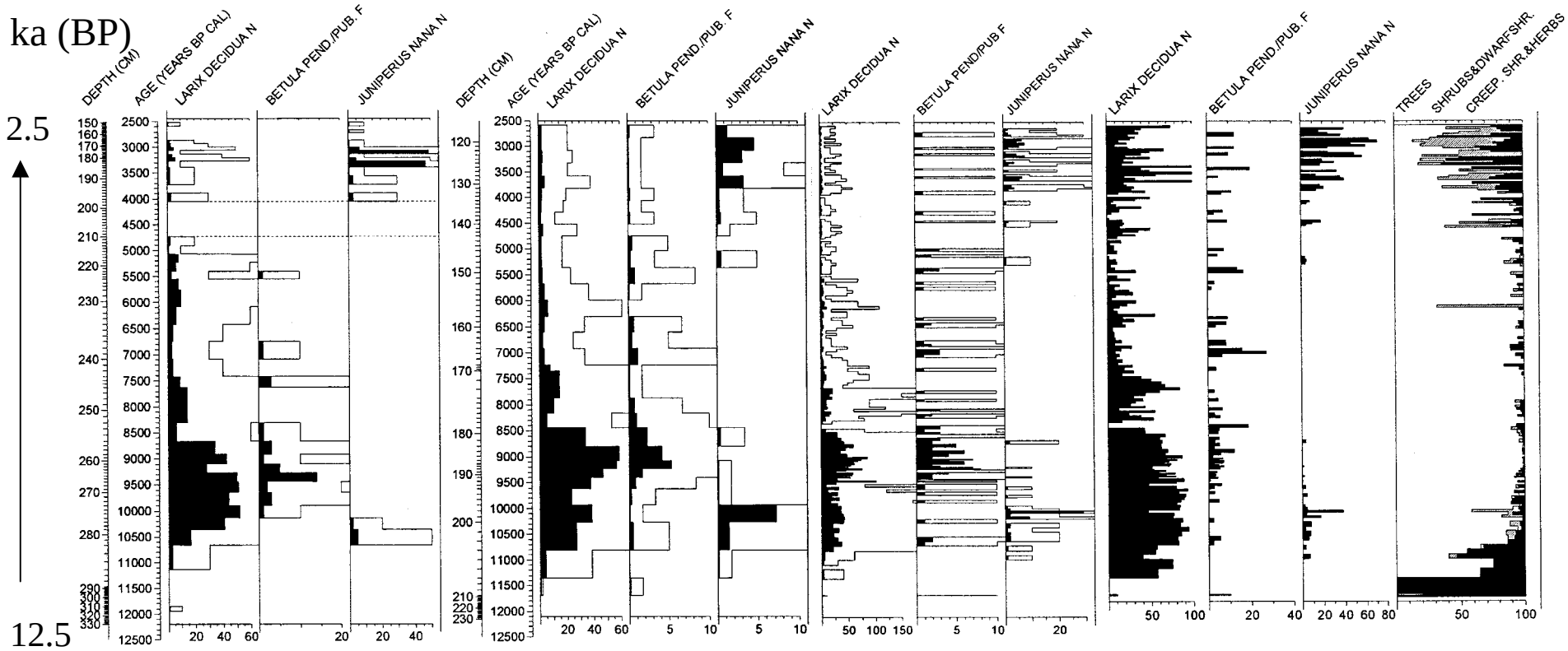
2343 m s.l.m.

Macrofossili Gouillé Rion

Kaltenrieder et al., 2005
Tinner, 2007

Carota GR 1-2 (conc.) | C a r o t a G R 6-7 (c o n c e n t r.) | Carota GR 6-7 (%)

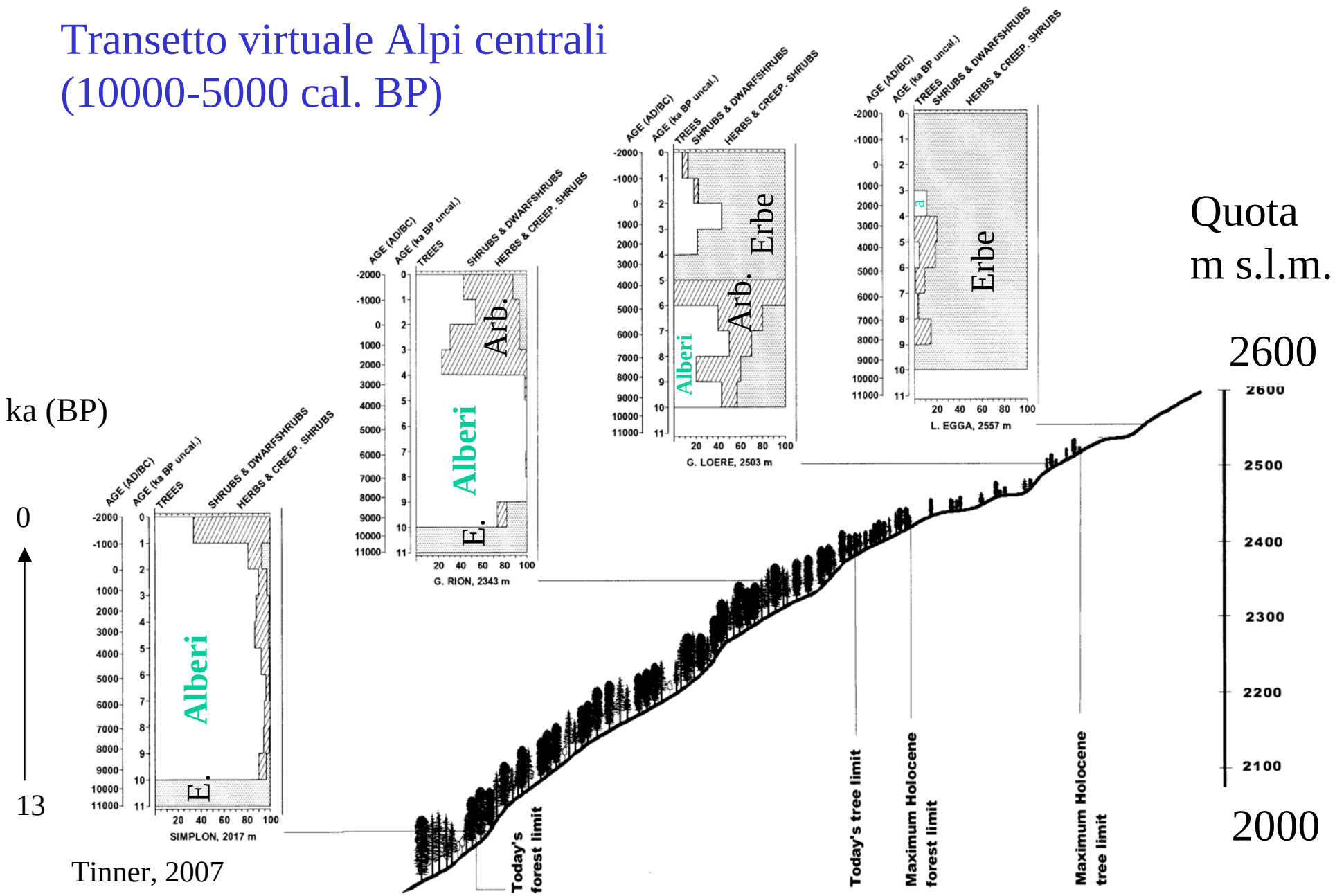
a) b) c) d)



14 date ^{14}C-AMS, terr.

