Climatic influences on growth and decline of oak in southern Sweden

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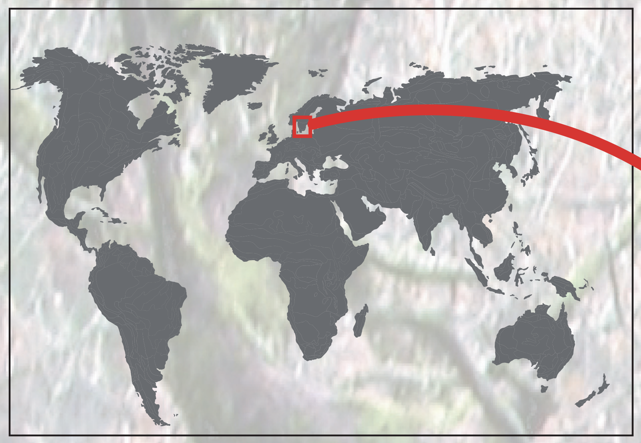
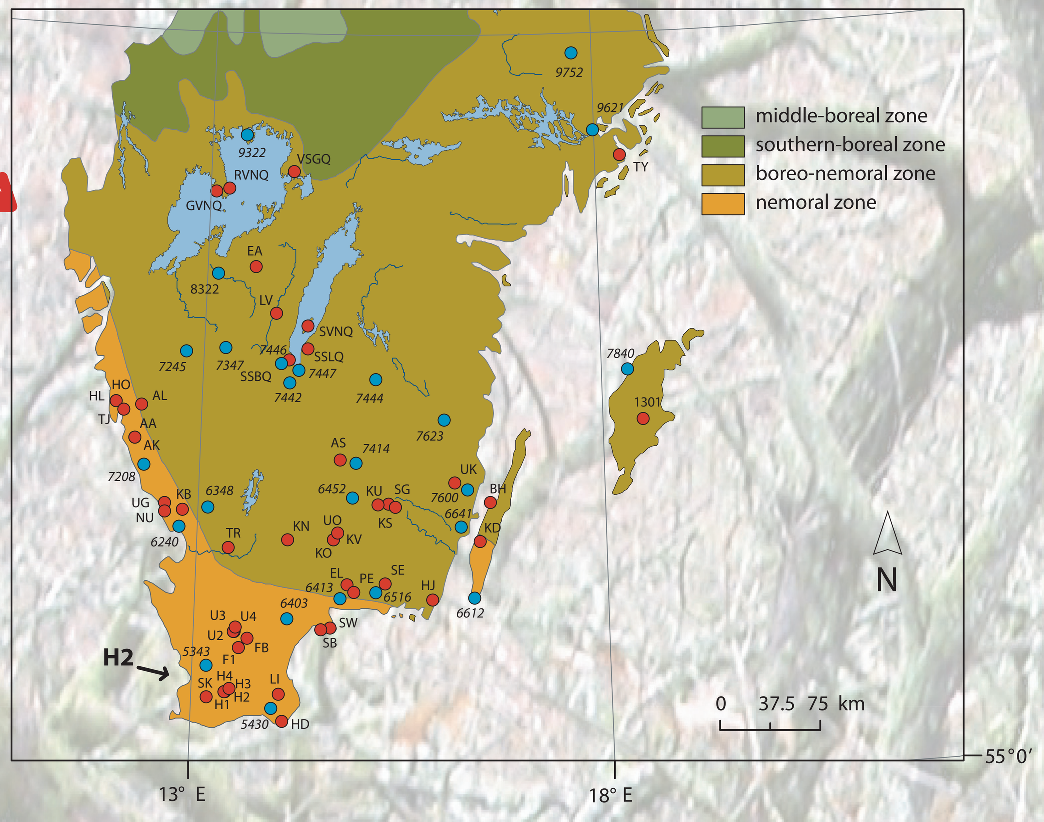




Location of the study sites (red dots, n =50) and climatic stations (blue dots, number in italics, n = 24) used in the analyses. Boundaries of the vegetation zones are according to the Swedish National Atlas (SNA 2001).