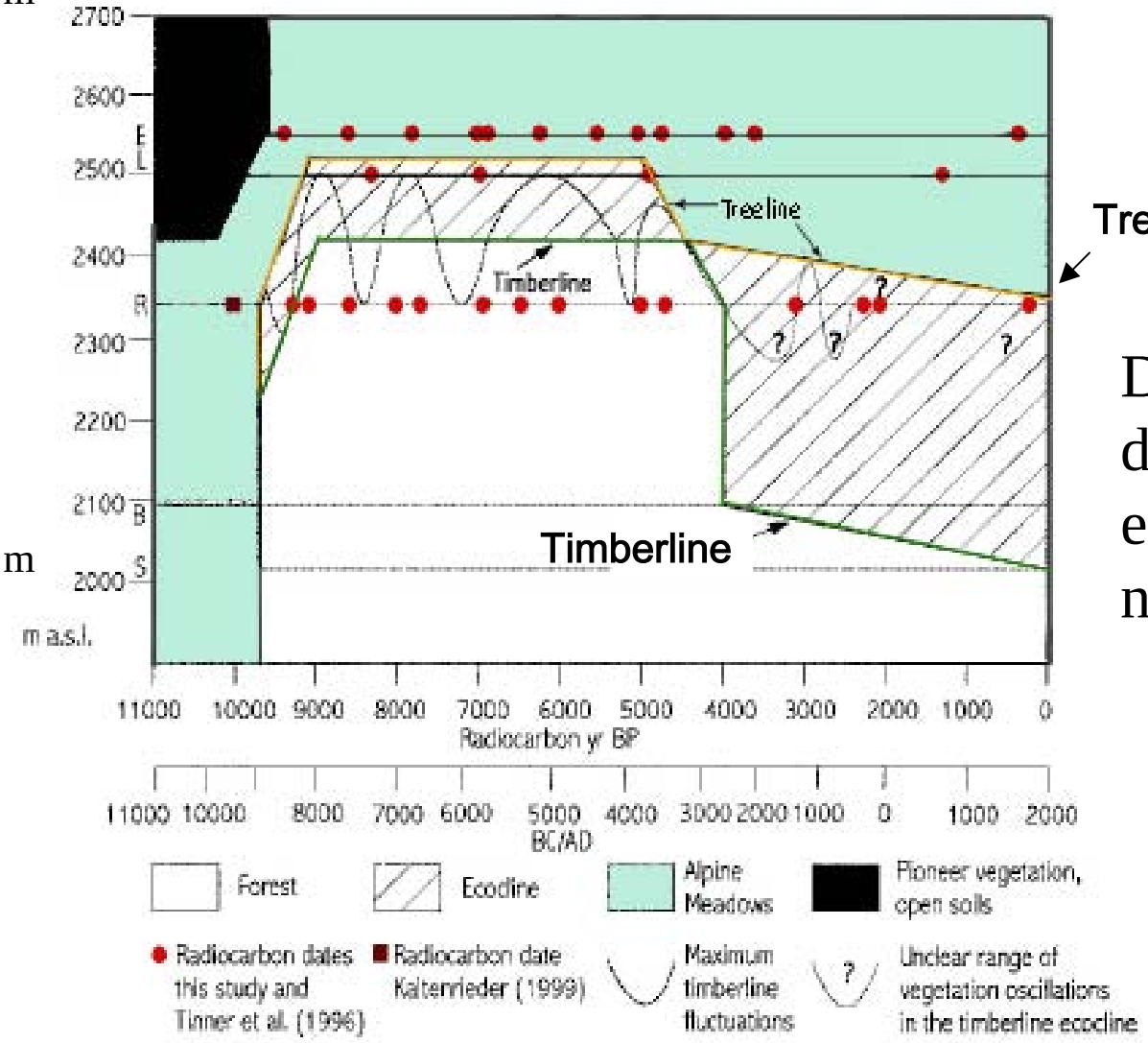
12 date ^{14}C-AMS, piante terrestri

Transetto virtuale Alpi centrali (10000-5000 cal. BP)



Tinner, 2007

2700 m



Treeline

2000 m

Dinamica olocenica
del limite della foresta
e degli alberi
nelle Alpi centrali

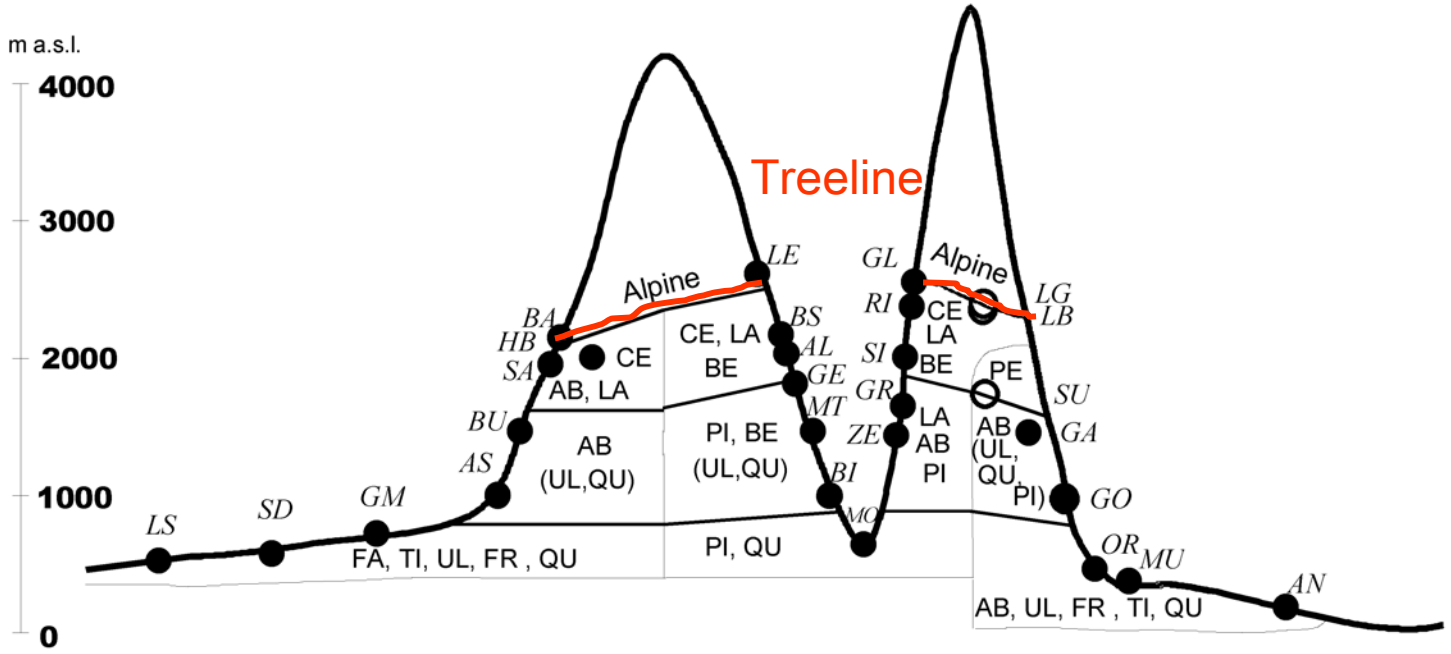
Max. Treeline c. 2520 m
Max. Timberline c. 2420 m

Dopo 4000 BP
Allargamento ecocline
da 100 a 300 m!

Tinner and Theurillat, 2003

Confronto tra nord e sud delle Alpi....