There is a general agreement about the complex nature of oak (Quercus robur L.) decline in Europe. A number of factors negatively affecting the condition and growth of oak include unfavourable climatic situations like summer droughts and winter/spring frosts, unfavourable site conditions, fungal infection of oak roots, insect outbreaks, and indirect effects of nutrient imbalances. By analysing oak tree-rings we identify climatic variables affecting the growth of oak in the southern Sweden.

Conclusions

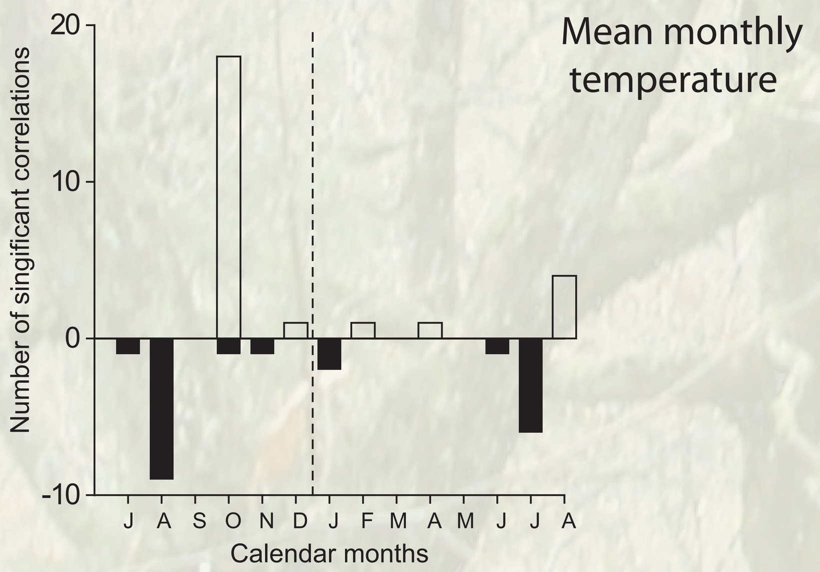
1 **Growth of oak is positively correlated with the precipitation in the current and in the previous growth seasons, and with temperature in October of the previous season.**

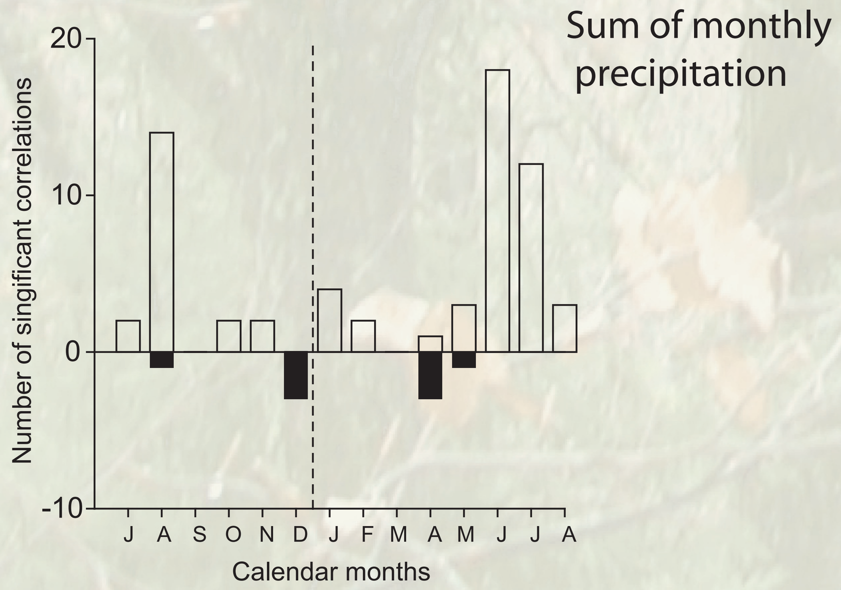
2 **The pronounced annual growth anomalies (pointer years), most of which were negative, have been likely caused by extremes in temperature and not in precipitation.**

3 **On the sites with clay-rich soils correlation between growth and precipitation may become negative. Oak on such sites may be at risk during the periods with excessive rains.**

1

Growth vs. monthly weather





Pattern of interactions between monthly weather variables and oak growth at 50 sites in Southern Sweden. Response function analysis was run on each site chronology and climatic data from the nearest weather station for the period previous year July - current year August.
Data - number of significant response function coefficients for each month and for each weather variable.