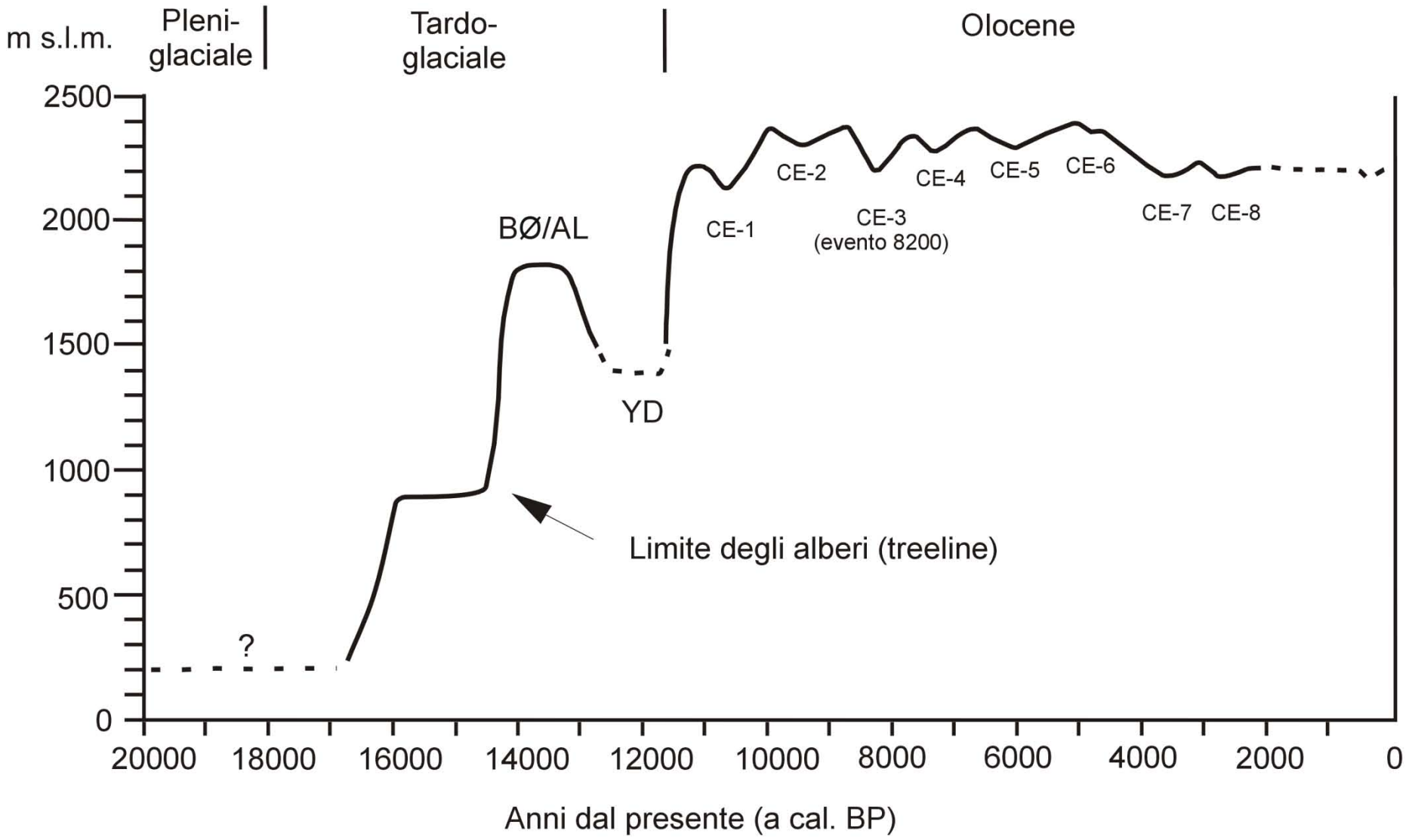
a) Vegetation belts at ca. 6500 cal. yr BP (4550 BC), 1.2-1.6 ° C warmer than today



Altipiano svizzero Alpi Pianura padana

Tinner and Ammann, 2005

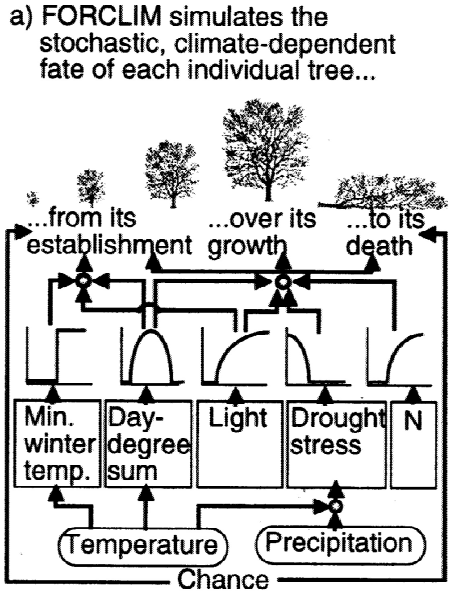
Dinamica del limite degli alberi nelle Alpi meridionali durante gli ultimi 20000 anni

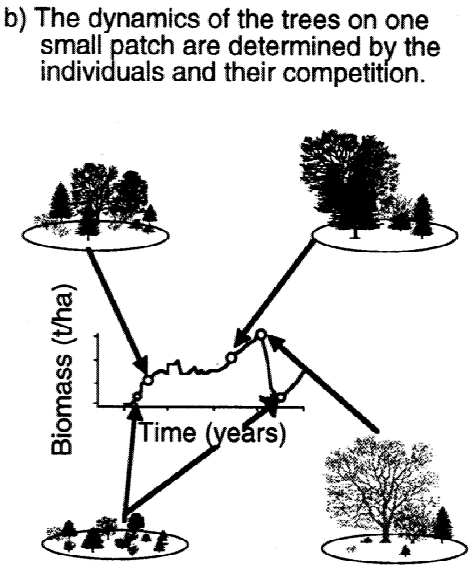


Tinner and Vescovi, 2007

I modelli dinamici: collegare il passato al futuro

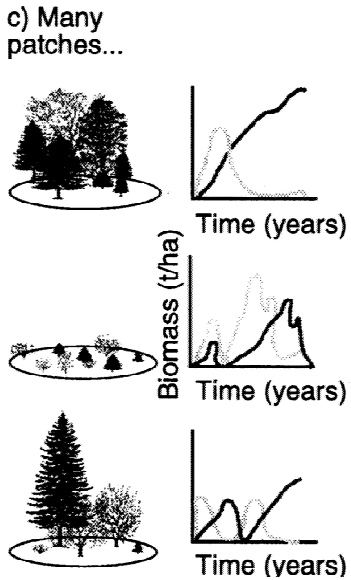
FORCLIM
Simula il „destino“ stocastico e clima-dipendente di ciascun albero

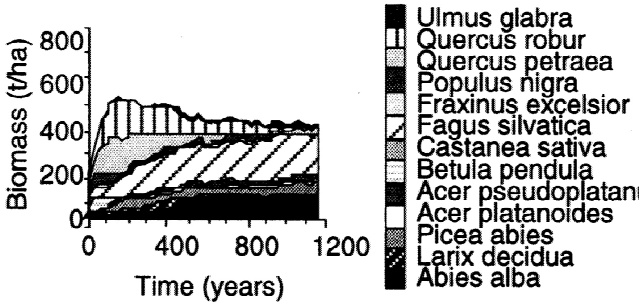




La dinamica degli alberi in ogni piccolo patch è determinata dai singoli individui e dalla competizione tra essi

diversi patches…

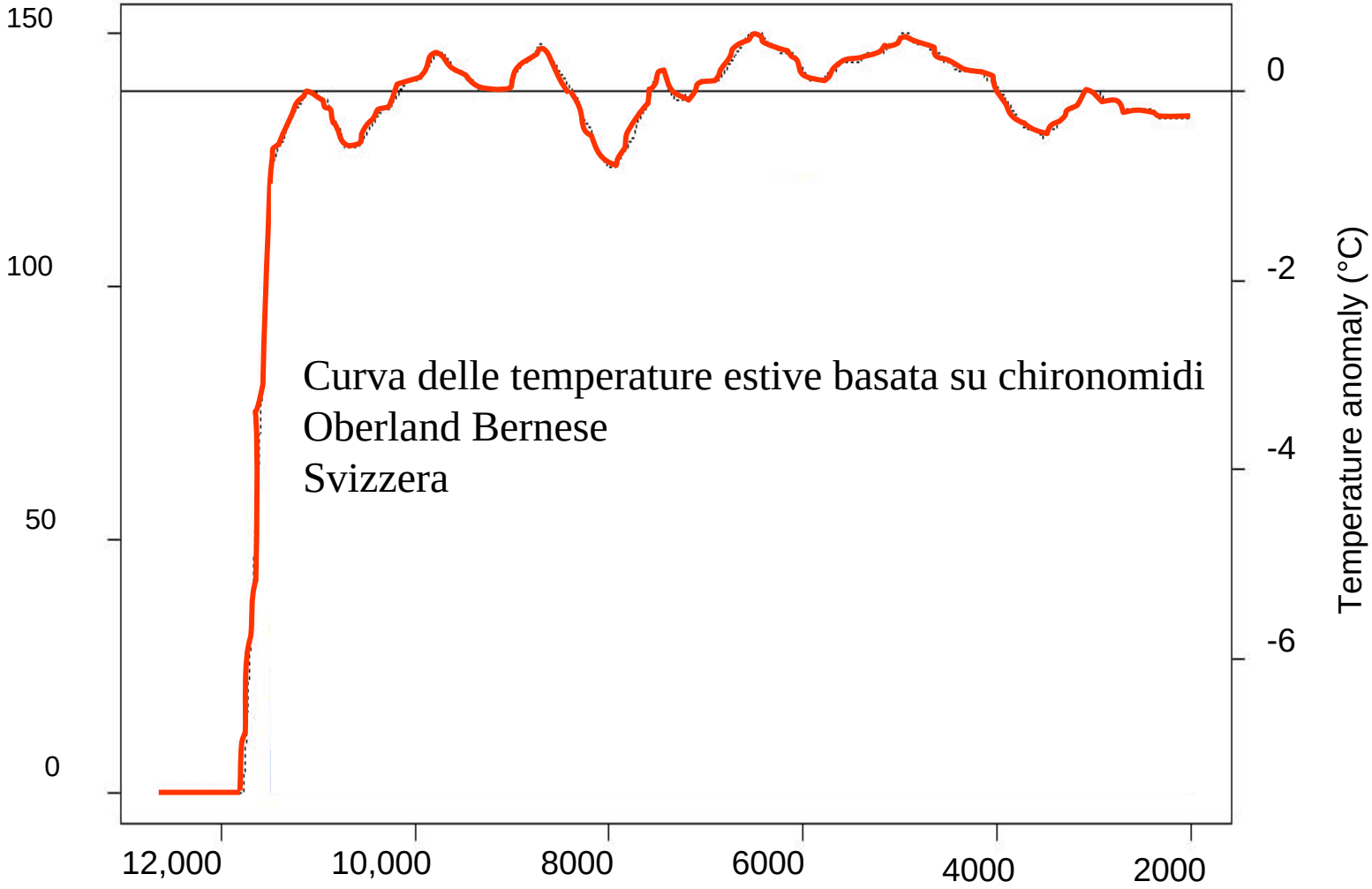




... formano la foresta...
... e determinano la sua dinamica

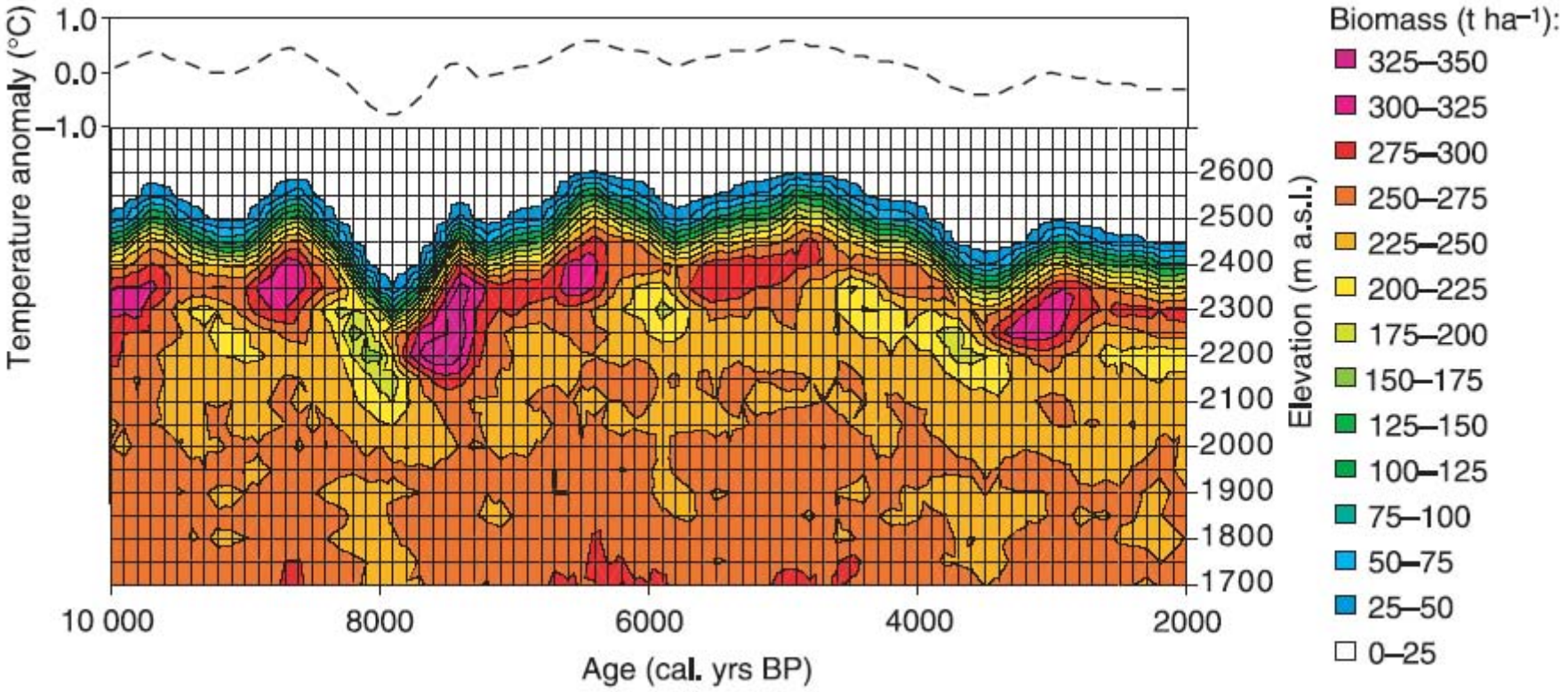
Bugmann 1994, 1996; Lischke et al. 1998

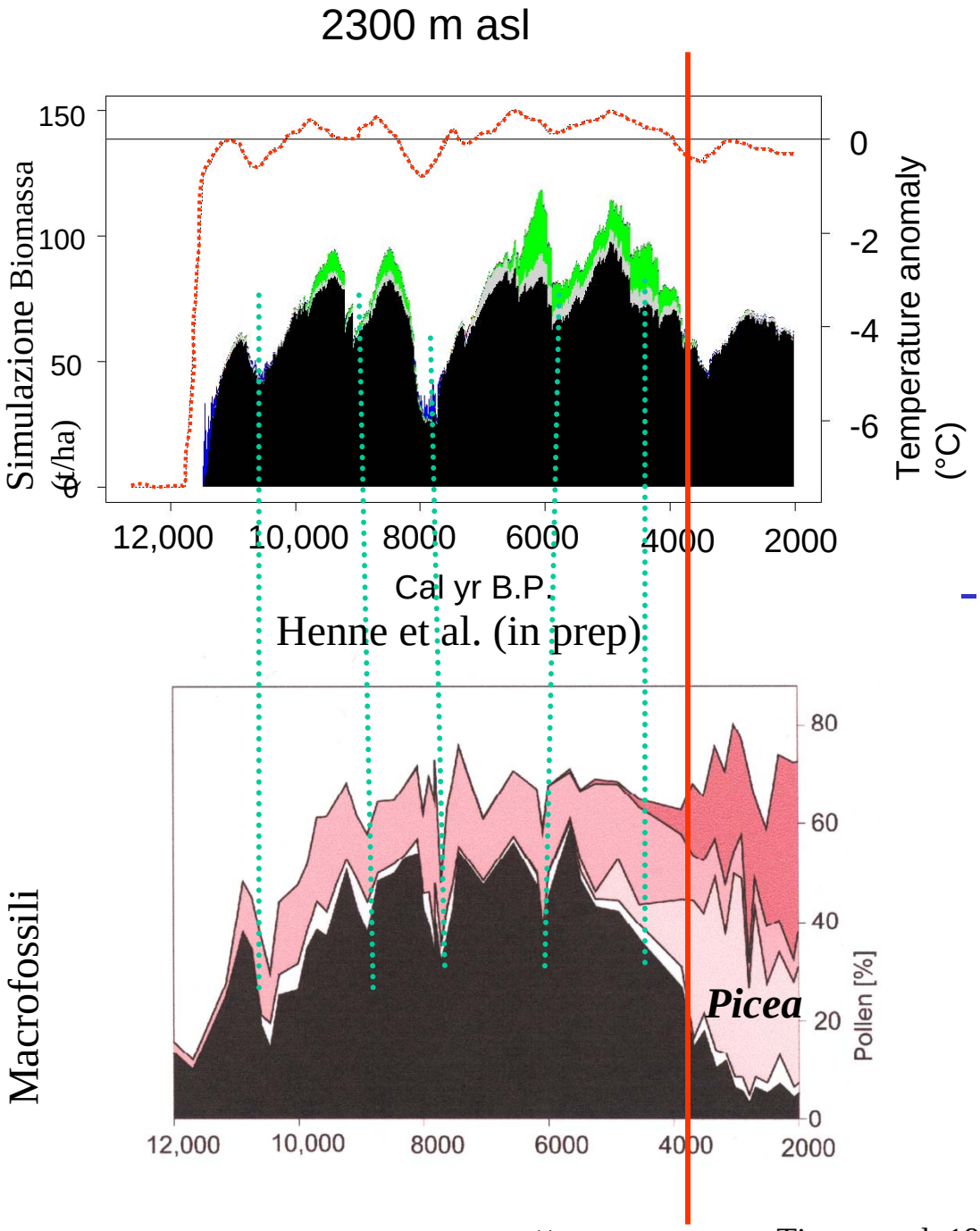
Sviluppo della temperatura estiva durante l‘Olocene nelle Alpi settentrionali