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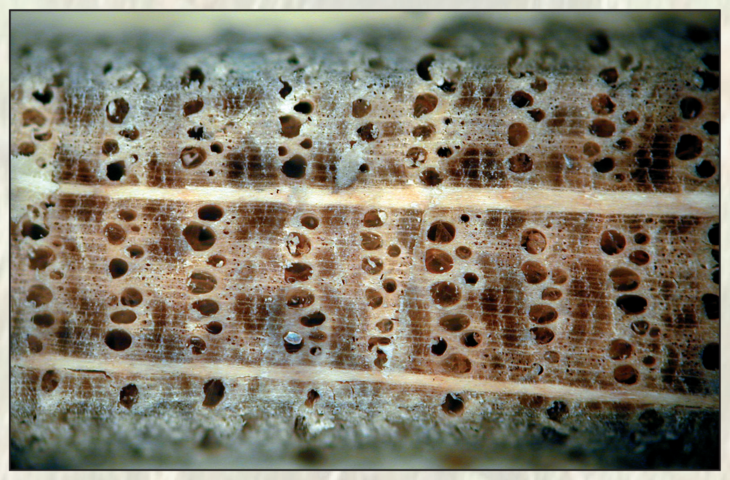
2

Regional pointer years and weather anomalies

Year	Number of trees		Type of pointer	Mean monthly temperature	Sum of monthly precipitation
	%	amount			
1965	**25.3%**	147	-	**July -**	
1868	**20.5%**	48	-	**December p.y. -**	
1940	**17.4%**	94	-	**November p.y. +** **February +** **March -**	
1947	**17.3%**	96	-	**May +**	**February –** **May –** **August -**
1992	**16.5%**	99	-	**May +** **June +**	**June -**
1890	**14.3%**	50	+	**July -**	**April +**
1988	**12.5%**	76	+	-	**January +** **February +** **July +**
1996	**11.4%**	64	-		**May -** **June +**

Pointer years in oak chronologies from the southern Sweden. A pointer year is defined as year with the ring-width index laying outside central 90% of the distribution of all ring-width indexes for a tree. In the years selected the growth anomalies were observed in more than 10% of all tree chronologies covering the year in questions. For this time period analysed (1860-2000) each year was replicated by at least 200 trees and each pointer year – by at least 48 trees.

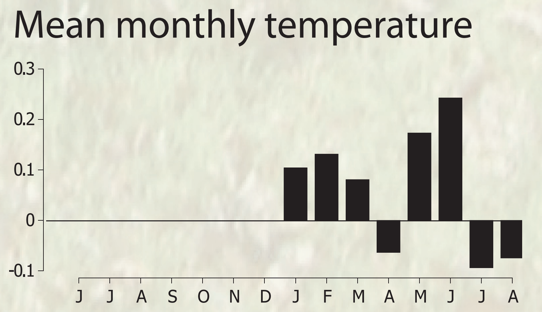
Months shown had the values of weather variables, located outside central 95% part of respective distribution.
"P.y." stands for "previous year".

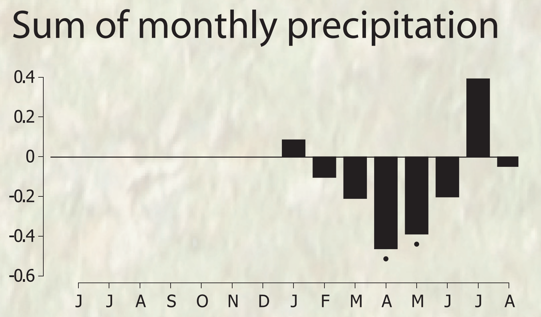


Quercus robur has a porous ring structure with latewood zones of varying width.

3

BUT, growth of oaks on clay-rich soils may be negatively correlated with spring precipitation (bar graph). A 40-years old stand on fine-textured soils in Häckeberga estate, Scania has declined after a period of extreem summer precipitation in 1996 and subsequent thining in 1998 (site H2 on the map).





Correlation coefficients between ring increment and monthly weather variables for H2 site. Dots indicate significant response function coefficients.

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