Heiri et al. 2004

Simulazione biomassa per un transetto virtuale (t/ha)





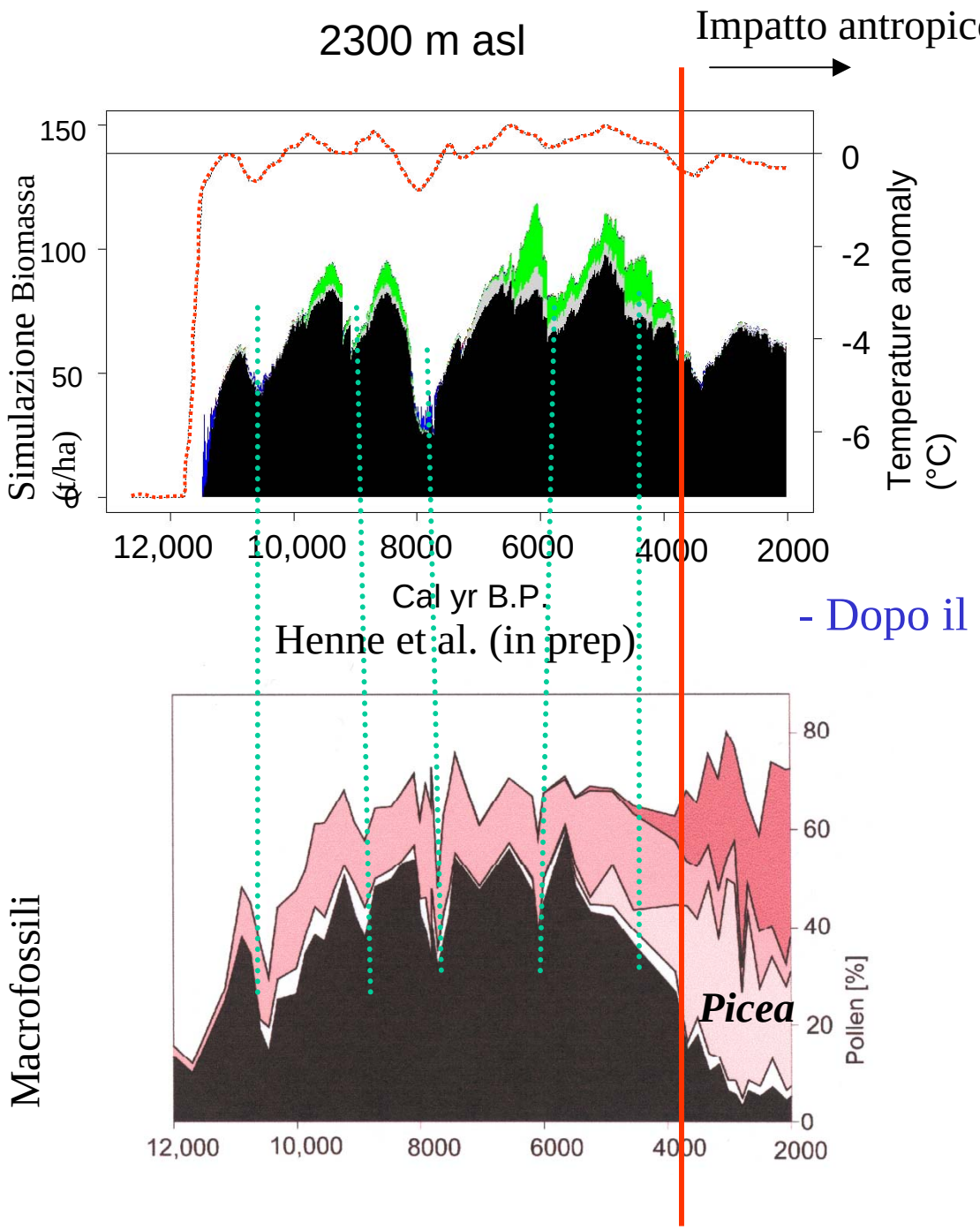
Simulazione LANDCLIM

- Pinus cembra
- Larix decidua
- Picea abies
- Alnus viridus
- Pinus mugo

- Correlazione fasi climatiche

- Alnus viridis
- Betula
- Picea abies
- Larix decidua
- Pinus cembra

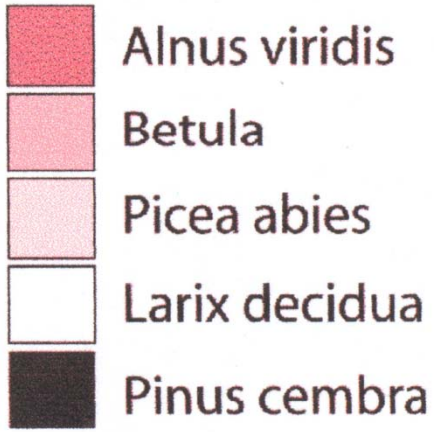
Tinner et al. 1996; Heiri et al. 2006



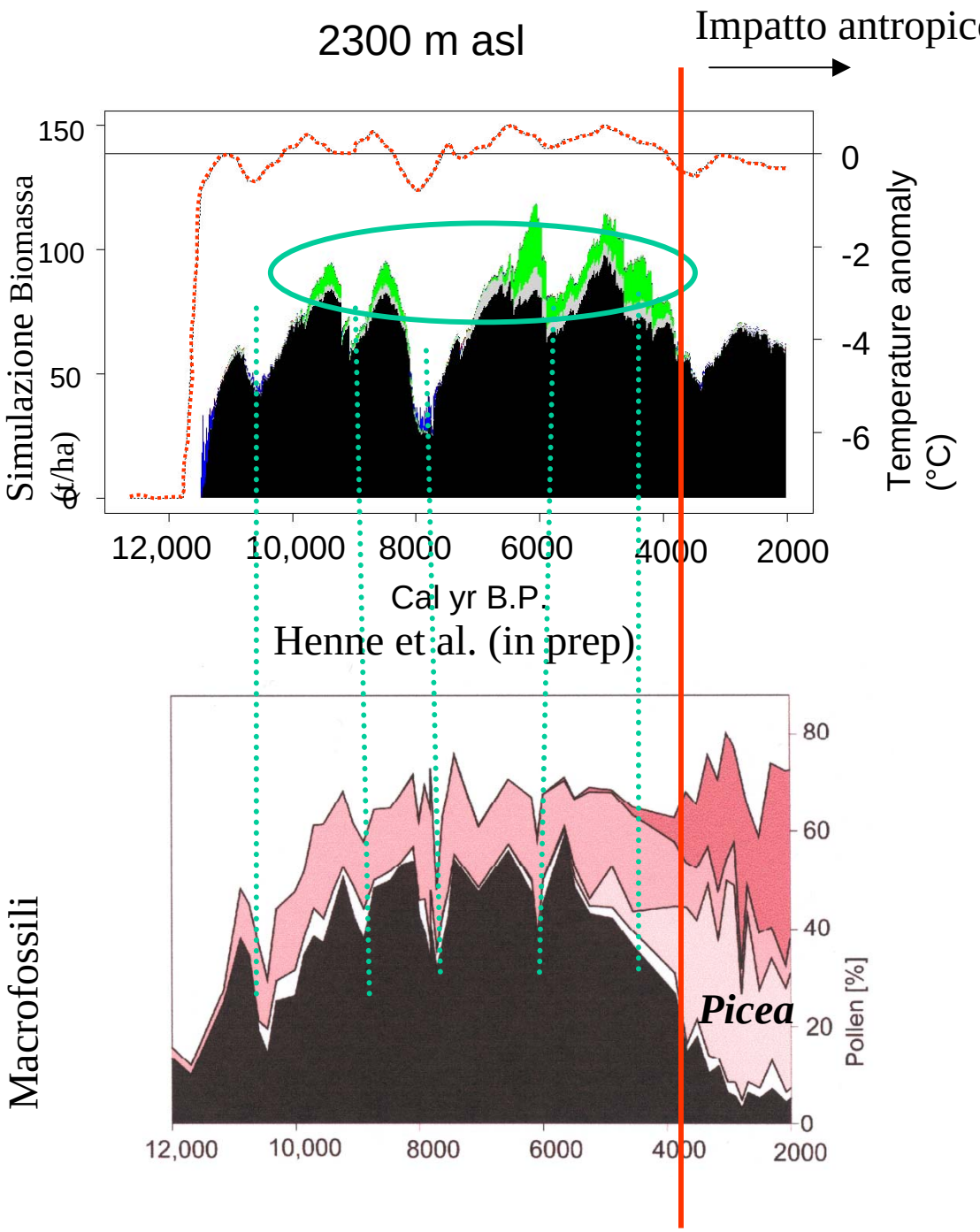
Simulazione LANDCLIM

- Pinus cembra
- Larix decidua
- Picea abies
- Alnus viridus
- Pinus mugo

- Dopo il 4000 cal. BP forte impatto antropico!



Tinner et al. 1996; Heiri et al. 2006

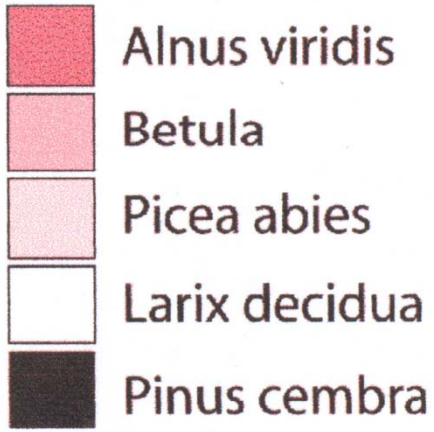


Time (Cal years BP), 12 ^{14}C-dates

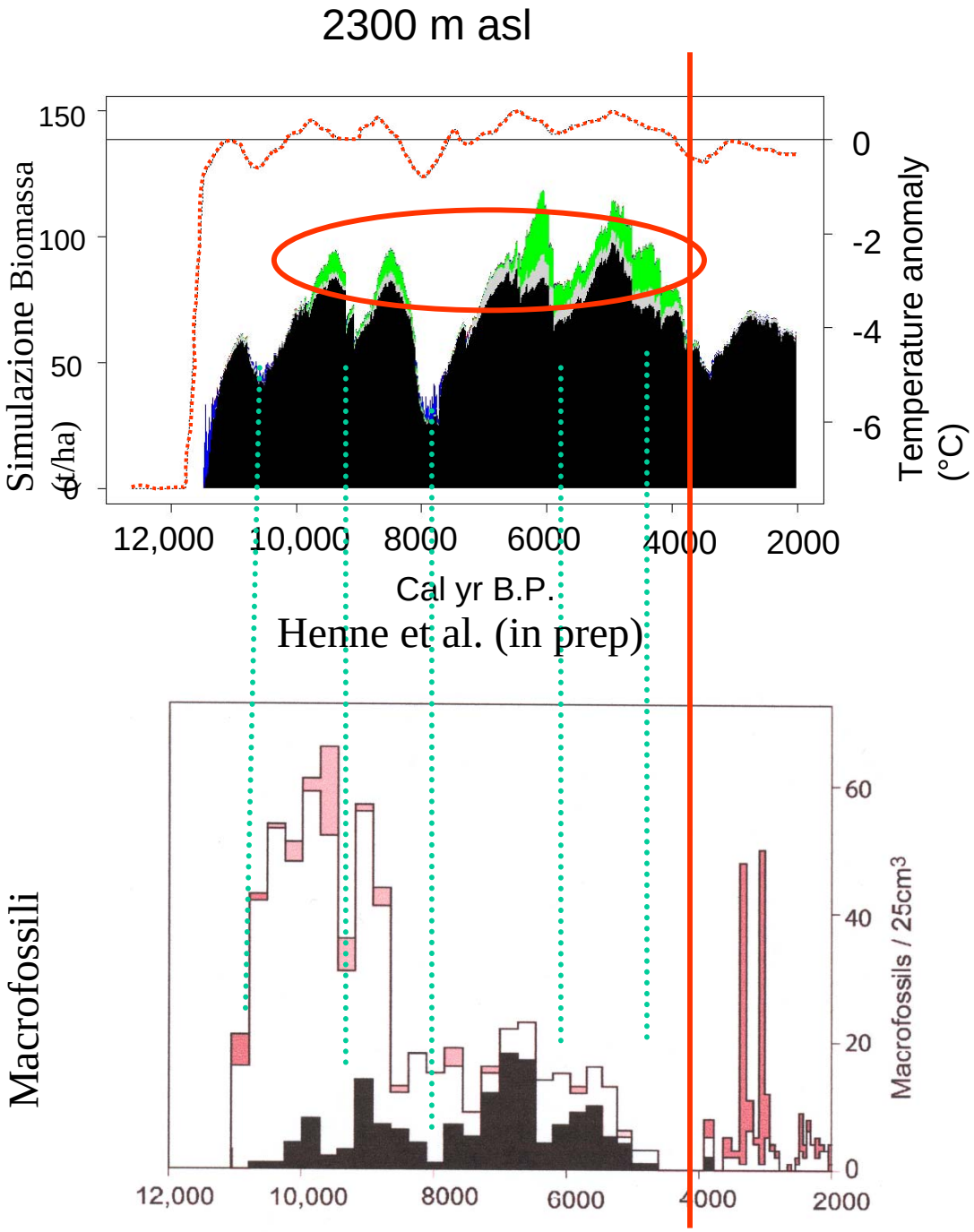
Simulazione LANDCLIM

- Pinus cembra
- Larix decidua
- Picea abies
- Alnus viridus
- Pinus mugo

- Perché Picea assente prima del 6000 cal. BP?



Tinner et al. 1996; Heiri et al. 2006



Simulazione LANDCLIM

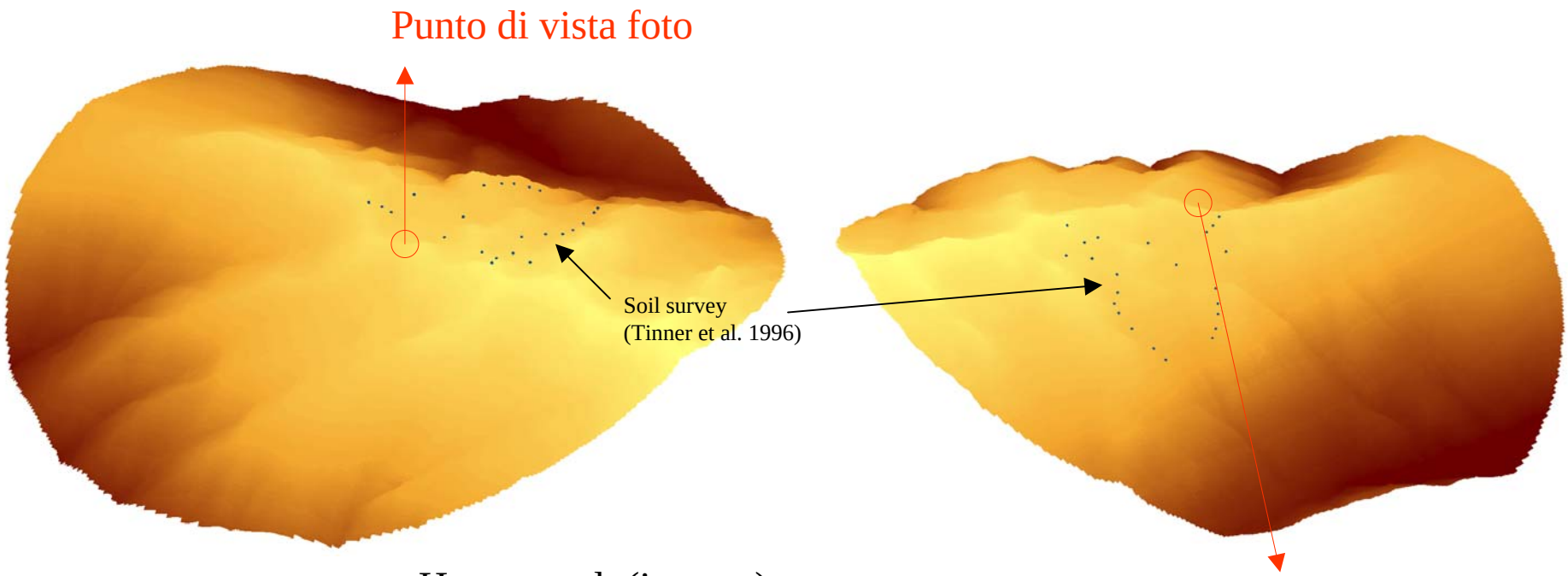
- Pinus cembra
- Larix decidua
- Picea abies
- Alnus viridus
- Pinus mugo

- clima?
- suoli?
- impatto antropico?

- Juniperus nana (needles)
- Betula alba (bracts, fruits)
- Abies alba (needles)
- Larix decidua (needles)
- Pinus cembra (buds)

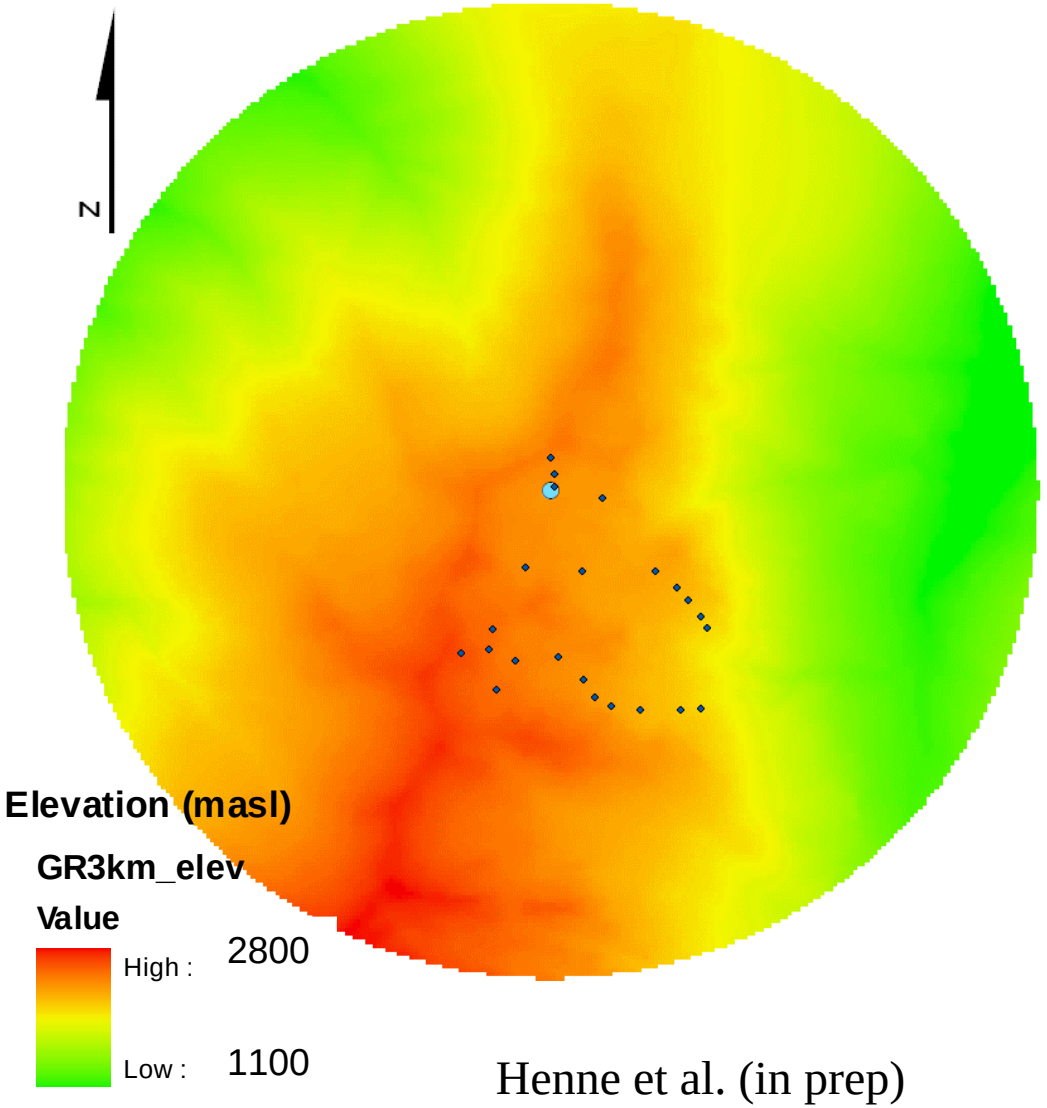
Tinner et al. 1996; Heiri et al. 2006

Paesaggio a Gouillé Rion



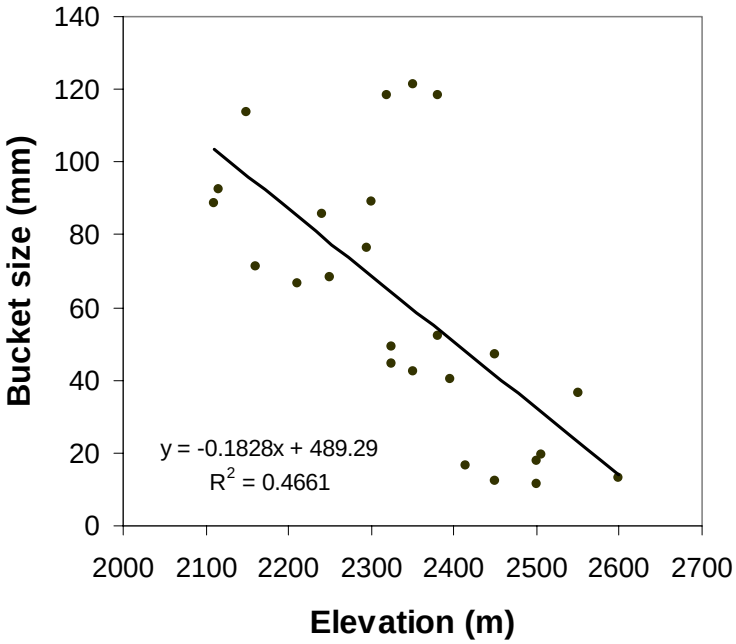
Henne et al. (in prep)

Rilievi pedologici a Gouillé Rion

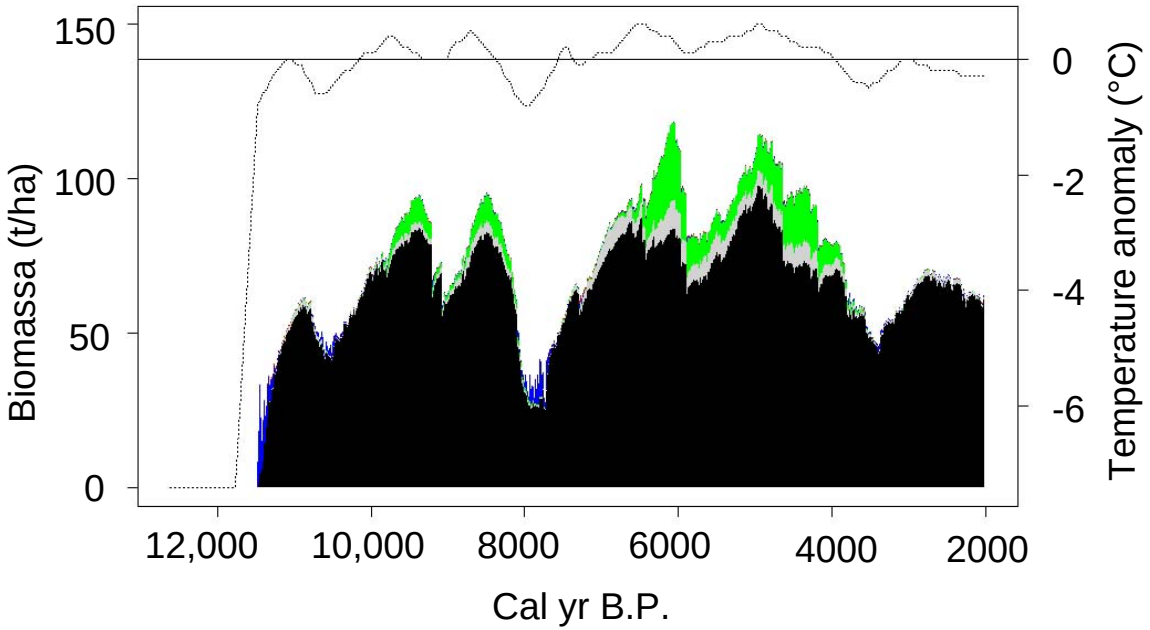


Henne et al. (in prep)

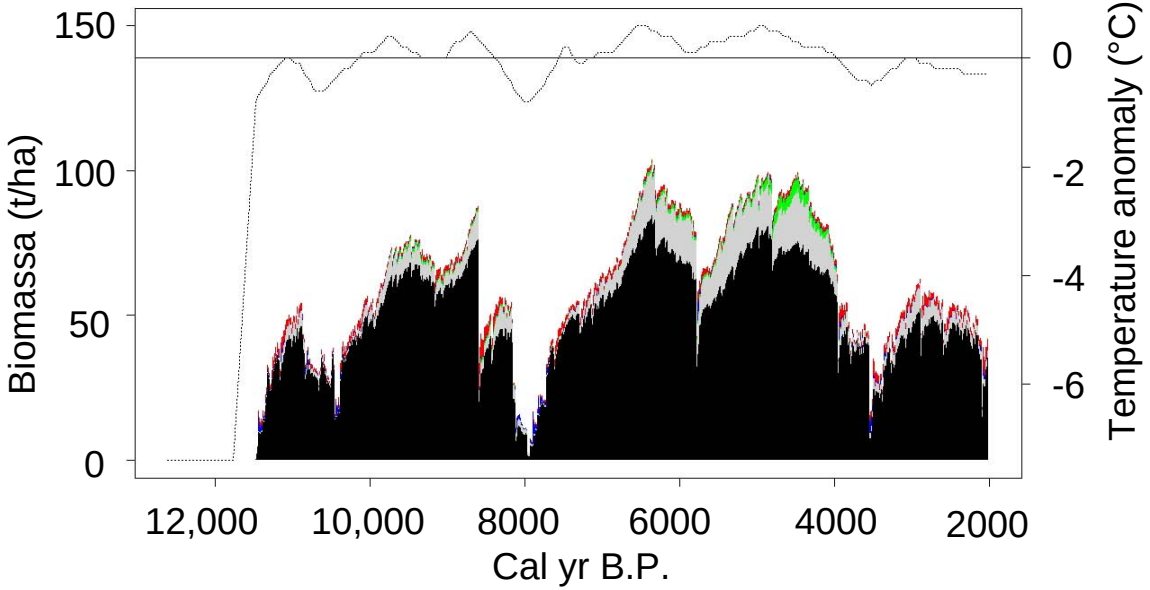
Acqua a disposizione delle piante e quota in m s.l.m



2300 masl



Henne et al. (in prep)



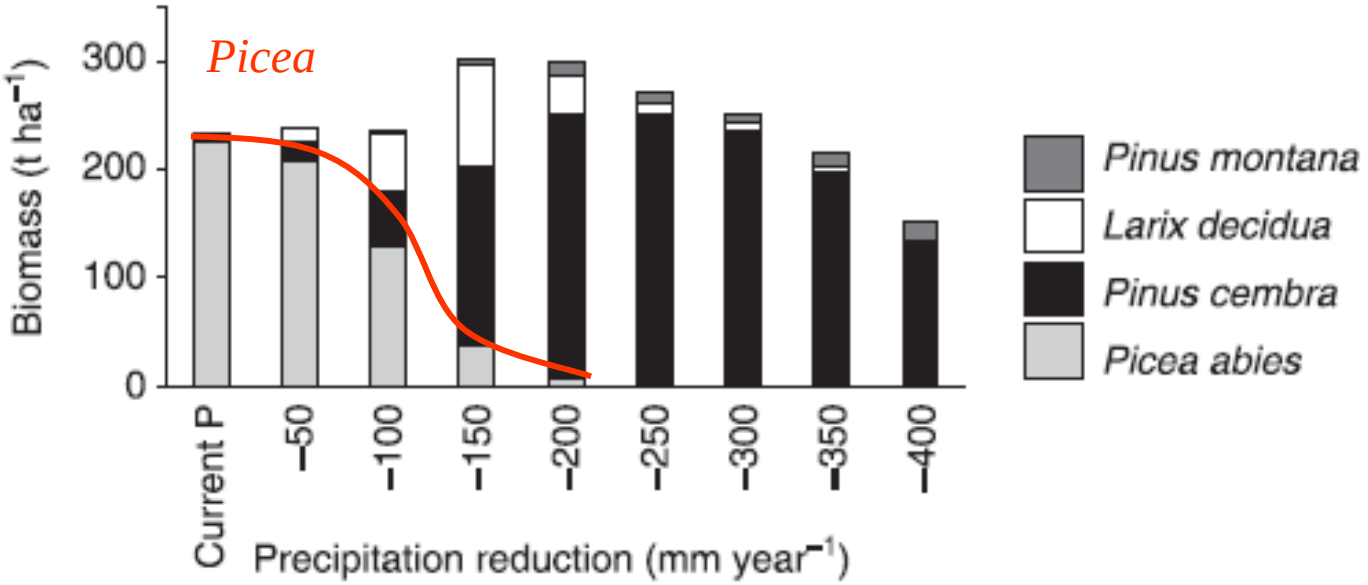
Profondità suoli costante (120 mm acqua)

Pinus cembra
Larix decidua
Picea abies
Alnus viridus
Pinus mugo

Suoli interpolati sul paesaggio

> Più secchi!

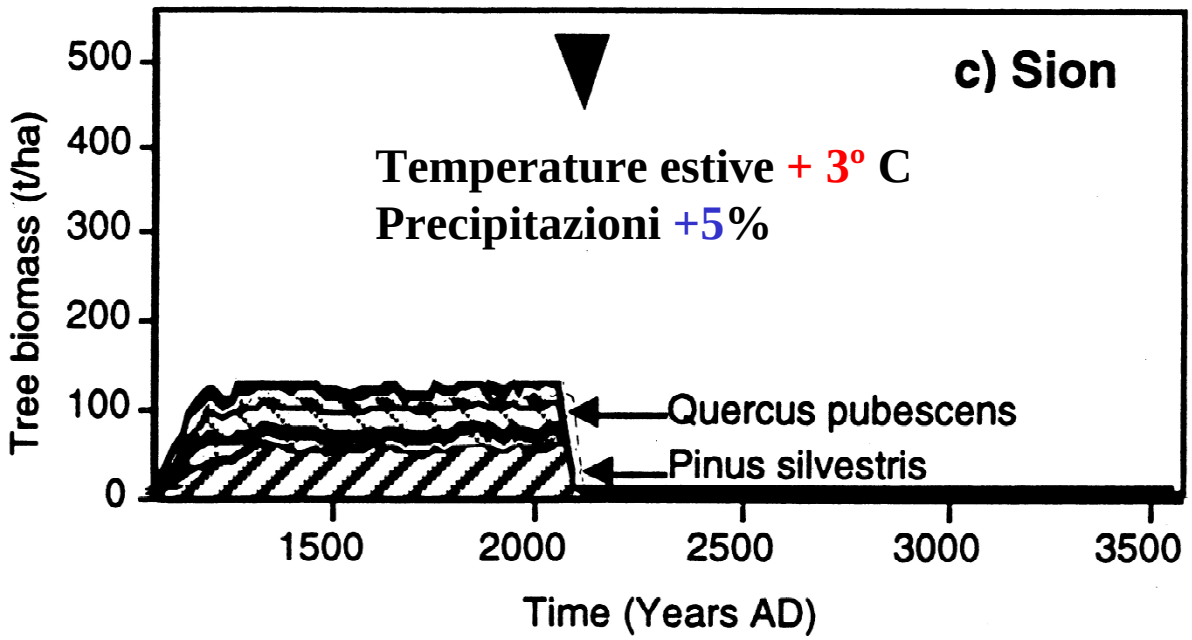
O clima più secco fino al 6000 cal. BP?



Un limite inferiore degli alberi nelle Alpi del futuro?

Modelli dinamici per previsioni

Simulazione per il 2080



Lischke et al. 1998

Gaps!

- **specie esotiche (p.e. querce sempreverdi) mancano in questa simulazione!**
- **assenza di disturbi (p.e. fuoco)!**
- **convalida dal passato!**

Studi sulla palaeo-treeline studies possono fornire:

- ricostruzioni ambientali e climatiche a lungo termine
- conoscenze sulle interazioni a lungo termine tra biosfera, clima e uso del territorio
- controllo affidabilità studi modellistici

Studi modellistici possono aiutare a:

- Comprendere meglio i paleo-records
- Distinguere tra le cause di cambiamenti ambientali: fattori climatici, biotici e antropogenici
- prevedere sviluppi futuri su lunga scala temporale